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Wind dispersal of Puccinia horiana

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About 1964 in several countries of Western-Europe *Puccinia horiana* P. Henn. was recorded for the first time in chrysanthemums, *Chrysanthemum morifolium*. In all cases it could be established that the rust was imported with infected cuttings (Boerema and Vermeulen, 1964; Melder, 1964; Jørgensen, 1964; Baker, 1967).
During the field inspection performed by the Plant Protection Service we found outbreaks which could not be explained by dispersal with infected cuttings. We therefore collected information on the dispersal of inoculum.
In 1965 we visited a plot with chrysanthemums severely attacked by *P. horiana*; we also found the symptoms in the adjacent plots (Fig. 1). The following observations were made:
(1) Infected plants were almost exlusively found in the sector east of the attacked plot, over a distance of up to 350 m. At greater distances there were no chrysanthemums.
(2) The greater the distance from the attacked plot, the less was the percentage of infected chrysanthemum plants.
(3) Close to the attacked plot, infection was found all over the plants. At a greater distance from the source, infection was usually confined to the upper parts of the plants.
(4) In glasshouses in the same sector, infection was found mainly under the ventilation windows.
In 1966 we made the following observations:
(1) About 7 August a heavily infected crop in a glasshouse was destroyed. A fortnight later a plant with sporulating sori was found outside the glasshouse in a corner with frequent whirlwinds.
(2) In another locality, at a nursery close to an infected crop, a mild infection was found especially at a place outside with whirlwinds.
(3) In a third locality, at two nurseries east of an infected crop at distances of about 500 and 700 m, respectively, (Fig. 2), we found an infection at places with whirlwinds. Between the infected crop and the two eastward nurseries, no chrysanthemums were cultivated.
(4) In several other places we saw that nearly all infections, clearly unrelated to infected cuttings, were found east of the infected crop.
These data show that there is a horizontal gradient of infection from an attacked plot. The gradient tapers out in down-wind direction. This direction usually is east because

Fig. 1. Wind dispersal of *Puccinia horiana* in 1965. 1 = origin of infection, 2 = lightly infected plots, 3 = strongly or moderately infected plots.

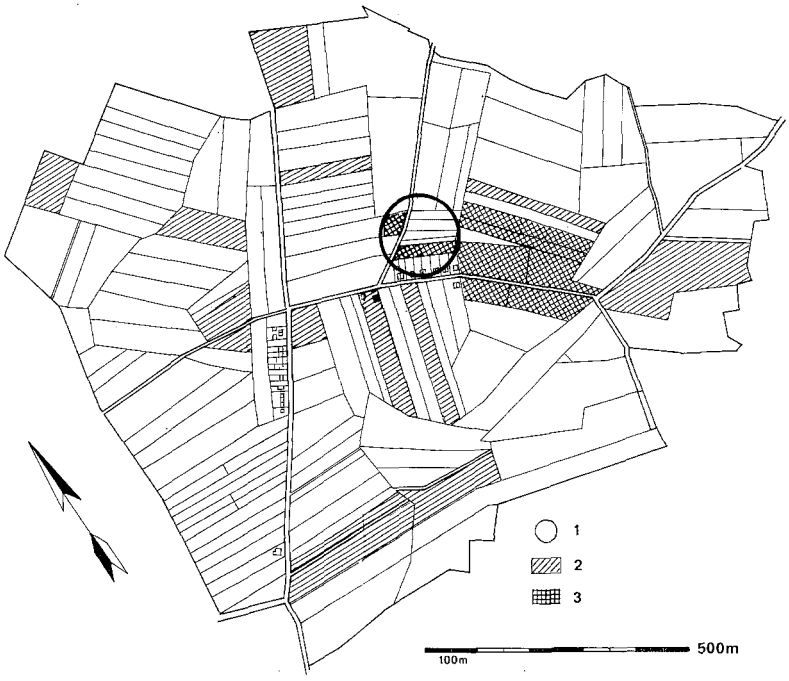

Fig. 1. Verspreiding van Puccinia horiana door de wind in 1965. 1 = oorsprong van de aantasting, 2 = zwak aangetaste velden, 3 = sterk of matig aangetaste velden.

west winds only bring the humid weather needed for infection. Besides there is a vertical gradient of infection. In plots known to be infected in an early stage of growing, the infection occurs all over the height of the plants. The farther from the source the less the infection of lower leaves, because the lower leaves were less accessible to the inoculum and/or because these leaves already acquired some degree of resistance before being infected.

These observations indicate that the rust inoculum can be dispersed by the wind over a distance of at least 700 m. Baker (1967) even supposed that the white rust was windborne over a distance of several miles.

On spots where large amounts of air pass at great speed, for example wind eddies in corners outside the glasshouse or under ventilation windows inside the glasshouse, we found relatively severe infections. It is supposed that in windy corners the influx of inoculum is increased because there pass large amounts of air, whereas high wind speed ensures good penetration of the crop by spore clouds as well as efficient impaction of the spores. Under ventilation windows conditions for entry and sedimentation of spores are ideal.

The above mentioned data also show that inoculum can as readily enter the glasshouse as it escapes the glasshouse, apparently by way of ventilation windows and other openings (compare Zadoks, 1967, p. 69).

Fig. 2. Wind dispersal of *Puccinia horiana* in 1966. 1 = plot infected with cuttings, 2 = plot afterwards infected.

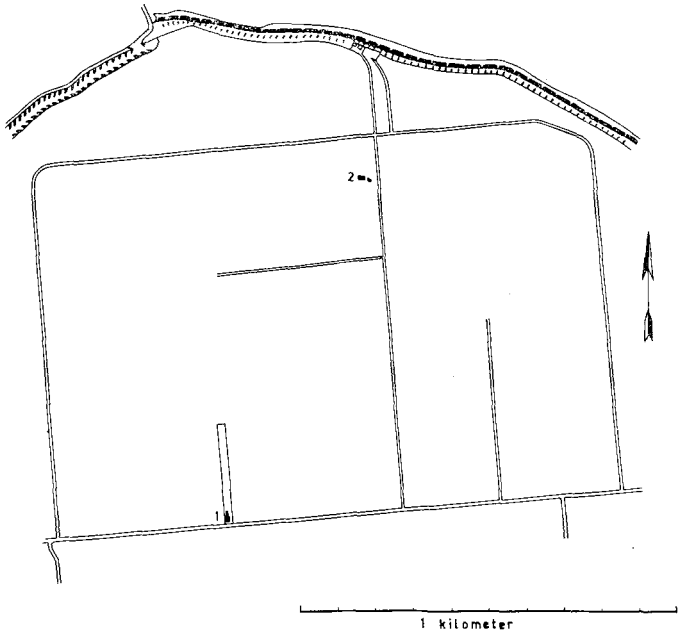

Fig. 2. Verspreiding van Puccinia horiana door de wind in 1966. 1 = veld aangetast bij het stekken, 2 = veld daarna aangetast.

The following conclusions were drawn and recommandations made:
(1) Dispersal of inoculum of *P. horiana* by wind is possible over distances up to 700 m at least.
(2) The inoculum causes new infections during moist periods, in The Netherlands usually associated with westerly winds.
(3) During the destruction of infected plants in glasshouses the doors and windows must be well closed. In all cases destruction of diseased plants must be done carefully in order to prevent the stirring up of spore clouds.
(4) It is advisable to treat the crop with a fungicide before the destruction of infected plants in order to prevent the development of new infections.

Samenvatting

Verspreiding van Puccinia horiana door de wind

De verspreiding van *Puccinia horiana* bleek niet altijd te geschieden met besmette chrysantestekken. Uit veldwaarnemingen werd afgeleid dat het inoculum van deze schimmel over een afstand van 700 m door de lucht kan worden verspreid (Fig. 2). De verspreiding van de ziekte heeft bijna uitsluitend plaats met winden uit westelijke richtingen (Fig. 1), omdat deze meestal een hoge luchtvochtigheid bezitten. Bij het

vernietigen van aangetaste chrysanten, zowel binnen als buiten de kas, moet met deze windverspreiding rekening worden gehouden. Door voorzichtige behandeling van de zieke planten moet men proberen het opwaaien van sporenwolken te voorkomen.

Acknowledgment

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References

Baker, J. J., 1967. Chrysanthemum White Rust in England and Wales 1963–1966. Pl. Path. 16: 162–166.

Boerema, G. H. en Vermeulen, H., 1964. Puccinia horiana, de "Japanse roest" ook in Nederlandse chrysantebedrijven. Vakbl. Bloemisterij 19 (30): 697.

Jørgensen, H. A., 1964. Japansk chrysanthemumrust (Puccinia horiana P. Henn.) konstateret i Danmark. Maanedsovers. St. plantepat. Forsøg 407: 17–19.

Melder, A., 1964. Der Pflanzenschutz im Zierpflanzenbau. Zierpflanzenbau 4: 335–336.

Zadoks, A., 1967. International dispersal of fungi. Neth. J. Pl. Path. 73 (Suppl. 1): 61–80.