

formed in the normal way and after some time, no trace of *Darluca* was left.

Simultaneous inoculations made with infected rust spores on the plants maintained at a lower humidity resulted only in the formation of uredinia without its parasitizing fungus. Among the greenhouse cultures too *Darluca filum* disappeared after the rainy season.

These experiments, when considered with the observations made in the greenhouse for several years, show that *Darluca filum* can develop on these rusts only in very humid conditions as are prevalent in the hills during the rainy season.

Padwick⁴ collected *Darluca filum* on *Puccinia chrysopogi* Barclay and *Uromyces inayati* Syd. in the last week of September at Simla. So far as the measurement of spores is concerned there seems to be little doubt that his collections and the fungus described here belong to the same species of *Darluca*. According to Keener,⁵ Trayler⁶ and Hardison⁷ successful infection of several grain and grass rusts has been obtained by means of cross-inoculations with *Darluca filum* and it is quite likely that the greenhouse infections described here may be wind-borne from some grass rust infested with this parasite. Keener's⁵ experiments, moreover, indicate that there are physiologic races in *Darluca filum* since any two collections may not behave alike in their rust host range.

Concerning the usefulness of *Darluca filum* in the control of cereal rusts in nature, it is apparent from what has been described here, that the growth of this fungus is largely governed by atmospheric humidities. It develops best where there is high humidity approaching 80-100%. In nature, such a state of affairs rarely, if ever, continues for long periods, specially during the wheat growing season. It is, therefore, useless to attempt to control wheat rusts in the field by *Darluca filum*.

RAGUBIR PRASADA.

Division of Mycology and Plant Pathology,
Indian Agricultural Research Institute,
New Delhi,
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POTATO NECROSIS

Introductory.—Some of the potato plants of variety *Darjeeling Red Round* raised in the insect-proof house from virus-free seed tubers, stock of which had been built up during the last few years suddenly developed necrosis of the growing point which spread downwards and gave the plants wilted appearance. The leaves became pale and flaccid and most of the plants were killed in due course. This was a

very serious matter as part of the nucleus disease-free seed of this variety produced after considerable labour and expense was about to be lost. The problem needed immediate attention and investigation into the cause of the disease was taken up. The young leaflets near the growing point of the infected plants show outward, or inward curling of margins and some smalling and narrowing of young leaves may also be observed in certain cases. After about a week light diffused brown areas develop in the top leaves which after a few days turn completely brown and dry up. Later on the outward curling of margins progresses to all the leaves of the plant and the tips of leaves point downwards. Ultimately the necrosis first observed at the growing tip progresses down and the plant is usually killed. Fig. 1 shows a plant of potato variety *Darjeeling Red Round* affected by the disease. In addition, virus-free potato plants of varieties *President* and *Craig's defiance* which were being grown as differentials for analytical work on potato viruses were also found affected by a disease characterised by smalling and curling of margins of younger leaves. The leaves also exhibited diffused light brown areas resulting in drying up of the top leaves. The plants were, however, not killed as a result of the disease.



FIG. 1

Transmission of the disease.—The experimental work was carried out in an insect-proof glasshouse and always young vigorously grow-

ing healthy plants were used for transmission tests. All attempts to transmit the disease to potato plants by inoculation in the presence of carborundum powder as abrasive were unsuccessful. Also the disease could not be transmitted by mechanical means to a number of solanaceous hosts, e.g., *Nicotiana tabacum* L., varieties White Burley and Harrison's Special, *Nicotiana glutinosa* L., *Datura stramonium* L., *Nicotiana sylvestris* Spegaz and Comes, *Solanum nigrum* L., *Capsicum annuum* L., *Petunia hybrida* Vilm. and *Lycopersicum esculentum* Mill. variety Sutton's Early Market. The disease was, however, successfully transmitted by grafting the diseased scions to healthy stocks of potato and certain other plants. Grafting was done both by wedge method as well as inarching and reactions on differential hosts were studied. As the disease was found to be transmissible only by grafting, it was necessary to investigate the cause of infection in the hitherto disease-free potato plants. It was observed that incidence of white fly, *Bemisia gossypiperda* M. and L. was high in the fields during the period under report. Experiments were, therefore, conducted to investigate if white fly was responsible for transmission of the disease. Insects were fed on diseased plants in micro-cages and then transferred to healthy plants of *Nicotiana tabacum*, variety Harrison's Special and *Lycopersicum esculentum*. The insects were allowed to feed for 24 hours on diseased as well as on healthy plants. In the case of tomato after 11 days yellowish diffused mottle appeared on the leaves and all the newly formed young leaves showed slight twisting; with age the mottle became more pronounced. The young newly formed leaves of tobacco exhibited faint mottle and the leaves became narrow. Also tips of the leaves showed slight curling. The insect transmission tests were not conducted on potato due to non-availability of sufficient number of virus-free potato plants at that time.

Reactions on Differential Hosts, Lycopersicum esculentum, variety Sutton's Early Market.—In tomato two weeks after grafting with diseased potato plants of *Darjeeling Red Round* variety distinct mosaic mottle appeared on all the newly formed leaves which was followed by reduction in the size of leaves. The young leaflets were elongated and narrow with curled margins. Some of the leaves were wrinkled and twisted so much so that they exhibited cork-screw distortion. The older leaves showed leafcurl with tips of leaves forming a characteristic hook-like structure. With age the mottling became faint but smalling of leaves in the shoots and the hook-like structure persisted.

Nicotiana tabacum.—In variety Harrison's Special two types of symptoms were observed. All the plants invariably produced transient mottle in 13-20 days on all the new leaves. This was followed by a pronounced stunting of the plant and shortening of internodes. The mottling disappeared after a few days and the plant carried the disease without obvious symptoms. When scions from such tobacco plants were grafted to tomato typical symptoms of the disease appeared. In other cases the

leaves of infected tobacco plants exhibited slight curling, twisting, bending of tips and narrowing. Though the source from which diseased scions were obtained was the same it produced two different types of symptoms in tobacco plants which may be due to difference in reaction of individual plants.



FIG. 2.

Solanum tuberosum.—The disease was successfully transmitted to potato plants of varieties *Phulwa*, *Craig's defiance*, *President* and *Arran Victory*. The *Phulwa* plants only exhibited foliar necrosis whereas in *Craig's defiance* the disease produced smalling and necrotic areas on young leaves. In potato variety *President* the top young leaves completely turned brown and dried up whereas the young leaves of variety *Arran Victory* developed necrotic areas and later turned completely brown. Fig. 2 shows an infected *Arran Victory* plant. All efforts to transmit the disease to *Lagenaria vulgaris* Seringe were unsuccessful.

The symptoms on differential hosts show that necrosis in *Darjeeling Red Round* variety had been caused by a mild strain of tobacco leafcurl virus (*Nicotiana virus 10*). This view is further confirmed by the fact that the disease is transmitted by *Bemisia gossypiperda* M. and L., vector of the tobacco leafcurl virus. In India tobacco leafcurl virus is wide spread and is responsible for serious losses to the crop. The disease has a wide host range and may, therefore, become a limiting factor in the cultivation of potato crop.

R. S. VASUDEVA.
R. N. AZAD.

Div. of Mycology & Plant Pathology,
Indian Agricultural Research Institute,
New Delhi,
June 23, 1948.