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NOTES ON THE OCCURRENCE AND DISTRIBUTION OF UREDINEÆ.

BY M. A. CARLETON, KANSAS AGRICULTURAL EXPERIMENT STATION, MANHATTAN, KANSAS.

VERY little attention has been given to the distribution of parasitic fungi, except so far as to note their occurrence on host-plants of more or less close relationship, and that they are usually somewhat more abundant in wet seasons and places than in those that are dry. But close observation reveals more facts than these, and some that are peculiarly interesting.

Strictly speaking, the parasitic fungi are affected by but two of the elements of environment concerned in the distribution of phanerogams. These are *temperature* and *moisture*, while flowering plants are also affected by differences in kind of *soil* and amount of *light*.

However, there is a kind of distribution of parasitic fungi, scarcely to be called geographical, although such distribution has probably been caused by changes in the anatomy and physiology of the host, which changes were themselves caused by variations in soil and climate. I refer to cases of certain hosts which support certain fungi in one locality and not in another. Of course, it may be said that in one or more of these localities there has yet been no chance for infection, but in numerous cases this is, to say the least, rather improbable, and sometimes the hosts are distributed so as to completely connect these localities, and yet without general distribution of the fungi. Moreover, some of these hosts are annuals, or occasionally biennials, so that it cannot be said that the fungi are prevented from spreading by the circumstance of their being reproduced yearly from perennial mycelium and not by infection by germinating spores.

Again, while a group of species (a genus, for instance) in one locality may all be attacked by a certain fungus, in another locality, where these hosts are all represented, only a part of the group may be affected by the same fungus.

Certain fungi have also peculiarities of occurrence in point of time. After being reproduced annually for several years, they may suddenly disappear for an indefinite period, or reappear after certain intervals of time.

In illustration of these general statements, it may be of interest to give here some observations that I have made on the distribution of Uredineæ in Kansas, covering a period of about six years.

In the first place, it seems to be true that *Aecidia* require more moisture than the other stages, and *telentospores* the least. In Kansas, east of the 96th meridian, the species of *Aecidia* number about fifty, and *telentospores* (of all genera) sixty-five; while west of the same meridian the proportion is about twenty-three of the former to fifty of the latter. The telentospores of western Kansas, it is seen, are more than twice the Aecidia. The difference in rainfall of the two portions is well known. But all Uredineæ are probably more abundant in wet seasons than in dry seasons, and also more abundant in warm seasons than in cool seasons. This season has been much earlier than the preceding one, and has been marked by a number of unusually hot days, alternating with heavy rains. Moreover, the rains have continued to date, and were quite frequent just at harvest time. The result has been a season unusually favorable for rusts. The following species have been collected in large quantities this season: *Aecidium peckii*, De Toni, on *Oenothera biennis; Aecidium euphorbiæ*, Gmel.; *Aecidium violæ*, Schum., on *Viola falmota*, L., var. *cucullata*, Gr., and cultivated pansies; *Aecidium zanthoxyli*, Pk.; *Aecidium cepholanthi*, Pk.; *Puccinia graminis*, Pers. II.; *Uropyxis petalostemonis* (Farl.), De Toni; *Roestelia pirata*, Thaxt., on *Pirus coronaria; Uredo cæoma-nitens*, Schwein., on *Rubus villosus* (cult.) and *Rubus canadensis*. Immense numbers of spermogonia were found with *Aecidium peckii*, De Toni, and with the *Uropyxis*, *Roestelia*, and *Uredo cæoma-nitens*, Schw., above mentioned. *Puccinia graminis*, Pers., has been quite destructive to grains, especially oats, over the greater part of the State, but particularly in the eastern portion. It is a very interesting fact that, while this species was quite rare last year, it is the predominating rust of grains this year, and has caused extensive damage. Last year *Puccinia coronota*, Corela, was very abundant on oats, but this year, in repeated examinations, I have been unable to find a single specimen. Even *P. rubigo-vera* (D. C.), Wint., the ever-present grain-rust, is very scarce this season.

The greatest damage from rust prior to this season that I recall was in 1877, when there was a severe rust scourge over northern Kansas. Many fields of wheat were entirely destroyed, and never harvested. Sulphur-like clouds of spores filled the air and irritated the nostrils of the workmen. I had no knowledge of botany then, but a vivid remembrance of the general appearance of the rust, coupled with my present knowledge of the differences between the species, inclines me to believe that it was *Puccinia graminis*, Pers., that did the damage. I have always doubted the usual statements that *P. rubigo-verà* is the rust that usually does the damage in this country, and this season the facts in Kansas strongly confirm my opinion. Of course, the last-named rust is the more common from year to year, but seldom attacks the stem to any great extent, and, in my own experience, any amount of it on the leaves usually does little damage, but when the stem becomes covered with red powder and finally weakens and falls, and the grain shrivels, and the straw becomes very light, then you may guess that *Puccinia graminis* is in the field. However, there may be facts from other portions of the country, even this season, that furnish contrary evidence, for aught I know.

The above facts call up further instances of variations in the occurrence of species. The following species, originally known in Kansas, have not, to my knowledge, been reported for several years: *Aecidium abundans*, Pk.; *Aecidium cassiæ*, E. and K.; *Aecidium sambuci*, Schw.; *Puccinia similacis*, Schw.; and *Aecidium macrosporum*, Pk. During the succession of recent dry seasons they have probably become so reduced in numbers that finally there were not enough healthy spores left to reproduce the species on the following year. In like manner *Puccinia solida*, Schw.; *P. seymeriæ*, Burrill; *P. saniculæ*, Grev.; and *Aecidium punctatum*, Pers., seem to have disappeared. In future wet seasons infection may take place from a distance, and the fungi reappear.

As to migration, *Aecidium tuberculatum*, E. and K., has certainly been coming rapidly eastward, until this season it was found at Manhattan for the first time. *Uredo gaurina*, Pk., seems also to be coming eastward. *Puccinia heterospora*, B. and C., with its host (*Abutilon avicennæ*), *Puccinia xanthii*, Schw., var. *Ambrosiæ*, Burrill, several varieties of *Aecidium compositarum*, Mont., and *Puccinia microsperma*, B. and C., are, without much doubt, working westward. Others might be mentioned, but the possibility of their having been present for years already, and overlooked, forbids that we should place much dependence on such observations.

But a more remarkable phase of distribution is found in the fact that a number of species known on certain host-plants in western Kansas for a number of years are entirely absent in the

eastern portion of the State from the same host plants, although the hosts themselves are very abundant in some cases. *Grindelia squarrosa*, Dund., ranges over the entire State in abundance, but *Puccinia grindeliæ*, Pk., has never, to my knowledge, been found east of Russell and Rooks Counties. Another singular fact is that I never found it on the variety *grandiflora*, Gr., which grows so abundantly in western Kansas. *Uredo gaurina*, Pk., and its *Aecidium*, too, are found in the western counties only, although three species of *Gaura* are native in eastern Kansas. *Lygodesmia juncea*, though not widely diffused in the eastern portion of the State, is still rather abundant in spots about Manhattan, but without any fungus; while over the western counties, not only is the plant itself very common, but it supports, in great abundance, a rust which has been named *Puccinia variolans*, Hark., var. *caulicola*, Ell. and Ev. I have noticed for several years that *Puccinia phragmitis* (Schum.), Korn., is never found on *Phragmites communis* in eastern Kansas (although abundant on *Spartina cynosuroides*), but is common on this host wherever found in the western counties, so *Uropyxis amorphæ* (Curt.), Schroet, abundant on both *Amorpha canescens* and *A. fruticosa* in the west, is found only on the former host in this region. What seems to be the *Puccinia grindeliæ*, Pk., above mentioned, is also found on *Aplopappus rubiginosus* in abundance in the west, but this host does not grow in this region. In these cases may there not be anatomical differences in the hosts (of the same species, even) which cause this peculiar distribution of their parasites. At least, the question is worthy of close investigation. It is another indication, to me, that plant *pathology* cannot be well understood without a knowledge of plant *physiology*. I have already shown in another article[1] how the host-plants themselves vary in passing from the more fertile to the more barren districts of the great plains. The distribution of their parasites may be greatly influenced by these variations.

IN MEMORIAM. — THE REV. W. C. LUKIS, M.A., F.S.A.

BY W. GREGSON, F.G.S., BALDERSBY, S. O., YORKSHIRE, ENG.

The death of the Rev. William Collings Lukis removes a familiar figure from the ranks of British scientists, and one who will long be remembered with feelings of deepest respect and esteem, not only in Great Britain, where he lived and worked so long, but throughout the whole of the scientific world. His tall, erect, manly form, and genial countenance, were well known throughout Yorkshire, and he was certainly one whose friendship it was a pleasure and a delight to claim.

Mr. Lukis was not only an archæologist of world-wide eminence but was also a considerable authority on geology, botany and other branches of natural science. He had long been an observant traveller in various parts of Europe, Africa, America, etc. More especially in the Netherlands, Denmark, France, Italy, and Algeria; and his writings and researches show that accurate and intimate knowledge of those countries which he acquired from careful personal investigations. The deceased gentleman was also an artist of considerable power and merit, as many of his works, illustrated by his own hand, sufficiently testify. He was born on April 8th, 1817, in the Island of Guernsey (English Channel), and was the third son of Colonel Frederick Corben Lukis, by Elizabeth, youngest daughter of Mr. John Collings of Guernsey. From his father, who was also an archæologist of distinction, Mr. Lukis inherited a taste for natural science, which he pursued at the University of Cambridge, under Professors Henslow and Sedgwick, and the writer has frequently heard him dilate on the benefits he derived from his connection with such far-famed scientists. He received his early education in Guernsey, afterwards in France, and at Blackheath, near London, under the mastership of the Rev. Sanderson Tennant, whilst in January, 1840, he graduated in honors at Trinity College, Cambridge. Twelve months later he was ordained at Salisbury, by Bishop Denison, and licensed to the curacy of Bradford-on-Avon (of which parish the late famous Harvey, formerly private tutor to Prince George, now Duke of Cambridge, was then vicar). In 1845, he was appointed chaplain to the Marquis of Ailesbury, who successively presented to him the livings of Great Bedwyn, and Collingbowne Ducis in Wiltshire, and Wath, near Ripon, in Yorkshire; which latter he held for thirty-one years up till the time of his death. Whilst residing at Cambridge he was one of the earliest members of and contributors to the Camden Society, then newly formed, and when living at Bradford-on-Avon, he published a quarto volume on "Ancient Church Plate," also other works on "Church Bells," "Church Towers," etc.

In 1847 he was elected a Fellow of the Royal Society of Northern Antiquaries, Copenhagen; in 1853, a Fellow of the Society of Antiquaries, of London; and in 1867, a member of the Société Archéologique de Nantes, whilst in 1872, he was elected a corresponding member of the Société de Climatologie Algerienne. Mr. Lukis was the author of many works on barrows, and other prehistoric monuments, and was a practical barrow digger on an extensive scale, in various parts of England, France, Denmark, the Netherlands, and elsewhere. The Society of Antiquaries, London, published his scale plans of Rude Stone Monuments, with descriptive text. He also edited, for the Surtees Society, Dr. William Stukeley's Diaries and Letters, published in three volumes; and when the Ripon Millenary Festival was celebrated, in 1886, he was an active member of the committee, which was formed to carry out the arrangements, and wrote an interesting and valuable article entitled "Ancient Ripon," since included in Mr. W. Harrison's "Millenary Record" (a beautifully illustrated volume published at Ripon, in 1892).

Mr. Lukis, who was a prominent Free Mason, and a J.P. for Wiltshire, married Lucy Adelaide, daughter of Admiral Sir Thomas Fellowes, who survives her husband, and by whom he leaves two sons and four daughters; the eldest daughter being the wife of a son of the late Canon Hawkins, J.P., of Topcliffe, Yorks (a relative of Mr. Justice Hawkins), and the second daughter being the wife of Mr. H. C. Bickersteth (son of the late Bishop of Ripon, nephew of the Bishop of Exeter, and cousin of the Bishop of Japan).

A committee has recently been formed, under the chairmanship of Sir Reginald Graham, Bart., of Norton-Conyers, near Ripon (which is close to Wath, and where the talented authoress of "Jane Eyre" at one time resided), for the purpose of placing in Wath Parish church a strained-glass window, as a lasting memorial of the late much esteemed rector, who was so ripe a scholar, so kind a friend, and of whom it may be truly recorded: —

> He seemed the thing he was, and joined
> Each office of the social hour
> To noble manners, as the flower
> And native growth of noble mind.

OBSERVATIONS ON DUCKLINGS.

BY C. LLOYD MORGAN, BRISTOL, ENGLAND.

OF seven eggs transferred from a hen to my incubator only two hatched out. Of the others four had not been fertilized and the fifth contained a dead bird in about its tenth day of incubation. Several hours before the ducklings chipped the shell they were piping to be free. One (A) was hatched four hours before the other (B). They were left in the drawer of the incubator for about 20 to 24 hours, and were then transferred to an experimental poultry yard in my study. Somewhat unsteady upon their legs, they kept tilting backwards on to their tails; but A was decidedly the stronger of the two and his motor coördination was better. They pecked with uncertain aim at anything which caught their eyes, such as marks on the basket in which they were to sleep, grain, sand. Chopped-up white of egg was placed before them and moved about with a long pin to draw their attention to it. The coördination for pecking was far from perfect. When a piece was seized after several shots it was mumbled rapidly and then shaken out of the bill unswallowed. A shallow tin of water was placed before them. They took no heed of it. As they tottered about they walked through it several times, but no notice was taken. I dipped A's beak into the water. He drank with characteristic action; he then pecked at

[1] "Contrib. U. S. Nat. Herb.," vol. XXI., No. 6, pp, 220-232.