submerged to the aerial growth phase in one of the following ways: by removal of aerial mycelium with a scalpel, by growing the mycelium under a cover glass that was later removed, by turning over the agar in a petri dish containing the fungal culture, and by pouring a second layer of agar on a colony. When aliquots of a shaken culture were poured into a petri dish and incubated, sclerotial initials were formed within 16 h on the liquid surface. These results show that the submerged mycelium of *S. rolfsii* has the potential to produce sclerotia when changing its growth patterns from the submerged to the aerial phase.

When *S. rolfsii* was grown in liquid culture, sclerotial production was observed even after the glucose in the medium was exhausted. Addition of glucose at this time induced new aerial mycelium instead of sclerotial initials. It is suggested that sclerotial production in *S. rolfsii* is an endogenous process controlled by external nutrients. *(L)*

EFFECT OF CONTROLLED ATMOSPHERE ON SCLEROTIUM FORMATION IN *ASPERGILLUS OCHRACEUS*

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Aspergillus ochraceus, a common mould of grain in stores and silos, regularly produces selerotia which can serve as a source of inoculum. Since promising results were obtained using modified atmospheres for the control of storage insects, it was decided to study the effect of controlled atmospheres on growth and sclerotium formation in *A. ochraceus*.

At levels of 20% CO_2 and above, sclerotia production was completely inhibited regardless of the oxygen concentrations given. At lower concentrations of CO_2 (15%, 10%, 5%), high levels of O_2 (10%, 50%, and 60%, respectively) caused a significant reduction in the number of sclerotia formed. The number of sclerotia was not reduced when the fungus was grown in an atmosphere with high levels of O_2 without CO_2.

Mycelial growth was retarded (by up to 50%) when the CO_2 concentration was 60%, whereas at 80% CO_2 fungal growth was completely inhibited. It seems that modified atmospheres can control sclerotium formation in *A. ochraceus* but the processes inhibited in the production procedure have not yet been determined. *(L)*

THE PHYSIOLOGICAL BASIS FOR THE PATHOGENICITY OF *PSEUDOMONAS TOMATO* TO TOMATO PLANTS

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Tomato plants were inoculated with *Pseudomonas tomato* by spraying the leaves with a suspension containing 10^4 cells/ml. Scanning electron microscopy (SEM) of the leaf surface immediately after spraying revealed only few bacteria and 24 hours later no bacteria were visible. However, microcolonies in the form of cell aggregates could be observed inside the stomata, in the sub-stomatal chambers and in the intercellular spaces below the epidermal cells. Extensive multiplication was observed in the stomata and in the trichome bases 48 h after inoculation, with the pathogen concentration reaching 10^6-10^7 cells/g leaf. Masses of *P. tomato* cells were observed within abraded leaves. Bacterial masses were also observed pouring out of the stomatal openings. Necrotic areas became apparent microscopically at broken trichome bases 100 h following inoculation. There was a sharp delineation between necrotic areas (specks) and apparently healthy tissue.

The area surrounding the specks, including stomata but not the necrotic spots, was covered with bacterial masses. After 120 h many of the bacteria-free necrotic specks were also covered with bacterial masses. After 140 h necrosis was almost total and many areas which did not collapse were covered with masses of the pathogen, trichome bases were destroyed, and the trichomes became detached. A different pattern of infection was observed in the resistant cultivar 'Rehovot 13'. Following inoculation, bacteria slowly disappeared with time, and after 140 h only few could be found.

Pseudomonas tomato showed strong proteolytic and deaminating capacities when growing in the tomato tissue. This resulted in an increase of the free amino acids as well as of ammonia in the leaves. At low concentrations, the latter caused chlorosis and necrosis. (*L*)

USE OF PLANT PROTOPLASTS FOR STUDYING RESISTANCE MECHANISMS AGAINST VIRUSES

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The approach of using plant protoplasts for studying resistance against viruses was hampered by the finding of Japanese researchers that in isolated protoplasts from resistant plants, virus multiplies to the same extent as in protoplasts from susceptible tobacco cultivars. This discrepancy between low virus multiplication in intact resistant tobaccos and the high titer reached in protoplasts was found by us to be due to the presence of the plant hormone 2,4-dichlorophenoxyacetic acid (2,4-D) in the protoplast incubation medium. 2,4-D markedly enhanced tobacco mosaic virus multiplication in protoplasts from resistant cultivars, while in the susceptible cultivars it reduced virus multiplication.

A substance(s) inhibiting virus replication (IVR) is released into the medium from TMV-infected protoplasts of a cultivar in which the infection in the intact plant is localized. IVR inhibited virus replication in protoplasts from both resistant (Samsun NN) and susceptible (Samsun) plants, when applied up to 18 h after inoculation. It was not produced in protoplasts from susceptible plants or from non-inoculated protoplasts of the resistant cultivar. IVR was partially purified using $Zn(Ac)_2$ precipitation, and yielded two biologically active principles with molecular weights of about 26,000 and 56,000 daltons. Preliminary results indicate that IVR inhibits replication of TMV and several other non-related viruses when applied to inoculated leaf disks. (L)

ELEVATION IN ENDOGENOUS ANTIOXIDANT LEVEL: A POSSIBLE MECHANISM GOVERNING THE INDUCED RESISTANCE OF TOBACCO INFECTED WITH *PERONOSPORA TABACINA* AGAINST *ERYSIPHE CICHORACEARUM*

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Tobacco plants, the foliage of which was infected with downy mildew incited by *Peronospora tabacina*, exhibited resistance against powdery mildew incited by *Erysiphe cichoracearum*.

Infection with downy mildew caused a major increment in the activity of lipoxygenase, lipohydroperoxides, and antioxidants in leaf tissue as compared with non-infected control plants.

Endogenous antioxidants extracted with water from downy mildew-infected tobacco leaves (day 9) exhibited a strong inhibitory effect on conidial germination of *E. cichoracearum in vitro*. No such inhibition was recorded when extracts of non-infected control leaves were used.

When the endogenous antioxidant extracts were sprayed on the lower leaf surfaces of nor-