

BOTANY

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ABSTRACTS

Some observations on the taxonomy of *Oenothera*, subgenus *Euoenothera* in North America. RALPH E. CLELAND.—The North American *Euoenotheras* show much variability but few clear-cut boundary lines, and their taxonomy is in a very unsatisfactory state. A study of the cytogenetics of the group is uncovering facts which should make it possible to arrive at a system of classification which will express rather accurately actual phylogenetic relationships. The cytogenetic methods used in this study are briefly described, and the major groupings of phylogenetic significance are described. The possibility of elevating these groupings to the rank of species in any future taxonomic revision should be seriously considered.

An evaluation of fireblight resistance in pear seedlings. T. R. CARPENTER, Purdue University.—Seedlings of *Pyrus ussuriensis* Maxim were inoculated with *Erwinia amylovora* (Burrill) Winslow et al. in, 1) early growth stages in the greenhouse, and 2) later growth stages in the nursery row to ascertain the relative merits of inoculations at the two periods of growth. Seedlings inoculated at the sixteen to twenty-four leaf stage could be divided into three general infection classes; namely, immune, resistant and susceptible. No appreciable resistance was expressed prior to the eight leaf stage. Immune individuals could be detected between the eight and twelve leaf stage. Resistant individuals could be consistently detected between the sixteen to twenty leaf stage. A higher percentage of susceptible individuals were eliminated in the early growth stages in the greenhouse than were eliminated from similar progenies initially inoculated in the nursery row. There was less shifting to lower infection classes during the second year inoculations on the part of the greenhouse inoculated plants than among the seedlings initially inoculated in the first year nursery row. There was a tendency for plants to gain in resistance with age, especially among those plants inoculated in early greenhouse growth stages. A higher percentage of infection was obtained at a minimum greenhouse temperature of 80° F. than at 60° F.

A new life cycle variant of the *Stipa*-mallow rusts. GEORGE B. CUMMINS, Purdue University.—Recently Gäumann (Ber. Schw. Bot. Ges.

57:248-249, 1947) has described *Puccinia sphaeralceae* as a new species, under a preempted epithet, producing aecia and telia on *Sphaeralcea ambigua* Gray in California. The species also is known to parasitize *S. orcuttii* Rose in California and *S. rivularis* (Dougl.) Torr. in Idaho. It represents a new life cycle species in the complex including the macrocyclic autoecious South American *P. digna* Arth. & Holw. on *Stipa*, the demicyclic heteroecious *P. interveniens* Bethel on Mallows and *Stipa*, the demicyclic autoecious *P. graminella* Diet. & Holw. on *Stipa*, the microcyclic *P. sherardiana* Körn. on mallows and the endo-form *Endophyllum tubercutatum* (Ellis & Kellerm.) Arth. & Fromme on mallows.

Possibilities of hybrid vigor in *Liriodendron tulipifera*. I. W. CARPENTER, Purdue University.—Maintenance of *Liriodendron tulipifera* in forest stands in Indiana is desirable since it is a principal source of hardwood veneer stock and is also the state tree. Preliminary investigations into the requirements of this tree led to a study of its reproduction. High seedling mortality was observed in quadrat studies of several different sites. The low germinative capacity of tulip tree has long been known, and an attempt was made to discover if this was due to continual selfing of the flowers.

Trees were cross pollinated with pollen from widely separated geographic localities. The seed thus obtained was compared with open pollinated seed from the same parents as to germinative capacity. Six lots of the hybrid seed and open pollinated seed were grown in the greenhouse and records kept to determine if there was any induced vigor. Results indicate marked increase in germinative capacity and possible hybrid vigor.

***Tolypella prolifera* Leonh. found in Indiana.** FAY KENOYER DAILY, Butler University.—A brief description is given of *Tolypella prolifera* Leonh. representing a genus of the algae evidently not found previously in Indiana.

Chlorophyll therapy and its relation to pathogenic bacteria. MABEL M. ESTEN¹, and ALBERT G. DANNIN².—The achievements to date in the field of chlorophyll therapy are briefly summarized, with particular reference to the relation of such therapy to the pathogenic bacteria. The derivatives of chlorophyll used in the treatment of diseases, methods of treatment, chief diseases for which chlorophyll preparations have been used, toxicity of these preparations, and the chief results of chlorophyll therapy are reviewed. The efficacy of chlorophyll preparations in deodorizing and healing suppurative and other types of diseases has stimulated research to determine the effect of such preparations on the pathogenic bacteria. Results of research to date indicate that chlorophyll preparations have a bacteriostatic, rather than bactericidal, effect upon pathogenic bacteria in living tissues. (To be published in the Butler University Botanical Studies.)

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Preliminary report on the phytopathology of *Physoderma graminis* (Busgen) Minden, 1911. K. S. GOPALKRISHNAN, Notre Dame University.—*Physoderma graminis* (Busgen) Minden, first reported for this country from Madison, Wisconsin, was later collected at Ottawa, Canada, northern and southern Indiana, Illinois, and southern Michigan. This chytrid parasitises *Agropyron repens* Chev.; parasitism is systemic in which respect it differs from *Ph. zeamaydis* Shaw. There is a complete inhibition of the inflorescence, and the affected plants are readily recognizable in the field by their erect habit and yellowish color. Infection occurs through the overwintering sporangia in dead disintegrating leaves of the previous season. Artificial infection by inoculating the soil with sporangia was successful. Infection through leaves occurs only in very early stages. The incubation period is from eight to twelve days. The symptoms consist of yellow streaks which gradually coalesce and turn brown until the leaf dies. The peak period of infection in the field is June and there appears to be a second period of infection some time in the fall depending upon the warmth of the weather. In the laboratory the optimum temperature for the germination of the resting sporangia is 29° C. The resting sporangia require a dormancy period of three to four months but the dormancy can be broken by low temperatures (—10° C.), burial in the soil, or alternate heat and cold treatments. Drugs tried so far have not produced any break in the dormancy of the sporangia. So far cross inoculations with zoospores, and sporangial suspensions on *Agrostis alba*, *Phleum pratense*, *Dactylis glomerata*, *Euchloena mexicana* and *zea mays* proved unsuccessful. The first four grasses which are naturally associated with *Agropyron repens* are free from infection in the field. These two facts suggest that the parasite is obligate on *Agropyron repens*. The possibility of the occurrence of physiologic races should not be overlooked. Host hypertrophy is common, the infected leaf becoming many times thicker than the normal and often highly distorted and tubular. The hypertrophy is due to the enlargement of the cells.

Rhizomycelium, ephemeral sporangia, and zoospores and the germination of the resting sporangia all resemble those of *Physoderma zeamaydis* occurring on corn. Multiciliate zoospores were noticed in a small percentage of those liberated from the resting sporangia the significance of which cannot be definitely assessed at present. Apparent fusions were noticed but the very small percentage of such fusions cannot be satisfactorily explained at the moment.

Data with regard to certain environmental influences on the germination of the resting sporangia are presented.

Growth-rainfall trend-coefficients shown by six species of hardwoods in Brown County, Indiana. RAY C. FRIESNER, Butler University.—Highest trend-coefficients shown are: *Carya ovata*, May-July; *C. glabra*, May-July, August-July, and June-May; *Acer saccharum*, May-August and May-June; *Liriodendron tulipifera*, July-June; *Fraxinus americana*, April-July; *Sassafras albidum*, none of any significance. Trend-coefficients for all species increase in percentage with increase percentages of

rainfall change. Higher trend-coefficients are shown when rainfall decreases only are considered than when increases only are considered. When any individual tree is compared with any other individual tree, the highest percentage of agreement is as likely to be with an individual of a different species as with an individual of the same species. *Liriodendron* is the only species which shows a higher average percentage of agreements with individuals of its own species than with individuals of other species.

An investigation of the root-stem transition of *Phaseolus coccineus* Willd. GINO V. GRASSI, University of Detroit.—This work consisted of an investigation of the root-stem transition of *Phaseolus coccineus*, Willd., which was found to be completed high in hypocotyl. The first indication of transition from the tetrarch exarch primary root to the endarch stem occurs where parenchyma is differentiated between the cells of the metaxylem arms forming four distinct triangular-shaped groups of protoxylem and metaxylem. Secondly, metaxylem differentiates tangentially so that there are bands of metaxylem alternating with the four transitional bundles. Continuing up the axis, the protoxylem elements of each bundle differentiate as two rows of spiral cells which are formed at right angles to the metaxylem. Eventually these rows are separated by parenchyma, and now each transition bundle consists of two units. At a higher level, the protoxylem points of the bundles mature in a line with the metaxylem elements. Farther up, there is centripetal differentiation of the protoxylem and a centrifugal differentiation of the metaxylem. Ultimately the endarch condition is reached.

The relation of soluble aluminum ions to the common potato scab disease and to the growth of *Actinomyces scabies* in culture. GEORGE A. GRIES, Purdue University.—Common potato scab may be invariably controlled in mineral soils by increasing soil acidity to pH 5.0-5.2. The same procedure often fails to give satisfactory control in muck soils, with cases being recorded in which scab was severe at pH 4.5. Many strains of the causal organism are found which fail to grow below pH 5.0 but others isolated from both muck and mineral soils will grow in culture at pH values of 4.2-4.3. As little as 16 ppm of aluminum added to the culture solution will inhibit the development of these acid-resistant organisms at pH 5.2 and below. There is a close inverse relation between the growth of *Actinomyces scabies* and the solubility of aluminum over a wide pH range. Maximum growth is obtained at pH 6.5-6.8 at which Al is extremely insoluble. Growth is inhibited in more acid solutions in which Al is soluble as the cation and in more alkaline solutions in which the soluble aluminate is present. It is suggested that scab control under field conditions may be related to soluble aluminum rather than to pH *per se*. The results of field experiments will be discussed.

History of forests in the glacial Lake Chicago area. G. K. GUENNEL, Division of Geology, Indiana Department of Conservation.—A fossil pollen study of peat samples from Pinhook and Merrillville bogs was

made. The bogs are located at the edge of the Glacial Lake Chicago basin in northwestern Indiana. The results of the pollen analysis showed that the general succession since glacial recession was *Abies-Picea* to *Quercus-Carya*. However, slight modifications of this sequence were recorded. Pinhook bog, located in LaPorte county, disclosed a transitional pine period, whereas Merrillville bog, in Lake county failed to show evidence of such a period between the *Abies-Picea* and *Quercus-Carya* forest types. A striking phenomenon was noted in the Merrillville profile. *Pinus*, according to the quantitative record, became a strong associate of *Quercus-Carya* during the more recent past. This increase in pine pollen in the upper layers of Merrillville bog was due to local, rather than climatic factors. It represents a *Pinus strobus* relic colony, which persisted on the bog mat until 1940, when a fire eliminated all but one tree. From the general succession, as indicated by pollen frequencies, the following deductions as to climatic changes can be made: The cold-moist climate, which fostered *Abies-Picea*, changed to a warm-dry climate which supported the *Quercus-Carya* association.

Effects of various concentrations of 2,4-D on corn seedlings. ROBERT W. HOSHAU, Purdue University.—In the field most varieties of corn are tolerant of 2,4-D in concentrations which can be used for effective weed control. However, in most cases corn is not resistant to higher concentrations of 2,4-D than those recommended for field use. Two yellow dent single hybrids, Wf9 x Hy and Tr x 38-11, were grown in the greenhouse and treated by spraying with the triethanolamine salt of 2,4-D in concentrations ranging from 500 ppm. to 3000 ppm. Ten pots were treated with each concentration. Both pre-emergence and post-emergence methods of application of 2,4-D were used. The pre-emergence application was made immediately following planting, and the post-emergence treatment was made when the corn was between 8 inches and 12 inches high. The effect of the pre-emergence treatment was noticeable as soon as the plants emerged, with the bending most evident in the pots sprayed with the higher concentrations of 2,4-D. Both the coleoptile and the sub-coleoptile internode were excessively elongated. In many cases the coleoptiles elongated to such an extent that the first leaves emerged from them with difficulty. Also many adventitious roots developed in an irregular manner above the soil level. The recovery of seedlings from the pre-emergence treatment was remarkable during a period of 10 days following emergence. The plants which were subjected to a post-emergence spray treatment showed evidence of bending within 24 hours and by the fifth or sixth day bending was at a maximum. At the higher concentrations the lodging appeared to be permanent and some of the stems showed evidence of breaking. The higher concentrations of 2,4-D greatly reduced plant height and decreased the overall vigor of the plants.

Effects of butyl ester of 2,4-D on some algae. J. DONALD LA CROIX, University of Detroit.—Controlled laboratory experiments on four species of algae, three of which were algal nuisances, were carried out using the butyl ester of 2,4-D as the herbicide. *Cladophora crispata* (Roth)

Kutz., and *Hydrodictyon reticulatum* (L.) Lagerh. were killed in a 2,4-D concentration of two hundred ppm. and were definitely inhibited in one hundred ppm. The alga, *Phormidium ambiguum* Gom., was unaffected by one thousand ppm. 2,4-D and lower concentrations. The growth of the flagellate, *Euglena viridis* Ehr. was checked in all concentrations, but the higher dilutions had a greater effect. However, two hundred ppm., the minimum concentration required to kill the algae in this case, has been known to be lethal to fish and other aquatic organisms. It should be remembered that concentrations employed in controlled laboratory experiments may be less effective in ponds, but the laboratory findings should indicate the general trend of field experiments. The present cost of the chemical is so great that its general use will undoubtedly be limited. It is estimated that at the effective concentration of two hundred ppm. of the butyl ester of 2,4-D, the cost would well exceed \$850 per acre foot. However, other means such as serial applications of such a dilution to a floating algal mat might prove more feasible. Rotifers and ciliates were destroyed in a concentration of two hundred ppm. while snails were killed in a concentration of nine hundred ppm.

An ecological study of the relationship between direction of slope, elevation and forest cover in Brown County, Indiana. CARL R. MCQUEENEY, Butler University.—During the winter of 1948-49, the forest cover on four slopes facing north, south, east, and west respectively, were studied quantitatively by the quadrat method. Each slope was divided into upper and lower elevations. The four stands on the lower elevation level proved to have a different phytosociological complex than the corresponding stands on the upper elevation level. The forest cover of the area, as a whole, was dominated by *Acer saccharum*¹, *Fagus grandifolia*, *Quercus alba*, *Q. borealis v. maxima*, and *Q. velutina* with *Acer rubrum* and two species of *Carya* playing a secondary part. Each individual stand was dominated by a combination of these species. The north facing slope was dominated by a mixture of species with *Acer saccharum*, and *Fagus grandifolia* controlling the lower elevation and *Acer saccharum*, *Fagus grandifolia*, *Quercus alba*, and *Q. borealis v. maxima* sharing the upper elevation. On the south facing, *Fagus grandifolia* dominated the lower elevation with *Acer rubrum*, *A. saccharum*, *Carya ovata* and *Quercus velutina* playing an important part in the crown cover. The upper elevation of this slope was controlled almost exclusively by *Quercus alba* and *Q. velutina*. *Acer saccharum*, *Fagus grandifolia*, *Quercus alba*, and *Q. velutina* shared dominance on the lower elevation of the east facing slope while *Quercus alba*, *Q. velutina*, and to some extent *Carya glabra*, dominated the upper elevation. The west facing slope was dominated by *Fagus grandifolia*, *Quercus alba*, and *Q. borealis v. maxima* on the lower elevation and *Fagus grandifolia*, *Quercus alba*, and *Q. velutina* on the upper elevation. *Acer saccharum* and *Fagus grandifolia* were in all cases less prominent in the upper elevation and almost completely absent on the latter elevation of the South and East facing slopes. On these

¹*Acer saccharum* includes *Acer nigrum*.

two slopes, *Acer saccharum* dropped out rather abruptly at 48 ft. above the valley floor. *Quercus* was, on the whole, more prominent in the upper elevations though important in all stands and *Carya* apparently preferred a habitat which was more xerophytic than that best suited to *Acer-Fagus* and less xerophytic than that best suited to *Quercus alba*.

The effect of precipitation on the annual ring growth in three species of trees from Brown County, Indiana. CHESTER W. MILLER, Butler University.—An attempt was made in the late fall and early winter of 1948 to ascertain the relationship between the precipitation and annual ring growth of three species of deciduous trees from Brown County, Indiana; also, to determine which area of the tree, i.e., the top area or the bottom area, gives the highest percentage of agreement between growth and rainfall. 23 different month combination rainfall periods were chosen. *Fraxinus americana* shows highest growth-rainfall trend coefficients for the rainfall periods May-August and June-August; *Quercus alba* for the periods June-August and May-August; and *Quercus velutina* for the periods June-July and June-August. With but few exceptions, growth-rainfall trend coefficients increased with increase in degree of rainfall change. When annual growth of individuals of each species and of different species is compared, the highest percentage of agreement is shown between individuals of the same species except in *Quercus velutina*. *Q. velutina* shows higher average agreement with *Q. alba* than amongst individuals of its own species. *Fraxinus americana* shows higher growth-rainfall trend coefficients when decreases only in rainfall are considered. The same is true for *Quercus alba* except in the case of 40% or greater rainfall changes. *Quercus velutina* shows higher growth-rainfall trend coefficients when increases only are considered in rainfall than when decreases only are considered when comparison is based upon lower degrees of rainfall change, but the reverse is true when comparison is based upon higher degrees of rainfall change. The average trend coefficients between growth in the top area and the bottom area of the same trees of *Quercus velutina* is 82% while the average for *Quercus alba* is 80%. In both *Quercus velutina* and *Quercus alba*, the top areas give higher growth-rainfall trend coefficients than do the bottom areas. This would appear to indicate that annual growth in the top areas of these species are more sensitive to rainfall changes than annual growth in the bottom areas. (To be published in the Butler University Botanical Studies 9 (17). 1950.)

The effect of sap-removal for syrup-making upon radial growth in sugar maple. CHESTER W. MILLER, Butler University.—Annual growth data of *Acer saccharum* is given for all the sections studied; the oldest dating to the year 1710. This data is presented because the trees offer growth data covering a longer period of time than has previously been reported in any Indiana studies. Sugar maple shows highest growth-rainfall trend coefficient for the rainfall period June-July. This would appear to indicate that the annual radial growth is more sensitive to rainfall during the early summer months. The removal of sap from a

sugar maple tree has a definite retarding effect upon the radial growth. The average yearly radial growth for fourteen years prior to the year following cessation of tapping is 0.8 mm. while the average yearly radial growth ten years towards the center of the tree from the innermost limit of the spilehole is 1.8 mm. The year following cessation of tapping shows the maximum amount of radial growth attained in any one year. The annual growth then grades towards the normal ring size over a period of five years. (To be published in the Butler University Botanical Studies 9 (20). 1950.)

The botanists of India and Pakistan. C. M. PALMER, Butler University.—During a two year period, beginning in the summer of 1947, spent in India and Pakistan, the writer had opportunities of meeting a considerable number of botanists and other plant scientists in the educational and research institutions. Photographs of a number of the workers and of the science buildings were taken. The scientists are facing a different situation as the new independent Indian and Pakistan governments strive to increase facilities for scientific work, particularly for practical research and for opportunities for education for all the best qualified students. Several of the scientists have done research which has received worldwide recognition. They were exceedingly cordial and cooperative and were anxious to have additional contacts with scientists in America and elsewhere.