

Rare symptoms on *Chrysanthemum morifolium* infected with *Puccinia horiana*

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During investigations of *Puccinia horiana* P. Henn., the white rust of *Chrysanthemum morifolium*, some rare and as yet unpublished symptoms were observed. The rust was grown on cv. 'Indianapolis White Giant IV' in a conditioned greenhouse with temperatures between 16° and 18°C.

P. horiana is a leptocyclic rust propagated by teliospores. After inoculation (Zandvoort et al., 1968), whitish yellow flecks, usually slightly concave, with a diameter of about 1 mm appear on the upper surface of the leaves. Later, the colour turns into a light yellowish brown. On the underside of the leaf the usually slightly convex lesions show a number of light orange-brown swellings developing into teliospore-bearing cushions. When mature, the cushions are coloured greyish brown by the numerous basidia. The lesions extend and finally measure 1-15 mm in diameter, depending on the density of infection. In large lesions the cushions are sometimes arranged in more or less concentric rings.

Of rare occurrence is the "white ring symptom", where a white ring surrounds a small lesion. Sometimes the white ring remains sterile, sometimes it produces new spore-bearing cushions. Regularly, but in small numbers, a "white fleck symptom" has been observed. It appears simultaneously with the chlorotic flecks which are the onset of normal lesion development. The "white flecks" are up to 10 mm in diameter, and show minor whitish protuberances at the upper surface at hand-lens magnification. The rust does not sporulate on these white flecks. Microscopic examination using cotton blue or hematoxylin stains reveals intercellular mycelium with stroma-like concentrations mainly in the substomatal cavity. Sometimes, the mycelium is clearly dikaryotic.

Still rarer than the 'white fleck symptom' is the "red fleck symptom". This looks like a white fleck but it is purplish-red from the beginning, possibly because of anthocyanin formation. Microscopic examination confirms the results obtained with the white flecks. Intercellular mycelium, present throughout the lesion, forms a kind of subepidermal stroma, usually under a stoma. Dikaryotic cells have been observed in the mycelium.

Simultaneous appearance of all these symptoms after inoculation, absence of the symptoms when there is no *P. horiana*, and the dikaryotic cells observed suggest that all symptoms mentioned are due to *P. horiana*. Isolation of the fungus from the flecks and

re-infection seems to be impossible because *P. horiana* is an obligate parasite. Transplantation of the flecks has not been attempted.

The origin of the white and red flecks is a matter of conjecture. They might be:

- (a) Environmentally induced;
- (b) the result of mutations yielding sterile mycelium, or
- (c) caused by infertile mycelium due to a failure in somatic hybridization between heterokaryotic strains of the rust (Allen, 1935).

Samenvatting

Zeldzame symptomen op chrysant geïnfecteerd met Puccinia horiana

Enkele zeldzame symptomen van de witte roest van chrysant werden in de kas waargenomen. Dit zijn het “witte-ringsymptoom”, het “witte-vleksymptoom” en het uiterst zeldzame “rode-vleksymptoom”.

References

- Allen, R. F., 1935 A cytological study of *Puccinia malvacearum* from the sporidium to the teliospore. J. agric. Res 51: 801–818.
- Zandvoort, R., Groenewegen, C. A. M. and Zadoks, J. C., 1968. Methods for the inoculation of *Chrysanthemum morifolium* with *Puccinia horiana*. Neth. J. Pl. Path. 74: 174–176.