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## WHITE RUST A NEW DISEASE IN SURINAM

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In May 1963, several plants of chinese cabbage were received from farmers by the Plant Protection Service showing as symptoms white blisterlike postules.

A survey during the next six months showed the disease to be present mostly in the vegetable areas on shell ridges around the capital city of Paramaribo. This being a new disease, we were not content with our initial diagnosis, but material sent up to the Plant Protection Service at Wageningen, Holland, confirmed the disease as being caused by the white rust fungus, Albugo candida (Pers. ex Chev.) Cystopus candidus (Pers. Rous).

Symptoms of this disease which is new for Surinam are yellow spots on the leaves. Furthermore on the lower surface of the leaves are found the pronounced white chalky sporemasses. There is no indication of any disease present until light coloured areas begin to appear under the epidermis on the lower surface of the leaves. These areas enlarge, become lighter in colour and produce a raised area before they finally cause the epidermis to rupture and at this stage the conidia are released. The edges of the ruptured epidermis dry and shrivel, exposing more and more of the white spore mass. The spots enlarge, producing single, more or less circular postules, or the epidermis is ruptured in several places often resulting in more or less circular rows of small postules or sori surrounding the original one. The leaf tissue of the upper surface directly above the postules becomes yellow, dies and turns brown. Eventually dark brown necrotic spots are visible.

According to publications by J. C. Walker, R. H. Larson, A. L. Taylor, George F. Weber, and others, white rust is found on many wild and cultivated crucifers and is worldwide in its distribution. However in Surinam white rust was found only recently on chinese cabbage namely on the varieties amchoi, pakchoi, and kaichoi. On the latter, the disease incidence was the least while on the former, sometimes the under surfaces of the leaves were for a large part covered by the white postules, which render this vegetable unsalable. Distortions, which were mentioned also by Walker and others, were not observed in Surinam. Only an attack of the leaves was found, while in other countries, stalks, flower petals, stamens and ovaries were found hypertrophied and many times their normal size.

In Europe white rust Albugo candida which grows between the cells and feeds by means of haustoria, does not kill the tissues right away, but frequently it is the cause of morbid growth, which develops after normal cell division and the formation of giant cells. In the cells where morbid growth takes place, oogonia and antheridia, the organs of reproduction of the fungus are formed. After copulation the oogonium becomes a oospore, a thickwalled resting spore. The oospores are capable to carry the fungus through unfavourable periods. However if the conditions are favourable 100 or more zoospores or swimming spores can be produced from an oospore.

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Usually cool weather and soaking in water for a few hours cause the oospores to germinate and form zoospores. The oospores are formed between the cells of the plants and they are carried over in plant debris or soil. Usually after one year "overwintering" they germinate and form zoospores which the cause of the primary infection the next year. Shortly after the primary infection the above mentioned white spore masses may develop; it is the the so-called asexual form, which is the source of distribution of the disease during the growth period of the crop. These spore masses are formed from the intercellular mycelium under the epidermis in groups of conidiophores or sporangiophores. Afterwards small chains of round sporangia develop and these are visible with a lens as small granules after rupture of the epidermis.

In each sporangium 4 to 8 zoospores are formed, which appear to be the same as the previously mentioned sexually formed zoospores. The development of these asexual zoospores takes place only when the sporangium has lost about 30% of its moisture content. On the leaves this loss of moisture is determined by the rate of water loss of the tissue of the host plant. When plants have a shortage of water due to long periods of warm or dry weather, low water level or high rate of evapotranspiration, these asexual zoospores develop rapidly. The asexual zoospores cause the spread of the disease. In Surinam especially these conditions are found frequently, and it is for this reason that after primary infection a rapid spread of the disease takes place.

Since the disease is not of major importance, in many countries, no control measures are undertaken. In some publications it is even mentioned that no effective control measures are known against Albugo candida. However in Holland the Plant Protection Service at Wageningen advises spraying of the plants with zineb (zinc aethylene bisdithiocarbamate) at a rate of 350 grammes per 100 liters of water, TMTD, tetramethylthiuramdisulfide at a rate of 250 grammes or copperoxychloride at a rate of 500 grammes per 100 liters of water.

In Surinam it is a regular practice to grow seed from some plants left over for that purpose and replant on the same beds. A high incidence of infection with Albugo candida spores is the result. We advise the farmers not to follow this practice.

Since this disease is of major importance in Surinam we plan to run some control experiments the next season. Concerning the introduction of this disease in Surinam nothing is known but we suspect that it was imported on plants that were not inspected by our Plant Protection Service. It would be of interest to find out in which countries in the Caribbean region this disease is present.