

# Occurrence of *Phytophthora* Root and collar rot disease of *Chamaecyparis* and *Thuja* in Tonekabon area in the west part of Mazandran, North of Iran

Seyed Esmail Mahdavian<sup>1</sup> and Saeb Javadi<sup>2</sup>

Associate Professor, Plant Protection Research Station, Khoshkhdaran, Tonekabon, Natural Resources and Agricultural Research center of Mazandaran. Iran<sup>1</sup>

Research Lecturer, Plant Protection Research Station, Khoshkhdaran, Tonekabon, Natural Resources and Agricultural Research center of Mazandaran. Iran<sup>2</sup>

**ABSTRACT:** High rot of the root and crown of the *Chamaecyparis* and *Thuja* due to *Phytophthora* fungus occurred in Tonekabon area from north of Iran in winter of 2014 and in spring of 2015. The symptoms like yellow, wilting and fall of the needles, root and crown rot and dry shrubs were observed in infected conifers shrubs. The disease is poorly drained soil in gardens, ornamental cedars production was observed in 20 of 30 nurseries. The appearance of *Chamaecyparis* and *Thuja* infected in the lands with heavy soils more than 60 and in some of production nurseries reached to 100 percent. The element of the disease and pathogen was characterized based on mycology properties, *Phytophthora sp.*, where the symptoms and the element of this disease completely conform to internal and external sources.

**KEYWORDS:** Fungi, Root and Collar Rot, *Phytophthora*, *Chamaecyparis* and *Thuja*

## I. INTRODUCTION

Cypress family (Cupressaceae): This Plant has 20 Genus Consists of *Chamaecyparis* and *Thuja* and it has approximately 140 species. In recent years in the Tonekabon region, located in West part of , Mazandaran Province cultivation and production of woody plants green space has increased dramatically. The varieties of ornamental plant species *Chamaecyparis* and *Thuja* in some gardens growers with poor drainage, the symptoms of yellowing wilting and general decline, and signs of drying shrubs, root and crown rot disease were observed. According to the essence of epidemic from injury, it was suspected that some pathogens may be associated with this disease. There are many diseases *Chamaecyparis* and *Thuja* mainly by fungi such as *Fusarium*, *Rhizoctonia*, *Pythium* and *Phytophthora* fungus is most important. Fungi *Fusarium*, *Rhizoctonia*, *Pythium* damping-off caused before and after the emergence of budding occurs in nurseries and cause root, crown and shoot rot. In particular it was believed that pathogenic fungi *Phytophthora* species as a possible cause, because the fungus as a major pathogenic causes similar diseases in other countries *Chamaecyparis* and *Thuja* were reported. The experiment and investigation of the sub ground parts (consist of root and crown), showed the dense disease in root, especially the lack of feeder roots. In winter of 2014 and in spring of 2015, we investigated of diseased plants and suspected ones in root and crown disease the *Phytophthora* genus was isolated. This disease exists in the gardens of breeding of ornamental plants wood in west part of Mazandaran and appeared as a threading factor of young trees such as *Chamaecyparis* and *Thuja* in the nurseries plants conifers in Tonekabon in Mazandran west area in north of Iran. One of the most common disease in ornamental plants and ornamental conifers is root and crown disease, some of pathogenic factors living in the soil consist of fungi of *Phytophthora* and *Pythium* genus from Oomycetes class can cause the root disease. The fungi of *Phytophthora* and *Pythium* are a various group of pathogenic factors which effect on various spectrum of ornamental plants , scion, seedling ,shrub and tree can influence either in the main ground or in the pot dish. The wood plants specially the

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

*Phytophthora* genus which the most common of them are *Phytophthora cinnamomi* are very sensitive, but some other species, including *P.lateralis*, *P.cactorum*, *P. parasitica*, *P. citricola* and *P. syrnge* are also sensitive. This disease usually can be seen with bad ecological circumstances, especially in high humidity and high temperature can be seen in the soil with poor drainage. In the circumstances such as drought, watering too much, root harm, very high temperature which can be stressful to plants, increase the sensitivity of plants to root damage. It is a wide range of host. The cedar barrel, Azalea, Cedrus, *Camaesypris*, Erika, ficus, pine, peony, rhododendron, larch, thuja, Yew, Blueberries, claymilk, magnolia, walaut. Oak, sulyesh, pome fruits, apple, pear are the influence plants and susceptible hosts. One of the important diseases of these ornamental conifer in the world and Iran is the root and crown rot disease which also has infected more than 50 percent of the wood ornamental plants. Studies conducted in the years 1393 and 1394 the disease infects up to 75 percent of the nurseries. Yellowing and wilting of foliage blight symptoms and root and collar rot and drying ornamental woody trees infected from late February to June month was observed. The disease is poorly drained soil in gardens, ornamental cedars production was observed in 20 of 30 nurseries. The appearance of *Camaesypris* and *Thuja* infected in the lands with heavy soils more than 60 and in some of production nurseries reached to 100 percent. This disease reported in Belgium, California, Ireland, Canada, Netherland, England, Taiwan and France, by different researchers on *Camaesypris* and *Thuja*, in the production nurseries of conifer plants. Ershad[1] separated and reported fungi such as *Phytophthora cactorum*, *P. pcirticola*, *P. citrphtoray*, *P. caypogea*, *P. drechsleri*, *P. nicotianac var. parasitica* in the years of 1993 to 1994 from the north nurse's and central of Iran, and expressed these fungi sometimes cause the plant death to 80 percent. Kavianpey[2] isolated the root decay fungi in forest trees in Khoozeston Province and investigated the morphology and pathogenic characteristics of that fungus in 1997 and 1999. Saadati and et al.,[3] express that the fungi disease from the soil can be such as the limiting factor for growing plants and for the settled trees consist of pine and cypress in different jungles. The decay and death of aforementioned plants can cause the economic and ecologic damage in different areas of Pharse, in South East of Iran. Shafizadeh and his colleagues [4], isolated the *Phytophthora* fungi in the north nurseries of Iran and they identified them. *Phytophthora* root rot is widespread, but this disease almost were ignored in the green space plants. The *Phytophthora lateral* is a soil born pathogen and causes the tree species death, such as *Chamaecyparis lawsoniana*. In a humid conditions the air infections can occur too. Thuja tree as a new host plant species of fungi have been described recently. The fungus *Phytophthora lateral* cause of death is known *Chamaecyparis lawsoniana* tree. The other species of *Chamaecyparis*.spp, for example the Asian species of *C. obtusa*, *C. pisifera* and *C. formonsensis* are considered less sensitive, Brassier, et al [5]. More recently, the fungus *Phytophthora lateral* in nurseries in Scotland *Thuja occidentalis* foliage isolated and was introduced as the new host. Schlanzig, et al, [6]. The fungus *Phytophthora lateral* in 1996 and 1998 in different regions of France were isolated from *C. lawsoniana*. Hansen, et al[7]. *P.lateralis* fungus was isolated in only one nursery in the Netherlands from the species *C. lowsoniana* Mumford[8]. Brassier, et al, [9]found the *P. lateral* fungus in one Jungle in Taiwan and suggested Taiwan may be in the geographical center of origin of the pathogen. More recently, the fungus *Phytophthora lateral* in nurseries in Scotland *Thuja occidentalis* foliage isolated and was introduced as the new host.

*P.lateralis* were reported in *C. lowsoniana* nursery in France. Robin, et al[10]. *P.lateralis* was found in different places in Scotland, England and Northern Ireland in the years 2010 and 2011. Two descends were found, distinguished from *P. lateral* in Britain, which one of them occurs in Northwest of America and the other was recognized only in Scotland. These isolates show the disease prevalence in France (1996-1998 and again in 2009),Netherland (2004, 2010, 2011)and recently in Belgium, different isolates in England and Ireland(2010 and the next year) and this disease is recognized more widely in Europe. Schlenzig, et al., [11] was reported *P.lateralis* for the first time form the *Chamaecyparis pisifer* species.

## II. MATERIALS AND METHODS

### Sampling

Different areas of growing woody plant green space of *Camaecyparis* and *Thuja* were visited and 30 samples of infected root and collar were collected from 30 breeding of ornamental plants wood gardens in Tonekabon area and studied separately.

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

## *Isolation, purification and identification of pathogen*

parts of the main roots, secondary roots and crowns of infected shrubs 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 *phythophtora* sp fungus were isolated and identified.

## III. RESULTS

### *Signs and symptoms*

Wilting foliage, deflection and brown needles and in severe cases destroyed plant needles and conifers shrubs mortality was observed. Collar and root rot increased due to disease progression and plant unable to absorb food and water and finally tree will dry. 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 conifers and in particular the lack of feeder roots. Primary symptoms of infection to soil-borne fungus appear in late winter and early spring in gardens and cause delay opening in the sprouts. The root rot spreads to crown or stem base or trunk plant. (Figure 1-10).



Figure 1. Seedlings with *Phytophthora* root rot



Figure 2. Necrotic and chlorotic shrubs in rows where water has accumulated



Figure 3. Necrotic and chlorotic shrubs in rows where water has accumulated



Figure 4. Root rot symptoms throughout field



Figure 5. *Phytophthora* root rot



Figure 6. Sever *Phytophthora* root rot in the field



Figure 7-8. *Phytophthora* root and collar rot cupressaceae



Figure 9-10. Diagnostic discoloration of the inner bark

#### ***Disease factor***

The root and collar rot disease factor of *Chamaecyparis* and *Thuja* species is a Soil-borne fungus which called *Phytophthora* sp.

#### **IV. DISCUSSION**

More than 5 species of *Phytophthora* have been reported to infect *Chamaecyparis* and *Thuja* species in different countries van Der Gaag and Merffert. [12].The *Phytophthora* fungus already reported from the nurseries and plantations of cypresses by different researchers in Iran,[ 1,234].. The results showed that phytophthora fungus is the factor of *Chamaecyparis* and *Thuja* root and crown rot in the Tonekaboon in north of Iran. *P. citrophthora* species obtained in this study was similar with the study in Iran and the other countries. The phytophthora fungus is very aggressive and is an important factor of threat for producers of ornamental trees such as *Chamaecyparis* and *Thuja* in Iran, especially in heavy soils and poor drainages. As reported, the disease has a high moisture in the soil and poor drainage in nurseries is highly desirable. The main way of p. laterals spread probably is from human aids with Long distance.

Move or relocation form the host plants with infected soils and their touch with host plants and non host plants which are healthy, the infected soil relocation from machining car, shoe and etc can spreads. The pathogen is soil borne and

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 3, March 2016

produces' animated spores and move in water easily. symptoms may *Phytophthora* species of fungi that are present in many European countries, such as *P. cinnamomi* and *P. cryptogea* are attributed. Europhyt, [13]. The normal emission of fungus species such as phytophthora is the main factor in root and crown decay and occurs less than 1 meter in every year and zoospores occurs less than 10 centimeters in the soil, Erwin and Ribeiro, [14]. natural dispersion further distances through water and humanly possible, Jules et al., [15]. Air spread of pathogens for the first time in the coastal region of Oregon in 1957 and 1959 have been reported. In this regard the air expansion can occur too, Air expansion reported from pathogen for the first time from the coastal area in 1957 and 1959, Trione, [16]. This method of spreading the disease was not reported again until the recent outbreak in the West Britain, Robin et al [17]. The humid condition is necessary for air infections

*P. lateralis* was isolated from the aerial parts of *Chamaecyparis* in Taiwan. Weakened trees often follow the trend of poor drainage occurs in gardens, especially in humid regions. The symptoms are not apparent in the foliage. Weakness, stunted growth, yellowing and shrinking needles, drop of needle before maturity, dry branches, wilting and death of the tree can be seen. The high flow gum can be observed in outer skin in root and crown area. The water is a key factor for infection. After some times of water remain or after weak drainage, the infection occurs in the plant. The burning and yellowing of seedlings is seen in lines, where the water is collected after planting. The symptoms and element of the disease and pathogen was characterized based on mycology properties, *Phytophthora sp.*, where the symptoms and the element of this disease completely conform to internal and external sources.

## ACKNOWLEDGMENT

This investigation was conducted at Lab. Plant protection research of Nashtaroud. Authors are thankful to Lab for cooperation in doing this study.

## REFERENCES

- [1] J Ershad. Investigation damping-off conifers in the northern and central nursery of Iran. Journal of Plant Pathology. vol 32,1.2:16-26.1994.
- [2] A Kavianpey. Isolation and identification of fungal root rot and damping-off and seedling nurseries of forest trees in Khuzestan. Persian plant pathology. 2000.
- [3] A Saadati, A Zakeri, Z Banihashemi and H Zargani. investigation and identification of pathogenic soil fungi in the forest of pine and cypress. Research Report. Natural Resources Research Center of Fars province.2001.
- [4] S Shafizadeh, M Mirabolfathi, A Sharifitehrani and MR Arefipor. The fungus causes damping off control methods nurseries pine in northern Iran. Research Report. Pests and Diseases Research Institute of Forests and Rangelands. 1994.
- [5] CM Brasier, AM Vettrano, TT Chang, A Vannini. *Phytophthora lateralis* discovered in an old growth *Chamaecyparis* forest in Taiwan. Plant Pathology 59, 595 – 603.2010.
- [6] A Schlenzig, R Campbell and V Mulholland. *V. Thuja occidentalis*: a new host for *Phytophthora lateralis*. New Disease Reports 24,8.2011
- [7] Hansen. survival of *Phytophthora lateralis* in infected roots of port Orford cedar plant disease.80:1075-1078.
- [8] JD Mumford, O Booy, RHA Baker, M Rees, GH Copp, K Black, J Holt, Leach, AW M Hartley. Invasive species risk assessment in Great Britain. Aspects of Applied Biology 104, 49-54.2010.
- [9] CM Brasier, AM Vettrano, TT Chang, A Vannini. *Phytophthora lateralis* discovered in an old growth *Chamaecyparis* forest in Taiwan. Plant Pathology 59, 595 – 603.2010.
- [10] C Robin, D Piou, N Feau, G Douzon, N Schenck, EM Hansen. Root and aerial infections of *Chamaecyparis lawsoniana* by *Phytophthora lateralis*: a new threat for European countries. Forest pathology. Blackwell Verlag GmbH. Published online <http://wileyonlinelibrary.com>.2010.
- [11] A Schlenzig, R Campbell and R Eden. First report of *Phytophthora lateralis* on *Chamaecyparis pisifera*. New Disease Reports (2014) 29, 15.2014.
- [12] D.J Van Der Gaag and J Meffert. Pest Risk Assessment for *Phytophthora lateralis* Netherlands Food and Consumer Product Safety Authority trecht, 2013 Webbe,
- [13] Europhyt. European database on plant health information. (last access September 2013). Hansen EM, Goheen DJ, Jules ES, Ullian B (2000) Managing Port-Orford-Cedar and the introduced pathogen *Phytophthora lateralis*. Plant Disease 84, 4-14.2013.
- [14] DC Erwin, OK Ribeiro. *Phytophthora lateralis*. In: *Phytophthora diseases worldwide*. American Phytopathological Society, St Paul, 365-367.1996.
- [15] ES Jules, MJ Kauffman, WD Ritts, A Carroll. Spread of an invasive pathogen over a variable landscape: a nonnative root rot on port orford cedar. Ecology 83, 3167 –3181.2002. [16] EJ Trione The pathology of *Phytophthora lateralis* on native *Chamaecyparis lawsoniana*. Phytopathology 49,306–310. .1959.
- [17] C Robin, D Piou, N Feau, G Douzon, N Schenck, EM Hansen. Root and aerial infections of *Chamaecyparis lawsoniana* by *Phytophthora lateralis*: a new threat for European countries. Forest pathology. Blackwell Verlag GmbH. Published online <http://wileyonlinelibrary.com>.2010.

# International Journal of Innovative Research in Science, Engineering and Technology

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 5, Issue 3, March 2016**

## **BIOGRAPHY**



I have been working as a researcher (Assistant Professor) in Dept. of plant protection research in Natural Resources and Agricultural Research center of Mazandaran North of Iran. I am holding MSc and PHD degree in plant pathology and environmental science respectively. I have 27 years experience in above field. I have published and presented more than 40 papers in various national and international conferences and journal. I was awarded by head of Iran citrus research Institute and head of Sari Jihad-Agricultural organization and etc. my research area is pesticide residue and plant diseases. And also I teach at the University.