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MAJOR DISEASES OF LETTUCE GROWN BY COMMERCIAL NUTRIENT FILM TECHNIQUE IN THAILAND

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ABSTRACT

Hydroponics has formally been known in Thailand since 1988. Nowadays, it is commercially established in many areas in Thailand for high quality vegetable production. Among these, nutrient film technique (NFT) is one of the most commercial systems for lettuce production. The important diseases of lettuces grown in commercial NFT were reported in this article.

KEYWORDS: hydroponics, *Pythium myriotylum*, lettuce

1. INTRODUCTION

Hydroponics or soilless culture is a cultivation technique for growing plant without soil. This technique has formally been known in Thailand since 1988 from the conference held by the Thai Society of Soil and Fertilizers [1]. In fact, it might be previously known in many agricultural academics. Hydroponics for plant production has initially been conducted under the HRH Princess Maha Chakri Sirindhorn's project at the Royal Chittralada Palace. There were also many research activities held by Kasetsart University under the supporting of FAO to find out the possibility and suitable technique for hydroponic plant production in Thailand [2-3]. Recently, hydroponics has been set up in many areas for high quality plant production. The general growing systems are nutrient film technique (NFT), deep flow technique (DFT), dynamic root floating technique (DRFT) and substrate culture. Among these, NFT is the most popular technique due to an attractive platform. In addition, it could urge the production cycle especially in leafy vegetables. In case of lettuce production, it could be planting up to 8-10 production cycles per year [4]. Therefore, most of the premium lettuces are commercially produced by NFT. Like the other cultivation systems, plant disease is one of the factors limiting the productivity. Occasional plant diseases are found in NFT and may be severe at a certain condition. Additionally, several features of growing system such as the abundance of a genetically uniform host, the constant of

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temperature and moisture regime and the lack of microbial diversity are also supporting the outbreak of diseases [5-6]. For these reasons, disease investigation of lettuces grown in NFT was determined. This study contributed useful information for the researchers to further study and the growers to manage plant disease in proper time and suitable condition.

2. MATERIALS AND METHODS

The investigation was done in commercial hydroponic greenhouses located in Bangkok area (BKK) and nearby, which grew lettuce by NFT. Samples were collected from lettuces that showed disease symptoms either on upper or lower part. Some samples were sending by the grower for diagnosis. Most of the samples were isolated by tissue transplanting technique. The pathogen was purified and identified based on their morphological characteristics under light microscopic observation. The identified pathogens were inoculated to the host plant for confirming their pathogenicity.

3. RESULTS AND DISCUSSION

Some diseases were found on commercial NFT grown lettuce during the year 2005-2007. However, only major diseases that usually found and affected the productivity were reported here. The important diseases found in this investigation could be categorized into two groups. They were root disease (including the abnormality found at the lower part of plant) and leaf disease (including the abnormality found at the upper part of plant). The detail of each disease was reported as follows:

3.1 Root rot and other related diseases

Pythium root rot: This disease was usually found in many NFT growing sites and also in other hydroponic growing systems (Figure 1). The infected plants were wilting due to the decay of root and dying consequently. The causal agent was identified as *Pythium* spp. This pathogen not only infected lettuces but also vegetables mostly grown in hydroponics [5-7]. Among *Pythium*, *P. aphanidermatum* has been reported as a common species that infected hydroponic crops in Thailand such as European cucumber [8] and other leafy vegetables (Figure 2). It could infect lettuce if the inocula contaminated into the growing system or artificial inoculation. However, in this investigation, most of the causal agent of lettuce grown in the commercial NFT was *P. myriotylum* (Table 1). Using the mycelia fragments of *P. myriotylum* inoculated to the tested plants resulted in root rot disease development within three days (Figure 3). This is the first report of *P. myriotylum* causing root rot disease of lettuce grown in commercial NFT in Thailand.

Figure 1 Pythium root rot of hydroponically grown vegetables in Thailand.
(a) lettuce in NFT
(b) amaranth (pigweed) grown in DFT
(c) European cucumber grown in substrate culture

Figure 2 *Pythium aphanidermatum* caused root rot disease of many vegetables grown in hydroponics.
(a) colony on PSA (potato sucrose agar)
(b) reproductive structures: oogonia and oospores (round shape), sporangia (filamentous shape)
(c) European cucumber infected with *P. aphanidermatum*
(d) pigweed infected with *P. aphanidermatum*
(e) celery infected with *P. aphanidermatum*

Table 1 Root infected agents of lettuces grown in commercial NFT

Isolate	Samples	Location	Identification[1/]
RD1	Infected Cos	BKK : in greenhouse	*P. myriotylum*
RD3	Infected Greenoak	BKK : in greenhouse	*P. myriotylum*
RD5	Infected Greenoak	BKK : in greenhouse	*P. myriotylum*
RD6	Infected Greenoak	BKK : in greenhouse	*P.* group F.
RD7	Infected Greenoak	BKK : in greenhouse	*P. myriotylum*
RD8	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*
RD9	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*
RD11	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*
RD12	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*
RD13	Infected Greenoak	Nearby BKK : outdoor system	*P.* group F.
RD14	Infected Redoak	BKK : in greenhouse	*P.* group F.
RD15	Infected Redoak	BKK : in greenhouse	*P. myriotylum*
RD16	Infected Redoak	BKK : in greenhouse	*P.* group F.
RD17	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*
RD18	Infected Greenoak	Nearby BKK : outdoor system	*P. myriotylum*

[1/] Identification based on the morphology of sporangium and oogonium that produced on glass blend culture and v8-agar

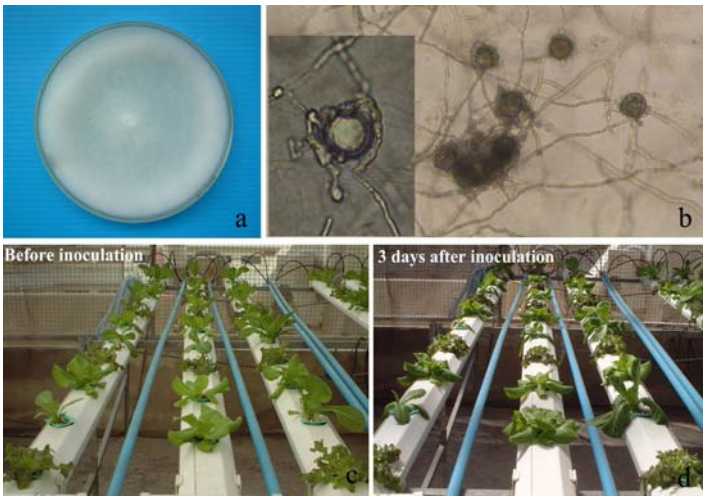

Figure 3 *Pythium myriotylum* caused root rot disease of lettuce grown in commercial NFT.

(a) colony on PSA (potato sucrose agar)
(b) reproductive structures: oogonium with multiple antheridium
(c-d) pathogenicity test using mycelia fragments

Bacterial rot: This disease was occasionally found in NFT growing site with less sanitation procedures. Damaged plant from cultural practices and insect chewing were conducive to disease infection. Disease symptom usually developed from small soaking lesions at the succulent tissue such as petiole. The lesions expand to the large size and spread out to leaf vein resulted in leaf sheath rotting consequently. In sever case, all leaves of lettuce were dropped and collars became rotting (Figure 4). The causal agent could be various species of *Erwinia* and *Pseudomonas*.

Figure 4 Bacterial rot of lettuce grown in NFT.
(a) infected plant showing leaf drop and heart rot symptom
(b-c) damage plant and insect chewing conducive to disease infection
(d-f) disease developed from small soaking lesion to collar rot

Collar black rot: This disease was found in some NFT growing sites. The infected plants showed black rot symptom at the collar region nearby the substrate. The sever plant might be wilting due to the rotting of collar. Shoot was separated from root easily when it was pulled up by little force (Figure 5). The causal agent of collar black rot was unidentified in this investigation, but many references reported that it was caused by *Rhizoctonia* sp. [9, 10].

Figure 5 Collar back rot of lettuce grown in NFT
(a) infected plant showing black rot at collar without softening decay
(b-c) rotting at collar region resulted in shoot separated from root

3.2 Leaf spot and other related diseases

Leaf spot of lettuce: This disease was first found in 2004 at NFT growing sites where lettuce was grown under outdoor condition. During the last 3-4 years, it became one of the major diseases found in lettuce grown in commercial hydroponics in Thailand. Disease distribution usually occurred during the rainy season. The symptom was initially found at the lower leaves and spread out to the upper leaves. The crowded planting, high humidity and bad ventilation were conducive to disease outbreak. The infected plant would lose their weight because the damage leaves had to be cut off and could not be sold to the premium market due to low quality products obtained (Figure 6).

Figure 6 Leaf spot of lettuce grown in commercial hydroponics
(a) yield loss due to leaf spot disease
(b) symptom initially found from lower leaves and spreading out to other leaves
(c) the remarkable symptoms called “flog eye leaf spot”

The casual agent was identified as *Cercospora* sp. This pathogen could infect various varieties of lettuce including oak leaf, head and romaine lettuce (Figure 7). The pathogen was difficult to be isolated by tissue transplanting technique due to its slow growth. However, it could be isolated easily by single spore isolation.

Figure 7 *Cercospora* sp. caused leaf spot disease of lettuce grown in commercial NFT.
(a) reproductive structures; conidia, with inset of conidia and conidiophores
(b) pathogenicity test on cos lettuce
(c-e) various kinds of lettuce (butterhead, greenoak and cos) infected with *Cercospora* sp.

Tip burn of leaf: This abnormality usually found in the group of head lettuce such as butterhead. It caused by nutrient disorder. The leaf margin became burnt resulted in low quality product obtained. Eventually, the necrotic lesion might be conducive to rotting by bacterial pathogens.

4. CONCLUSIONS

Hydroponic plant production in Thailand tends to expand continuously, however plant disease is one of the factors limiting its productivity. Many plant diseases are transmitted by pathogens in soil that is called “soil borne diseases” [11]. Although hydroponics including NFT could prevent disease from soil borne pathogens, some of them was still found. Major diseases of lettuce grown in commercial NFT reported here were Pythium root rot, bacterial rot, collar black rot, Cercospora leaf spot and tip burn of leaf. Detecting major diseases and finding suitable methods for controlling as quickly as possible is necessary for improving hydroponic yields and marketing values.

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