Inhibitory Activity of Oak Pyroligneous Liquor against Coleosporium Plectranthi, an Obligate Parasite Responsible for the Rust Disease on Perilla Leaf

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Abstract

BACKGROUND: Coleosporium plectranthi, an obligate parasite, which is responsible for the rust disease of Perilla frutescens, a plant in Korea, commonly known as Perilla. All rusts are obligate parasites, meaning that they require a living host to complete their life cycle. They generally do not kill the host plant but can severely reduce growth and yield. Food and feed spoilage fungi cause great economic losses worldwide. It is estimated that between 5 and 10% of the world food production is wasted due to fungal deterioration. Rust disease of Perilla is highly frequent and is widely spread in Korea. The present study was designed to investigate a novel media for the urediniospore germination in vitro and anti-rust activity as well as GC-MS analysis of oak pyroligneous liquor.

METHOD AND RESULTS: Urediniospores were collected from the infected leaf of Perilla. Spore suspension was made and the suspension was inoculated in the 2% water agar media with proper humidity, then they were incubated at 26 ℃ for 56 hrs. The GC-MS analysis of the oak pyroligneous liquor was also done to check the chemical composition. GC-MS analysis of the wood vinegar was found 15 compounds, among them o-mthoxyphenol (25.93%), 2,6-dimethoxyphenol (16.06%), 4-methylene cyclohexanone (10.69%), 2,3-dihydroxytoluene (7.84%), levoglucosane (6.14%) and propanoic acid (5.32%) were the major components. Different concentration of the oak pyroligneous liquor was used, and spore inhibition was recorded on the basis of spore counting. The best results were noted at the concentration of 50% solution where 31.8% spores were inhibited.

CONCLUSION: On the basis of the chemical composition of the oak pyroligneous liquor and the activity recorded we can use it as an anti-rust agent.

Key Words: Coleosporium plectranthi, GC-MS, Oak pyroligneous liquor, Perilla

INTRODUCTION

The genus Coleosporium belongs to the family Coleosporaceae of the order Uridinales. This family has two other genera and nearly 80 cosmopolitans including the genus Coleosporium. The genus has numerous described species, many of which are doubtfully distinct morphologically (Cummins, 1997).

Historically, the classification of Coleosporium was decided by the morphology of teliospores, and species was decided by alternate hosts. Nevertheless recent found that the Coleosporium species are not strict in selecting for alternate hosts of some species often overlaps (Sato and Sato, 1982).

Perilla frutescens commonly known as Perilla is an annual herb of the genus Perilla of the mint family, Lamiaceae. Perilla is a summer annual plant and adapted to warm humid climates. The seed can be...
planted one centimeter deep as early as possible in the spring. The flowers self-pollinate without insect visits (Brenner, 1993). It is also known as beefsteak plant. Its essential oil has a strong taste. Its foliage is widely used as a side dish in Korean food and seed oil are also used in Korean cooking. The foliage is used as potherb and a garnish in Japan as well. The seed are eaten in Japan, Korea and India (Brenner, 1995). In Japan the foliage also provides a red (anthocyanin) food coloring and specialized red leaved perrila varieties are used in production of pickled plums (Suyama et al., 1983). Perilla is also used in Oriental medicine, especially in Chaina (Chen 1997).

Rust disease of Perilla is highly frequent and is widely spread in Korea (Al-Reza et al., 2010). End of June to mid August is the probable time when the Perilla rust occurs during the growing seasons. Initially, the symptoms appear as tiny yellowish projections on the lower surface of the leaves usually spreading inwardly from terminal leaf edge, accompanied by yellow to brown flecks formed on their opposite upper side and covering the whole leaves with spore masses within 2–3 weeks. Both aeciospores and urediniospores are reportedly pathogenic to Perilla, which are known to serve primary and secondary inocula, respectively, in a macrocyclic disease cycle of the rust fungus. However, at present the involvement of aeciospores in the development of Perilla rust may be relatively low because Perilla is widely grown in greenhouses in which the disease is prevalent during the wintertime and urediniospores readily over winter to serve as the continuous secondary inocula in the next year (as primary inoculum). Also the urediniospores must be the inoculums of the secondary infection responsible for rust epidemic in Perilla (Yun et al., 2007).

An Oak is a tree or shrub in the genus Quercus, of which about 600 species exist on earth. "Oak" may also appear in the names of species in related genera, notably Lithocarpus. The genus is native to the northern hemisphere and includes deciduous and evergreen species extending from cold latitudes to tropical Asia and the Americas.

Most parts of the Oak tree are used medicinally and their healing effects are varied. The distilled water of the Oak leaf bud can be taken internally or used externally to relieve minor inflammations. Bruised Oak leaves applied externally to wounds and hemorrhoids will also help to reduce and ease inflammation. The bark of the Oak tree is part most used in medicine, it being a tonic, astringent and antiseptic. As with other astringents it is also recommended for use in agues and hemorrhages. When bark is boiled with water, it can then be taken in a wineglass measure or dose, and used as a gargle mouthwash for chronic sore throats, or applied locally to bleeding gums and piles. It is also used in hot baths for chilblains and frostbite or as a hot compress for inflamed glands, hernias and hemorrhoids. A stronger decoction taken by the spoonful is useful in chronic diarrhea.

Oak bark as a powder makes a remedial snuff that can be inhaled to arrest nosebleeds. A pinch of powered Oak bark mixed with honey and taken in the morning will help and aid ladies with menstrual problems. Ground and powdered acorns taken with water was considered as a useful tonic for diarrhea, and a decoction of acorns and Oak bark made with milk, was used as an antidote to poisonous herbs and medicines. In old times, the thin skin of acorn was used to cover open cuts or wounds, and ground and powdered acorns taken in wine was considered as a good diuretic (George Knowles, 2002).

Materials and Methods

Collection of the samples

The leaves of Parilla infected by C. plectranthi were collected freshly from the open field near Daegu University, Kyoungsan, Republic of Korea in August 2011. The infected leaves with different size of pustules which are visibly free from other contaminants were selected and the uridiniospores were collected in a gelatin capsule by scooping the spores from each pustules of the leaf formed the bulk sample.

Preparation of urediniospore suspension

Urediniospores were mixed in 25 ml of sterile distilled water, pre-added with one small drop of 0.01% Tween 20 to make the final spore concentration approximately 1x 10^5 spores / ml.