

malate, fumarate, isocitrate), oxidases (peroxidases, "nadi-reaction"), acid phosphatase, and esterases, appeared to be of bacterial origin. A catalase band of bacterial origin was found 1 day after infection. Virulent bacterial isolates gave higher catalase activities than a nonvirulent isolate. In vitro tests showed inhibition of bean peroxidases by bacterial extracts and commercial catalases with the same characteristics (shape of curve, reversal by heat or higher H_2O_2 concn., decolorization of oxidized guaiacol). Within two days after infection, the peroxidase activity of susceptible bean leaves decreased or remained unchanged; in contrast, it increased in the resistant variety. Phenoloxidase activity of healthy and infected leaves was much lower than peroxidase activity. One possibility is that the resistant hypersensitive reaction is related to host peroxidases, which are suppressed by bacterial catalase in the susceptible combinations.

Growth of Venturia inaequalis on apple callus tissues in vitro in relation to pathogenicity. ADIB T. SAYD AND DONALD M. BOONE. (Univ. Wis., Madison.) Callus from McIntosh and Cortland varieties was isolated from leaf blades and petioles and maintained on White's medium supplemented with coconut milk, casein hydrolyzate, and 2,4-D. Two wild-type lines of *Venturia inaequalis*, one pathogenic to both varieties and the other only to Cortland, were used. Callus from apple, tobacco, tomato, and snapdragon was inoculated with spore suspensions and mycelial pellets. Both lines of *V. inaequalis* did not form visible colonies on the apple callus but did on the others and on supplemented White's medium. Microscopic examination revealed that although spores germinated, only limited mycelial development took place until after 7-8 weeks of incubation when the callus became senescent. Apple callus placed on media previously seeded with *V. inaequalis* was overgrown by the fungus if the medium (PDA) was unfavorable for callus growth, but not if the medium (supplemented White's) was favorable. On the latter medium, growth of the fungus in close proximity to the callus indicated that no diffusible toxin was being produced by it. Growth of *V. inaequalis* on callus from tobacco and tomato was extensive, but on snapdragon was limited and induced brown discoloration. In comparison, *Alternaria tenuis* grew abundantly on each callus and on the medium.

Puccinia recondita f. sp. tritici infection on species of Thalictrum native to the United States. E. E. SAARI, H. C. YOUNG, JR., AND D. D. DAVIS. (Okla. State Univ., Stillwater.) Certain species of *Thalictrum* collected from New Mexico, Colorado, Wyoming, and South Dakota were found to be susceptible to *Puccinia recondita* Rob. ex Desm. f. sp. tritici Eriks. *T. speciosissimum*, an Eurasian species, was used to check teliospore germination and sporidial infection. Severe infection of this species followed alternate wetting and drying of bulk field collections of telial material. Pycnia, and subsequently, aecia, developed on native species identified as: *T. alpinum* from Grant, Colorado; *T. dasycarpum* from Westcliffe and Lyons, Colorado, and Laramie, Wyoming; *T. dioicum* from Madison, Wisconsin; and an unidentified species from Rochford, South Dakota. In addition, pycnia and aecia developed on collections of *Anemone thalictroides* from Grant, Colorado, and Laramie, Wyoming. Aeciospores were inoculated on common wheat, and uredial infections were produced. The number of infections found on the species of *Thalictrum* native to the United States was only a fraction of that found on the exotic check species. These infections were found, with the exception of *T. alpinum*, primarily on the stem leaves and floral parts rather than on the basal rosette leaves.

Relation of moisture content and length-of-storage period to changes in the fungus flora and germination percentage of wheat. D. B. SAUER AND C. M. CHRISTENSEN. (Univ. Minn., St. Paul.) Soon after harvest in 1962, 140 samples of wheat were obtained from commercial elevators in the

United States. These were stored in the laboratory at very nearly the same moisture contents they had upon arrival at the elevators. Moisture contents were maintained essentially unchanged by storage in double polyethylene bags in a humidified incubator at 25°C. Portions were removed periodically and tested for moisture content, germination percentage, and number and kinds of fungi. After 74 weeks, germination percentage of the seed remained high in most samples with moisture contents below 14.0%, but had decreased to 0 in all samples of spring wheat with moisture contents over 14.1% and in all samples of winter wheat with moisture contents over 14.6%. Invasion by storage fungi, principally *Aspergillus restrictus*, was proportional to increasing moisture content and increasing time of storage in samples with moisture contents over 14.0%, and preceded decrease in germination percentage of the seed. Percentage of surface-disinfected kernels yielding field fungi when cultured on acidified potato-dextrose agar, originally 90-100%, decreased to less than 10% in 6-8 months in samples with 14-16% moisture content, and in 10-14 months in samples with 12-14% moisture content.

The nature of locus Rp_1 conditioning resistance to rust in corn. K. M. S. SAXENA AND A. L. HOOKER. (Univ. Ill., Urbana.) Several corn lines carry single dominant genes that condition resistance to *Puccinia sorghi*. A series of multiple alleles occurs at locus Rp_1 . Linkage can be determined if heterozygotes are crossed with a homozygous recessive and the progeny evaluated for rust reaction. With a single rust culture, only half of the recombinants with a susceptible phenotype are detected. The other half, being resistant, are indistinguishable from the parentals. Frequency of susceptibles in crosses are as follows: 1) $Rp_1 \times Rp_1 \times rp_1 rp_1$ was 1/5318, 2) $Rp_1^d \times Rp_1^k \times rp_1 rp_1$ was 2/5288, 3) $Rp_1^a \times Rp_1^d \times rp_1 rp_1$ was 2/4170, 4) $Rp_1^a \times Rp_1^k \times rp_1 rp_1$ was 13/9503, 5) $Rp_1^a \times Rp_1^1 \times rp_1 rp_1$ was 12/5891. The frequency of susceptibles in crosses 2) and 3) is not different from cross 1), which is considered to be due to mutation and/or deletion. The frequency of susceptibles in crosses 4) and 5) is significantly different from that of 1) and may be considered to include recombination events. Crossover value between Rp_1^a and Rp_1^k is 0.0027, and between Rp_1^a and Rp_1^1 it is 0.004. Present studies suggest that Rp_1 is a complex locus.

Substances toxic to plant-parasitic nematodes in decomposing plant residue. R. M. SAYRE, Z. A. PATRICK, AND H. THORPE. (Can. Dept. Agr., Research Station, Harrow, Ont.) In previous studies, substances capable of inhibiting the growth of roots of tobacco and lettuce seedlings were obtained from residues of rye allowed to decompose under appropriate conditions in soil. These substances were further purified, and tested in vitro as nematocides against plant parasitic nematodes, *Meloidogyne incognita* and *Pratylenchus penetrans*, and saprophytic nematodes. The data showed a linear relationship between the concentrations of the decomposition products and the percentage of nematodes immobilized or killed in solution and in soil. Concentrations immobilizing 50% of the nematodes in 3 hr were 380 ppm for *M. incognita*, 440 ppm for *P. penetrans*, and 3,500 ppm for the saprophytic nematodes, whereas concentrations of 410, 540, and 3,200 ppm, respectively, killed half of these populations in 24 hr. In soil, 1,350 ppm was needed to kill 50% of *M. incognita* and 2,100 ppm for *P. penetrans*, but the preparation was ineffective against saprophytic nematodes. The substances also partly inhibited penetration of roots of cucumber plants by the two parasitic nematodes. This is the first instance in which plant-derived decomposition products have been shown to have nematocidal activity.

Cultural variation and pathogenicity of the Colletotrichum blight fungus of dwarfmistletoe. ROBERT F. SCHARFF. (Pacific Southwest Forest and Range Expt. Sta., USDA,

Berkeley, Calif.) The fungus *Colletotrichum gloeosporioides*, previously reported infecting only the true fir form of dwarfmistletoe, *Arceuthobium campylopodum* f. *Abietinum*, also infects *A. campylopodum* f. *typicum* and *A. americanum* in California. Isolates of this fungus from each form or species of dwarfmistletoe are culturally distinct from one another. Differences in mycelial growth, colony color, and diameter growth and sporulation were noted. Cross inoculation showed that the fungus is not host specific. All three isolates will infect the dwarfmistletoe forms and species mentioned. Results of the studies suggest that: 1) Geographically distinct isolates of the fungus exist. 2) No perfect stage for long-distance spread occurs, because isolates on a given host in a particular area retain their distinctive characteristics.

Initial physiological effects of Helminthosporium victoriae toxin on oat tissue. R. P. SCHEFFER. (Mich. State Univ., East Lansing.) Some early effects of toxin on susceptible tissue are increased respiration, decreased incorporation of amino acids and uridine into TCA-insoluble components, and loss of electrolytes. None of these systems is affected in resistant tissue. Experiments were designed to determine which response is most sensitive to toxin. Loss of electrolytes was estimated by conductivity of distilled water containing tissue. Amino-acid and uridine incorporations were measured by use of cuttings previously exposed to toxin for 1, 2, or 3 hr. Leaf sections were then infiltrated with C-14 amino acids or uridine and incubated for 1, 2, or 3 hr. Amino-acid and uridine incorporations were brought about more quickly and by one-tenth of the toxin concentration that was required to cause loss of electrolytes. Amino-acid uptake was decreased after exposure to 2.5×10^7 dilution of a toxin solution which completely inhibited seedling root growth at 4×10^6 dilution. During the short exposure times used in these experiments, minimum toxic concentrations of several metabolic inhibitors did not affect amino-acid incorporation.

Fungi associated with root necrosis of Phytophthora-resistant soybeans. A. F. SCHMITTHENNER. (Ohio Agr. Expt. Sta., Wooster.) In greenhouse tests with 4 lots of field soil, root damage was moderately severe on all *Phytophthora*-resistant soybean varieties adapted to Ohio. Symptoms consisted of necrosis and collapse of small lateral roots or tips of larger roots and browning or blackening of the root cortex. *Pythium ultimum* was isolated from the majority of infected roots. *Rhizoctonia* and several species of *Fusarium* were also obtained. Using the carrot-disc technique, *Thielaviopsis* was consistently isolated from soybean roots from 2 of the soil lots. Soybean roots from these same soils were washed and stained in chloral hydrate-acid fuchsin and examined for fungus structures. *Thielaviopsis* chlamydospores were present on the surface of blackened roots. *Pythium* oospores and sporangia were abundant in necrotic and collapsed small lateral roots and occasionally present in the cortex of the tap root. The roots were extensively invaded with *Endogone* and also contained nematodes. In greenhouse tests, root necrosis was reduced in the *Thielaviopsis*-free soils by mixing with Dexon (*p*-dimethylaminobenzenediazo sodium sulfonate) at the rate of 10 μ g/g of soil. *Pythium* oospores were absent from stained roots from Dexon-treated soil.

Properties of tracheal fluids from susceptible and resistant cottons and their relation to development of Verticillium albo-atrum. W. C. SCHNATHORST, J. T. PRESLEY, AND H. R. CARNS. (ARS, USDA, U. of Calif., Davis, and Beltsville, Md.) Tracheal fluids from 3 resistant and 3 susceptible varieties were collected by root pressure from decapitated cotton plants. The pH of fluids varied from 5.9-7.0; refractive indices varied from 1.2-1.5 degrees B ϕ , and electrical conductivity varied from 22×10^{-5} to 50×10^{-5} mho. Fourteen amino acids and 7 sugars were found. No phenols were detected. *Verticillium albo-atrum* grew

ties. The effect of 18 amino acids and 4 sugars on conidial germination of 4 isolates was determined. Asparagine and glutamine were highly stimulatory; other amino acids were either slightly stimulatory, had no effect, or were inhibitory. Maltose was highly stimulatory, whereas fructose, glucose, and sucrose had either no effect or were slightly stimulatory. All of the stimulatory compounds were tentatively identified in tracheal fluids. Percentage of conidial germination in tracheal fluids varied with the age of conidia. There appeared to be no correlation between pH, refractive index, conductivity, or relative concentration of organic constituents in tracheal fluids and resistance or susceptibility of a variety. However, certain amino acids and sugars appear to be necessary for a high percentage of germination and normal germ tube development.

β -Glucosidase activity in Erwinia amylovora and Pseudomonas syringae. MILTON N. SCHROTH AND D. C. HILDEBRAND. (Univ. Calif., Berkeley.) The capacity of *E. amylovora* and *P. syringae* to synthesize β -glucosidase and to hydrolyze the glucoside arbutin, which occurs in pear tissues, was tested. Whereas all isolates of *P. syringae* synthesized large amounts of β -glucosidase, *E. amylovora* showed only slight activity. Synthesis was 100 to 1000 times greater in *P. syringae* than in *E. amylovora*. Although the amount of enzyme in *P. syringae* varied somewhat with the medium, it appeared to be constitutive. A simple test for detecting β -glucosidase in *P. syringae* was to sonicate the cells and allow the material to react with *p*-nitrophenyl- β -D-glucoside. *P. syringae* isolates were considerably more tolerant to the aglycone hydroquinone than were *E. amylovora* isolates. The maximum hydroquinone concentration in nutrient broth at which detectable growth of *E. amylovora* occurred ranged from 400 to 800 ppm, whereas *P. syringae* isolates grew at 1,200 to 1,800 ppm. The data suggested that β -glucosidase activity in *E. amylovora* was too low to significantly affect pathogenesis in pear. However, the high concentration of the enzyme in *P. syringae* might enable it to hydrolyze arbutin and possibly inhibit further advance of the pathogen in tissues containing large amounts of the glucoside.

An assay method for soil fungistasis and response of selected fungi to the principle. H. SCHUEPP AND R. J. GREEN, JR. (Purdue Univ., Lafayette, Ind.) A comparison was made of 2% agar, cellophane, and glass fiber discs for the assay of the fungistatic principle from soil. A modification of the sterile-cellophane method was used to assure sterility. This method includes the use of aluminum rings to support the cellophane and to eliminate contamination from the water film that forms on the cellophane surface. Activity was demonstrated much sooner on cellophane and glass fiber discs than on agar, and the degree of inhibition was also greater. The fungistatic principle appears to be volatile, at least in part. When assays were conducted under a partial vacuum, there was a marked reduction in activity. Among the fungi tested, the following were highly sensitive to the fungistatic principle: *Trichoderma viride*, *Penicillium oxalicum*, and *Aspergillus terreus*; the following were less sensitive: *Alternaria solani*, *Ustilago zeae*, *Ustilago tritici*, *Pestalotia macrotricha*, *Verticillium albo-atrum* (microsclerotia), *Diplodia zeae*, and *Helminthosporium maydis*; uredospores of *Puccinia polysora* were not inhibited by the principle. Chlamydospores of *Ustilago zeae* were contaminated with bacteria, and germination was erratic unless treated first with streptomycin.

Studies on the isolation of the strawberry leaf scorch pathogen Diplocarpon earliana. DONALD H. SCOTT AND DWIGHT POWELL. (Univ. Ill., Urbana.) All attempts to isolate *D. earliana* (E. & E.) Wolf from field-infected strawberry plants on 17 different solid media were negative. The organism was isolated only from artificially inoculated strawberry plants in the greenhouse, and only when diseased tissue was plated on wax-bean-nod agar. Field-infected