

## BOTANY

Chairman: CHARLES HEISER, Indiana University  
S. N. POSTLETHWAIT, Purdue University, was elected chairman for 1960

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### ABSTRACTS

**The Cytotaxonomy of *Helianthus petiolaris*.** CHARLES B. HEISER, JR., Indiana University.—The wide ranging annual sunflower, *Helianthus petiolaris* Nutt, is quite variable and two major morphological races may be recognized: subsp. *petiolaris*, primarily a plant of the Great Plains and a weed in the central and eastern United States, and subsp. *fallax* of the southwestern United States. Over forty samples of *Helianthus petiolaris* have been employed in a hybridization program, and a study of F<sub>1</sub> hybrids reveals that three cytogenetic groups are present: A. Minnesota (*H. petiolaris* subsp. *petiolaris*); B. Indiana, Missouri, Illinois, Kansas, northern Oklahoma and California (*H. petiolaris* subsp. *petiolaris*); C. South Carolina, southern Oklahoma, Texas (*H. petiolaris* subsp. *petiolaris*); Utah, New Mexico, and Arizona (*H. petiolaris* subsp. *fallax*). Crosses of different samples within any of the three cytogenetic groups produce fertile hybrids, whereas hybrids between samples from different groups give hybrids with reduced fertility. Examination of meiosis in hybrids of the latter category indicates that the parental types differ by one or two translocations. Group A differs from B by one translocation and from C by two translocations. Group B also differs from C by two translocations. It is of interest to note that Group C is composed of both subspecies, indicating that morphological differentiation has not paralleled the cytological differentiation.

**A Preliminary Investigation of the Influence of the Leaves and Axillary Buds upon Apical Elongation in *Tilia americana* L.** A. T. GUARD and S. N. POSTLETHWAIT, Purdue University.—Instead of forming an essentially straight axis in early development the young internodes of *Tilia americana* L. are often oriented in such a manner that the lines formed by two adjacent internodes make an angle in excess of 45°. By means of dissecting away young leaves and buds and comparing the development of these twigs with untreated controls an attempt was made to determine the effect of these organs on the elongating stem. Our experiments indicate that the developing leaves influence the angle of stem development markedly. The influence of axillary buds appears to be insignificant. Presence of leaves also appeared to result in marked increase of internode elongation. Sections of the stem tip show that this angular type of growth is initiated very early in the ontogeny of the stem.

**A Square-stemmed Corn Plant.** S. N. POSTLETHWAIT and O. E. NELSON, Purdue University.—The orderly progression of events culminating in which is considered a "normal" plant occasionally is interrupted or diverted by mutant genes, environmental disturbances, or some clandestine cause. The morphological expression of this alteration often

provides considerable information on how the "normal" form comes into being. A corn plant discovered in the genetic plots at Purdue University shows considerable promise as a possible tool for this kind of study. The plant has a decussate arrangement of leaves and a square stem. Ear shoots were formed in the expected axillary positions. Two ear shoots occurred on opposite sides of the stem at each of three nodes. No fertile grains were produced, however adequate pollen was obtained for out-crossing. Since the decussate arrangement of leaves and a square stem are the only digressions superimposed on the "normal" morphological pattern, one can anticipate that a future study may be very helpful in the age-old problem of meristem variation and phyllotaxy.

**Development of Flavonoid Pigmentation in Buds of *Impatiens balsamina*** L. CHARLES W. HAGEN, JR., Indiana University.—Mature petals of *Impatiens balsamina* of the genotype 11HHP<sup>r</sup>P<sup>r</sup> contain a 3,5-diglucoside and an acylated 3,5-diglucoside of pelargonidin as well as free kaempferol, a kaempferol glucoside and another flavonol glycoside which is probably a second glucoside of kaempferol. Sepals of the same plants contain the same pigments, but in addition have derivatives of cyanidin, peonidin, and quercetin. Petals which develop pigmentation in culture produce the pigmentation characteristic of sepals. (A. Klein, thesis, 1959.) In petals of developing buds, leucoanthocyanins appear first, flavonols follow and the anthocyanin glucosides appear last in a sequence which indicates that sugars and other substituents are added in stepwise fashion to a preformed aglycone. This developmental study also has implications which affect conclusions to be drawn from evidences of competition between flavonoid pigments.

**Development of *Polyphagus* in Algal Culture.** ROBERT M. JOHNS, Indiana University.—Several isolates of the parasitic chytrid genus, *Polyphagus*, have been isolated and grown in culture on algae from the Indiana University Algal Culture Collection. A continuing study of the host range and specificity of the parasite has more than tripled the number of algal genera that the fungus is known to attack. Isolates exhibit considerable morphological variation depending on the conditions of culture and the host organism on which they are grown.

**Preliminary Studies on the Migration of the Root-knot Nematode, *Meloidogyne incognita acrita*.** G. B. BERGESON, Purdue University.—Field studies of root-knot nematode populations have indicated that during the non-growing season, or when a field is in fallow, a high percentage of the total root-knot nematode population is present in the 2nd and 3rd foot soil depths. Greenhouse studies initiated to determine the vertical migration from these depths indicated that within a 1-6 week period a maximum upward migration of 21-24 inches had taken place. Migration occurred only in the presence of plants. Where no plants were grown the nematodes did not move out of their original placement site. The application of root exudates to root-knot infected soil columns were successful in inducing upward migration, thus confirming the stimulatory effect of root exudates on migration.

**Factors influencing the Fungitoxicity of Phenolic Compounds.** JOSEPH KUC and TOMIE MAXAM, Purdue University.—Chlorogenic and caffeic acids are phenolic compounds often implicated with disease resistance mechanisms in plants. These compounds differ in their effect on the growth of *Helminthosporium carbonum* Race 1, an incitant of a leaf spot in corn, depending on the composition and pH of the nutrient medium employed in the assay. Chlorogenic and caffeic acids  $1 \times 10^{-2} \text{M}$  each inhibit the growth of *H. carbonum* in potato-dextrose broth at a pH range of 4-8. In Czapek's medium, however, chlorogenic acid markedly stimulates growth of the fungus within the same pH range; whereas, caffeic acid totally inhibits growth at pH 4, 5 and 8 and stimulates growth at pH 6 and 7. The addition of quinic acid, a component of the chlorogenic acid molecule, to Czapek's medium containing caffeic acid at a pH of 4, 5 or 8 does not reverse the inhibition. Czapek's medium, however, containing L-alanine or L-phenylalanine  $1 \times 10^{-2} \text{M}$  and caffeic acid  $1 \times 10^{-2} \text{M}$  at a pH of 6 or 7 completely inhibits the growth of *H. carbonum*. The formation of toxic phenol and quinone amino acid addition products in potato-dextrose broth and in Czapek's medium containing L-alanine or L-phenylalanine may explain the observed growth differences. The composition and pH of the nutrient medium may also affect the production of extracellular phenoloxidases by *H. carbonum* and other fungi, thereby controlling the oxidation of phenols in the nutrient medium.

**The Relation of Certain Fungi to Root and Collar Rot of Apple.** ZOFIA MACIEJOWSKA and E. B. WILLIAMS, Purdue University.—Roots of diseased apple seedlings and trees were examined and isolations of microflora associated with the diseased tissue were made. Species of eleven genera, *Fusarium*, *Rhizoctonia*, *Botrytis*, *Mucor*, *Alternaria*, *Trichoderma*, *Verticillium*, *Pythium*, *Penicillium*, *Phytophthora*, and *Gliocladium*, were found to be commonly associated with diseased roots. Species of five of these genera, *Fusarium*, *Phytophthora*, *Pythium*, *Alternaria* and *Rhizoctonia* were found to be pathogenic on apple seedling roots. Non-sterilized rain water was used to facilitate the isolation and identification of *Phytophthora*. In this medium sporangia developed after three days. The *Phytophthora* species produced profuse mycelial growth on corn-meal agar but this medium was not favorable for the production of sporangia and oospores. *Rhizoctonia solani* was found to be the most serious cause of damping off of young apple seedlings. This organism spreads very quickly through the seed flat and causes complete loss of seedlings. *R. solani* is a rare contaminant on apple seed; while *Fusarium sp.* and *Alternaria sp.* commonly occur on the seed coat. Inoculations were made on apple seedlings with *Phytophthora* isolates from trunk cankers on apple trees. No infection was observed after thirty days.

**Studies on Teliospore Formation and Germination in *Puccinia coronata*.** D. E. ZIMMER, JOHN F. SCHAFER, and GEORGE A. GRIES, Purdue University.—The occurrence and rate of telial formation of *Puccinia coronata* var. *avenae* was studied in 8 mono-urediospore cultures representing 6 races. The rapidity of telial development was not correlated with virulence of the pathogen or degree of host resistance. No relationship existed between range of virulence of the rust culture and rate of telial produc-

tion. Neither was developmental stage of the host a limiting factor in telial formation. Telia formed as readily on seedlings as on mature plants. It was concluded that the rapidity of telial production is the result of a specific relationship between the host variety and the particular rust clone concerned. Rate of telial development was directly affected by temperature. No experimental methods were found to induce telial formation in non-telial producing cultures. Germination of greenhouse produced teliospores of *P. coronata* var. *avenae* was attempted. These teliospores were not induced to germinate by alternate wetting and drying, alternate freezing and thawing, leaching with water, mechanical separation, or combinations of these. Overwintering outdoors of greenhouse produced teliospores also failed to induce germination. Teliospores collected from the field and subjected to various chemical treatments were not stimulated to germinate, although natural overwintering of these resulted in abundant germination.

**A Virus from White Clover in Indiana.** J. B. BANCROFT, J. F. TUIITE and G. HISSONG, Purdue University.—A mechanically-transmissible virus has been isolated from white clover in Indiana. The virus is serologically related to viruses recently found in Holland and California. The host range of the virus includes 26 species in the following families: *Convolvulaceae*, *Cucurbitaceae*, *Leguminosae*, *Solanaceae*, *Tropaeolaceae*. The physical properties of the virus are: dilution end-point, about 1:100,000; thermal inactivation, between 65° and 75°c; longevity *in vitro*, < 2 weeks. The virus remains soluble and infective at pH 5.0 and is a nucleoprotein. The virus is a moderately flexuous rod. The average particle length of the modal distribution is 477 m $\mu$  and the width is about 15 m $\mu$ .

**Relative Humidities as Accumulated Percent-days Related to Some Indiana Plant Disease Problems.** R. W. SAMSON, Purdue University.—In attempts to correlate Indiana summer weather factors with outbreaks and severity of certain vegetable diseases it was found convenient and instructive to handle relative humidity data in terms of accumulated percent-days, one percent relative humidity for one day being one percent-day. Accumulated percent-days were calculated from U. S. Weather Bureau records (Climatological Data, Indiana Section) for June, July, August and September of each of the years from 1915 to 1959. When histograms are constructed from this data separately for each of the 45 growing seasons and arrayed as departures from a longtime average a gross but striking graphic portrayal of summertime relative humidity appears. The 45-summer period was characterized by the particularly humid summer of 1915, followed by 27 summers, none particularly humid and most much below the longtime average. The succeeding 18 summers were mostly much above average in total percent-days. The impact of the resulting increased severity of certain diseases during the latter more humid period is partially reflected in recent abandonment of many Indiana tomato canning factories that were built in the earlier period and in the decline of a muskmelon growing industry that flourished from 1916 to 1941 in southern Indiana.

**The Culture of *Erysiphe cichoracearum* DC. upon Detached Leaves of *Zinnia* and *Helianthus*.** RALPH M. MORRISON, Indiana University.—The

*Erysiphaceae* belong to the order *Erysiphales* of the class *Ascomyceteae*. The genera of this family grow as obligate parasites upon a large number of dicotyledons belonging to several different families. The taxon reported upon here, *Erysiphe cichoracearum* DC., parasitizes a number of genera in the *Compositae*. Before any detailed study of these organisms can be made, it is necessary that a culture method be utilized which will minimize both biological variation as well as environmental variation. Detached leaf culture proved to be the best method to accomplish this goal. Methods of culturing leaf disks of *Zinnia* and *Helianthus* are discussed. Types of sustaining media and environmental conditions necessary for the maintenance of leaf-mildew cultures are discussed with a view toward determining the factors influential in the sexual as well as the asexual phases of mildew development.

**Culture of Powdery Mildew (*Erysiphe graminis* D. C.) on Excised Wheat Leaves in Solutions of Benzimidazol.** RALPH M. CALDWELL, Purdue University.—The study and maintenance of pure cultures of the powdery mildew fungus have been difficult owing to the contamination between pure cultures in the greenhouse and the rapid loss of conidial viability in storage. As shown by Person, Samborski and Forsyth, excised wheat leaves can be maintained for relatively long periods if floated on or the cut ends are immersed in solutions of benzimidazol. Two races of *Erysiphe graminis* have been carried in pure culture through 9 transfers on wheat leaves so maintained in petri dishes in 40 or 60 p.p.m. of benzimidazol in distilled water. The cultures grew vigorously either in north window daylight or under fluorescent supplemented with Mazda illumination. The characteristic resistant or susceptible reactions of the wheat varieties, Michigan Amber and La Porte, were maintained under these conditions. Plastic petri dishes with center dividers to hold all but the cut ends of the leaves out of the solutions were well adapted for this purpose. Under these conditions, at temperatures of 60 to 75 F., the fungus sporulated luxuriantly and provided abundant conidial inoculum for experimental use. Transfers were necessary every 3 to 4 weeks.