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# Disease Loss Assessment and Chemical Management of Poplar Rust Using by Some Conventional Fungicides

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**Abstract.** Poplar rust caused by *Melampsora* spp. imposes heavy losses in poplar-growing areas in Iran. To estimate disease loss, wood volume was measured in two continual years from 2009 to 2010 and wood volume percentage increment was calculated. There was significant loss in infected trees comparing check plants in wood volume increment. Also, evaluation of some common fungicides comprising of propiconazol, mancozeb, carbendazim and benomyl showed that the best fungicide was propiconazol as foliage spray twice a year in recommended dose.

**Keywords:** *Melampsora*, fungicide, propiconazole, carbendazim, benomyl, mancozeb

## 1. Introduction

The deciduous tree, *Populus nigra*, commonly named black poplar is native to Europe, southwest and central Asia, and northwest of Africa (Pei & MaCracken, 2005; Wang & Fang, 1984). Over the past two decades, rusts on poplar caused by *Melampsora* spp. have been subjected to extensive study because of the severe damage (Pei & MaCracken, 2005). Poplar rust is easily recognized by the masses of yellow or orange fungal spores that cover the leaf surface in summer, mainly on the underside. After a few weeks, the leaves blacken, curl up and fall prematurely (Lnnsdale and Tabbush, 2002). Poplar rust is one of the most important fungal leaf diseases in Iran (Behdah, 1991). East Azarbayjan province has been reported as one of the heavily infected regions of Iran (Eslami *et al.*, 2008). Thirteen species and two hybrids of *Melampsora* have been described on *Populus* (Bagyanarayana, 1998). Conventionally, poplar rusts are regarded as nursery diseases. The disease causes premature defoliation, 2–3 months prior to normal leaf fall, thereby affecting plant growth (Pei & MaCracken, 2005). Although in some cases chemical control would report to remain expensive, sometimes physically impracticable and in many cases environmentally undesirable, the best controlling method of poplar rust is resistant plant varieties and hybrids implementation (Callan and Brenda, 1998). Chemical control is still one of the best and common ways to manage disease in established trees (McCracken & Dawson, 1998 and Sharma *et al.,* 2005). There are a couple of researches which has been carried out regarding poplar rust using by chemicals via foliage spraying. Three-time applying of 1% $CuOCl_2$ (end of May, June, and July), gave complete protection against *Melampsom allii-populina*, and *M. larici-populina*, and dithane was almost useless (Saric & Milotovic, 1960). Several investigators confirmed that Cu (as copper oxychloride in Cuprox®) and benodanil gave significant control of *Melampsora larici-populina* on poplar (Fullerton and Mnzies, 1974; Spiers, 1976 and Sheridan, 1978). McCracken and Dawson (1998) reported that benodanil (Calirus®) and myclobutanil (Systhane®) provided effective control of the rust, but only when applied as protectant at 14-day intervals, beginning in mid-May before the rust had an opportunity to establish itself. Successful control of leaf rust (*M. ciliata*) of *P. ciliata* in nursery seedlings was achieved by spraying carbendazim and mancozeb (Khan *et al*., 1988). Ruaro & May (1996) reported the efficacy of difenoconazole, captan and mancozeb against urediniospore germination of *Melampsora medusae* under *in*

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*vitro* conditions. Also, Post-symptom sprays of difenoconazole (0.02%), penconazole (0.06%) and carbendazim (0.05%) exhibited excellent eradicant activity and resulted in minimum production of urediniospores per uredinium and per unit leaf area when applied on nursery-grown poplar seedlings. When fungicides were tested as preventive and post-symptom sprays at fortnightly intervals, difenoconazole, penconazole and hexaconazole resulted in the least disease incidence and uredinia pustules per leaf, and minimum rate of spread of disease and area under disease progress curve (Sharma & Sharma, 2000). The current research aims were estimating wood losses in infected trees by rust and evaluation of some conventional fungicides efficiency on disease management.

# 2. Material and Method

## 2.1. Disease loss assessment

The experiment was performed in a black poplar (*Populus nigra* L.) garden with Italian origin cultivar namely Lombardy planted in March 2008 at Miyaneh region, Iran (47˚ 42 ´ E and 37˚ 24 ´ N, 1068 m.a.s.l.) in 2009-2010 growing seasons. The trees inter- and intra-rows intervals were 100 and 90 cm, respectively. Since wood production is the most important purpose of poplar plating, we tried to estimate wood loss caused by the disease. To estimate wood loss, two small horizontal lines were drawn on trunk as two marks in the first year i.e. 2009 on November 1. The first line height was 15 cm from the ground level and the other one was marked 1 meter above that. Sixty trees of infected and healthy cases were marked as mentioned above. The diameter of the trunk measured using by calliper in both marked sites. The wood volume has been calculated by following formula like a conical frustum:

$$v = \pi h/3((r_1^2 + r_1 \times r_2) + r_2^2)$$

in which h was height, $r_1$=downer line radius, $r_2$= upper line radius. In the second year i.e. 2010, November 1, the same sites volume was calculated by the same method. The wood increment percentage was calculated by formula below:

$$IP\% = (V_i - V_h)/V_h \times 100$$

in which IP% was increment percentage in wood volume, $V_i$= wood volume of infected plant and $V_h$= wood volume of healthy plant.

## 2.2. Chemicals efficiency's evaluation

To evaluate of chemical treatments effectiveness, four common fungicides comprising of propiconazol (Tilt®, EC250, 100 ppm), mancozeb (Dithan m-45®, WP80, 250 ppm), carbendazim (Bavistan®, WP60, 500 ppm) and benomyl (Benlate® WP50, 500 ppm) were used as foliar applications on May 21, 2009, once the first uredia were observed and repeated every other 21 day for three times. In the same year, disease assessment was calculated using Sharma *et al.*, (2005) after one, two and three months of first spraying. Briefly, the disease incidence was recorded by counting the infected and total number of leaves on each tree. To estimate disease severity, leaves were selected from different heights of the treated and check trees and uredinial pustules per leaf were calculated by counting the pustules on 10 leaves selected from top, middle and bottom positions of plants in each replication, and means calculated.

# 3. Results and discussion

## 3.1. Wood loss assessment

On the whole of studied garden, about 78% of poplars were infected by rust. The volume of wood in infected trees had been increased only 28.02% (250.26 $cm^3$) in a year, while in healthy plants it was increased approximately up to two times in average from 744 to 1376 $cm^3$ (84.96%) in a years (Fig. 1). It shows how much disease can impose heavy economic losses during a year and could be destructive in a continuous year. There was a significant loss in annually weed production about 233 $cm^3$ per plant. Also, there were death reports of poplars due to this disease in UK (Callan and Brenda, 1998). Therefore, since the wood achievement is the main purpose of poplar cultivation, there will be serious doubt about economic justify for popular establishments if the disease is heavily dominated in a region. The wood is selling by weight in this region, by converting volume to weight; it is possible to estimate the economic losses too.

Thus, a fast and effective method for disease control should be farmers' need for rust management. The chemical control might be a suitable option in this case which has been evaluated in this study.

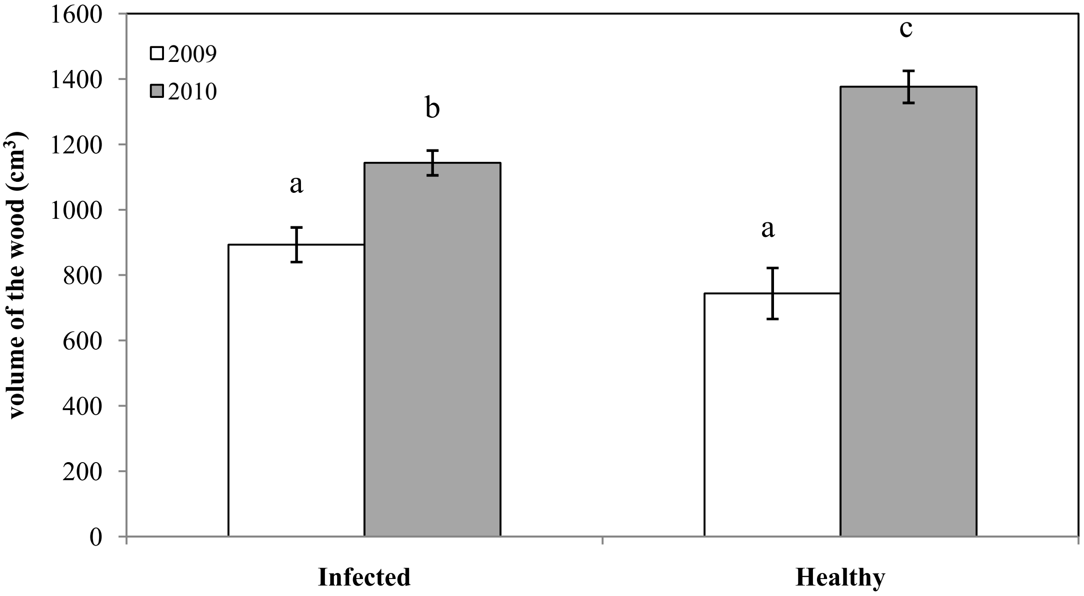


Fig. 1: Volume of wood in healthy and infected poplar trees to rust during 2009 and 2010

## 3.2. Fungicides effect evaluation

Disease incidence (the number of infected leave per tree) was about the same in three assessment times during 21 July – 21 August. About 91.4% of leaves in a tree were infected by rust. However, disease severity in (number of rust pustules per leaf) was increased during these three months from 50.3% to 89.34%. There was an increasing tendency of disease severity by time. On the whole, all chemicals could reduce disease incidence and severity comparing control. Decrement percentage was remarkable in disease severity than disease incidence. Carbendazim and benomyl affected disease severity less than mancozeb and propiconazol. In the first assessment time, propiconazol showed the best effects on disease severity reduction with 2.1 pustules per leaf in average (80.48% decrement comparing control). Also, propiconazole was the most successful fungicide in disease incidence too (67.13% decrement). Carbendazim had the least effect on disease severity but there was no significant difference in disease incidence between benomyl and mancozeb in the first assessment stage. Mancozeb was more effective on disease incidence than carbenzazim and benomyl in first assessment stage. Once spraying with propiconazole had the same effect on disease incidence with twice and three times spraying by carbendazim and benomyl. Also, benomyl spraying repetition could reduce disease incidence significantly but could not be effective on disease severity. Propiconazol spraying for two and three times could reduce disease incidence and be effective on disease severity comparing once spraying but third spraying by propiconazol could not be reasonable because the second one could reduce disease severity sufficiently comparing once spraying (Fig. 2 and 3).

Therefore, the most recommendable fungicide for disease chemical management would be propiconazole. It is better to spray trees twice in a year by propiconazol.

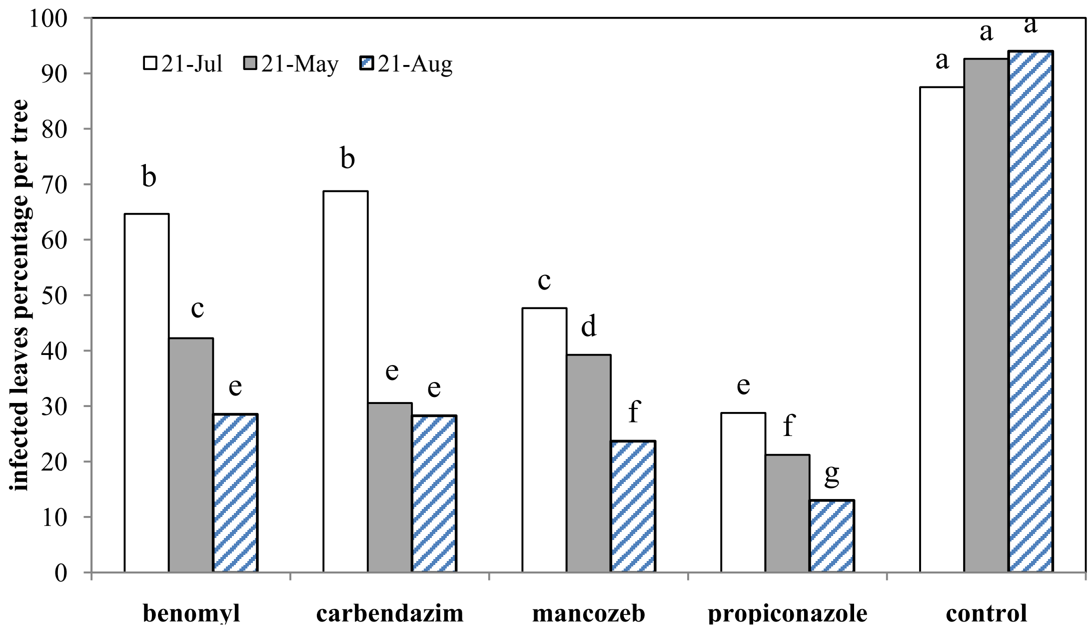


Fig. 2: Disease incidence as the number infected leaves per tree in fungicide treated poplars in three assessment time

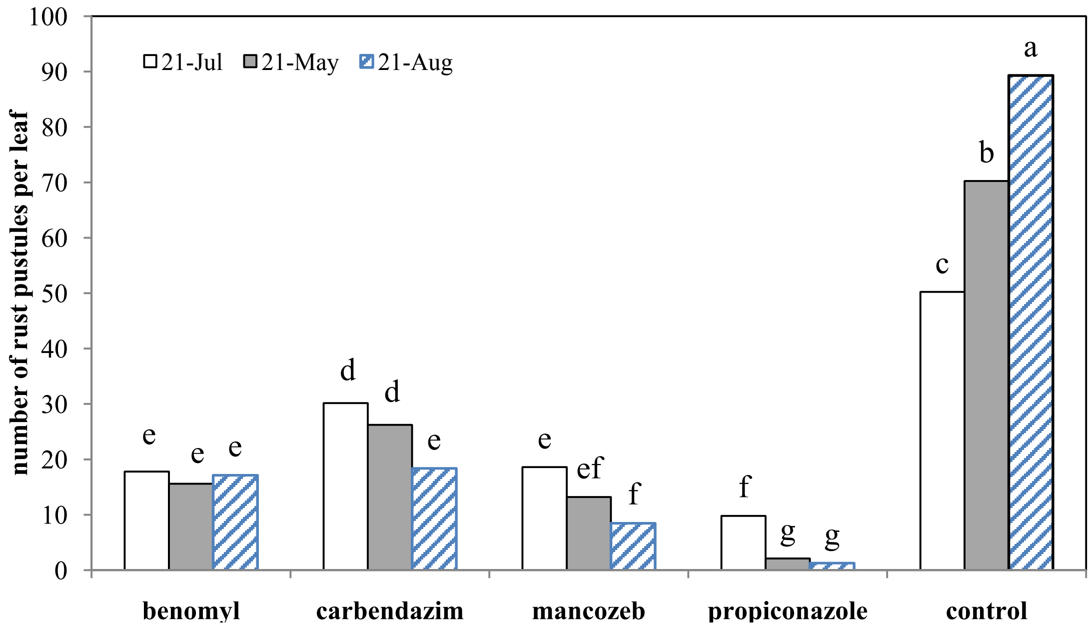


Fig. 3: Disease severity as the number of rust pustules in fungicide treated poplar trees in three assessment time

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