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Pest Risk Assessment (PRA) for Norway of the Pelargonium rust (*Puccinia pelargonii-zonalis*) on *Pelargonium zonale*

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Pest Risk Assessment (PRA) for Norway of the Pelargonium rust (*Puccinia pelargonii-zonalis)* on *Pelargonium zonale*

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Commissioned by the Norwegian Agricultural Inspection Service

1. Endangered area

The Pest Risk Assessment (PRA) area is Norway

2. Name and taxonomic status of the pathogen

2.1 *Puccinia pelargonii-zonalis* Doidge

2.2 Fungi, Basidiomycotina, Teliomycetes, Uredinales

2.3 Common names: Pelargonium rust (English)
Ruille du *Pelargonium zonale* (French)
Pelargonienrost (German)
Roya del geranio (Spanish)
Pelargoniumrust (Norwegian)
Pelargonierust (Danish)
Pelargonrost (Swedish)
Pelargonin-ruoste (Finnish)

3. Regulatory criteria

Norway: *Puccinia pelargonii-zonalis* is on the A list (Quarantine pest. Limit of tolerance = 0 %)

EPPO: A2 list: No 81

EU: Council directive 91/682 (ornamental plants, pelargonium),
Commission directive 93/49, Article 3.1 and Annex

P. pelargonii-zonalis is absent from the PRA area. However, it has been intercepted several times in the PRA area during the last 10 years.

4. Methods for identification/detection

The fungus can be identified by macroscopic and microscopic symptoms and signs.

Urediniospores infect the leaves, first small whitish spots appear on the lower surface, and after 48 hours they are seen as more yellow spots on the upper surface. The spots enlarge up to 6-8 mm in diameter. Reddish-brown uredinia form, mainly on the lower surface, and appear as powdery pustules. They are initially grouped in the centre of the spot, then develop in concentric rings. Secondary sori are formed from hyphae which grow through the leaf tissue from sori after primary infection. The spots gradually coalesce and become necrotic, and fairly rapidly the leaves will be chlortic, dry up and shed.

The urediniospores are ovoid/globose, light brown, slightly echinulate, thin walled with two subequatorial pores, and measure 19-29 x 17-24 micrometer.

Small, shiny, brownish-black pustules of telia may form around uredinia. The two-celled teliospores are ellipsoid or clavate and measure 36-57 x 16-27 micrometer. They are pale brown, the upper cell darker than the lower. Telia are, however, less commonly seen, and are not known to germinate.

Pycnia and aecia are unknown.

5. Establishment potential

5.1 Biological information of the pest

P. pelargonii-zonalis causes the disease pelargonium rust on *Pelargonium zonale*. The fungus was first described from South Africa (Doidge 1926).

5.1.1 Life cycle

P. pelargonii-zonalis is a microcyclic, autoecious rust fungus.

Only urediniospores and teliospores are known for this fungus. Teliospores are found in greenhouses during the winter, but they have never been observed to germinate. Urediniospores germinate readily when the conditions are humid on the leaves. As urediniospores is only spore stage known to germinate, they are the only source of infection.

Since infected leaves are rapidly dropping, the fungus is carried over as much by urediniospores as by mycelium in the plant. The urediniospores can survive up to 11 weeks on detached leaves.

5.1.2 Interaction pathogen/host

P. pelargonii-zonalis is a biotropic fungus. That means it is unable to grow on any substrate, but its plant host.

The pathogen is normally only found on leaves. Under conditions of high humidity and high inoculum, pustules developed on leaves.

5.1.3 Host range

The main host is *Pelargonium zonale.* The host is extensively grown in Europe. The rust has not been recorded on *P. peltatum* or variegated forms. *P. inquinas* is the only other species that has become infected in artificial inoculations. Artificial inoculation to other *Pelargonium* spp. has not been successful.

5.1.4 Dissemination and dispersal / epidemiology

Long distance dissemination is mainly by infected plant materials in international trade. Air-borne urediniospores are highly efficient in disseminating the fungus in greenhouses. Also, spores can be carried by wind over relatively long distances outdoors. Urediniospores of other rust fungi are often disseminated hundreds of kilometres by moving air currents. There are no studies on long distance transport of *P. pelargonii-zonalis* urediniospores..

High humidity and a film of moisture on the leaf are necessary for germination of urediniospores. Germination occurs between 7 C and 27 C, with highest germination in the range of 11C to 23 C. At lower temperature the spores will not germinate, but they can survive. At temperatures above 30 C the urediniospores rapidly loose the ability to germinate.

Successful infection requires 8 hrs high humidity with free water on the leaf surface. The incubation period is 11 to 14 days at 17 C or up to 22 days at 11 C. Urediniospores are released 3 to 7 days after the symptoms appear. There is a maximum spore release at noon. In the greenhouse environment, air currents, clothing on personnel, tools and water splash are important factors in dispersal (Spencer 1976).

5.1.5 Survival

P. pelargonii-zonalis can survive for weeks as inconspicuous lesions on leaves and stipules.

Urediniospores have been shown to survive at least 11 weeks in detached leaf materials.

5.1.6 Adaptability

P. pelargonii-zonalis is adapted to very narrow range of host plants. It is highly unlikely to adapt to other hosts.

5.2 Geographical distribution

5.2.1 The pathogen

The fungus *P. pelargonii-zonalis* was first described in South Africa (Doidge 1926).
The fungus has the same origin as its host plant.

Europe: The fungus is widespread in Austria, France, Germany, Greece, Italy, Luxembourg, Portugal, Switzerland and United Kingdom.

It is locally established in Belgium, The Czech Republic, Denmark, Hungary, The Netherlands, Spain, Sweden and Yugoslavia.

It has been reported from, but it is not established in Finland, Ireland and Norway.

Asia: Israel

Africa: Widespread in eastern and southern areas.

North America: Bermuda, Mexico, USA.

Central America: Costa Rica, El Salvador, Jamaica.

South America: Argentina, Brazil, Venezuela.

Oceania: Australia, New Caledonia, New Zealand, Papua New Guinea.

5.2.2 Host plant

The major host plant, pelargonium, is world wide in distribution.

In the PRA area the host is cultivated in greenhouse throughout the year. During summer transplants are grown outdoors.

The annual production in the PRA area is 2.6 mill of Pelargonium plants
(Norsk gartnerforbund 1995).

5.3 Environmental suitability in the PRA area

5.3.1 Climatic conditions for development

The climatic conditions in greenhouses in the PRA area are optimal for development of *P. pelargonii-zonalis*. During summer the fungus may develop on pelargonium outdoors.

5.4 Control

5.4.1 Control methods in regular use

Cuttings and other plants carrying latent infections is a major risk for introduction of *P. pelargonii-zonalis* into greenhouses. Careful control of plant material is important. Heat treatment of cuttings at 38 C for 48 hrs or 34 C for 4 days at high humidity will destroy mycelium and urediniospores. There are efficient fungicides available for control of the fungus (Spencer 1976).

5.4.2 Records of eradication of the pest

In several European countries eradication has been the major strategy to stop attacks of the fungus.

5.5 Case history

In the PRA area *P. pelargonii-zonalis* has been found several times. In each case the fungus has been intercepted and successfully eradicated.

Some of the outbreaks in the PRA area in recent years are listed below:

Year	Locality	Origin of plant material
1985	Lier	Germany
1987	Fredrikstad	Germany
1987	Bærum	Germany
1992	Tønsberg	
1993	Lier	Canary Islands

During the period 1988 - 1995 two imported lots of pelargonium have been rejected due to *P. pelargonii-zonalis* infection. Both originated from the Canary Islands (Norwegian Agricultural Inspection Service).

5.6 Conclusion on establishment potential

P. pelargonii-zonalis has establishment potential in the PRA area.

6. Spread potential after establishment

6.1 Suitability of the Natural and/or managed environment for Natural spread of the pest

The greenhouse environment in the PRA area is suitable for development and local spread of the fungus.

6.2 Movement with commodities or conveyances

The trade in pelargonium plants and cuttings represent a potential for long distance spread into and within then PRA area.

6.3 Intended use of the commodity

The trade in pelargonium mother plants and cuttings is a result of specialisation among the growers in the PRA area.

6.4 Potential Natural barriers in the PRA area

There are no potential natural barriers in the PRA area.

6.5 Case history

The above mentioned repeated introductions of *P. pelargonii-zonalis* into the PRA area illustrate its potential for dissemination.

6.6 Conclusion on spread potential

The 11 to 14 days long latent period and the rapidity of air and surface transport give the fungus a great spread potential

7. Potential economic importance

7.1 Potted pelargonium plants

Norwegian statistics (Norsk gartnerforbund 1995) shows that the annual production in the PRA area is around 2.6 million pelargonium plants with an estimated value of 38,4 mill NOK, sold from the growers.

Several of the producers sell circa 600 000 pelargonium annually. An outbreak at a grower with this production volume may cost 1.8 mill NOK if the plants are to be destroyed. Also, growers that are customers of the producer with an outbreak will suffer economic losses (Norsk gartnerforbund 1995).

Norsk Gartnerforbund (1995) estimates that 60 man-years are involved in the production of pelargonium plants in the PRA area.

7.2 Potential economic importance.

Severe epidemics of *P. pelargonii-zonalis* can force the growers to abandon the production of pelargonium in Norway.

An alternative strategy is to apply fungicides profylactically to control the fungus in the PRA area. This method has economic and environmental costs.

8. Introduction potential

8.1 Entry

8.1.1 Opportunity for contamination of commodities or conveyances

There is import of pelargonium into the PRA area from countries with *P pelargonii-zonalis* infected pelargonium every year.

8.1.2 Survival under environmental conditions of transport

The fungus will survive well in the environmental conditions for transport of pelargonium plants.

8.1.3 Detecting at entry inspection

Due to the long incubation period (11- 14 days) infection with the fungus is difficult to detect.

8.1.4 Interceptions to PRA area the last 10 years

During the last 10 years the fungus has been intercepted several times.

8.1.5 Movement into PRA area by natural means

There are no natural means for movement of the fungus into the PRA area.

9. Conclusion

The conclusion for the PRA area is that *P. pelargonii-zonalis* has a potential for establishment and that phytosanitary measures are justified.

10 . Literature

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