

Proceedings of the Iowa Academy of Science

Volume 15 | Annual Issue

Article 12

1908

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Recommended Citation

Wilson, Guy West (1908) "Notes on Peronosporales for 1907," *Proceedings of the Iowa Academy of Science*, 15(1), 85-89.

Available at: <https://scholarworks.uni.edu/pias/vol15/iss1/12>

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NOTES ON PERONOSPORALES FOR 1907.

BY GUY WEST WILSON.

Among the problems in the life history of the *Peronosporales* two important and interesting ones have received far less attention than they deserve. These are (1) the interrelation of meteorological conditions and the abundance and development of these fungi (2) the location of centers of seasonal distribution. While these problems have attracted the attention of a number of mycologists, they are of such a nature as to necessitate a series of observations extending over a term of years in a given locality and at the same time to require the co-operation of observers in localities widely separated in space and climate. To be of the greatest efficiency these observations, accompanied by specimens to properly authenticate them, should be communicated to some one who can study and correlate the accumulated data. In this way we may be able to arrive at some more definite conclusions concerning the problems of oospore formation.

As the papers on these subjects are of easy access, it is probably needless to review them at the present time. The most extensive series of these is by Dr. Halsted on the relation between the abundance of these fungi and the weather. These papers are based on observations made at Ames, Iowa, and New Brunswick, N. J. This series began with the data for 1886 and contained seasonal summaries of the abundance of the various species, but as a rule not taking into account either the dates of appearance or disappearance or the presence or absence of oospores, all of which would have added materially to the value of the records.

More recently another phase of the subject has been treated by Drs. Orton and Selby, who have been aided in their investigations of the centers of seasonal distribution by the facilities of the United States Department of Agriculture. These observations have been confined almost entirely to economic species, such as *Pseudopronospora cubensis* and *Phytophthora infestans*. From these studies on the first species, the oospores of which have so persistently eluded the collector, it appears that this spore form may be elided or only produced at irregular intervals as a means of rejuvenation. The fungus is perennial in Florida and from this center is carried northward by the conidia each season.

That the same state of affairs may account for the absence from herbaria of the oospores of other species is not improbable, but such a theory will not suffice in all instances. For example, *Rhysotheca vuburnii* extends from central New York to Alabama and may be perennial at some point in the south, thus dispensing with oospores. On the other hand *Rhysotheca ribicola* extends from West Virginia through Wisconsin to Washington, with a probable northern extension of range, yet no oospores have so far been observed in America.

The accompanying notes on the *Peronosporales* during the past collecting season are based on observations made from early spring to late autumn at various localities. The season up to July 17th was spent in New York City and consequently few observations were made. The 18th and 19th of July were spent in the vicinity of Newark, Delaware, where short collecting trips were made each day. The remainder of the summer months were spent in central Indiana, the collections being made chiefly in Hamilton, Madison, Marion and Putnam counties. After arriving in Fayette in early September, but few observations were possible, as other matters made such demands as to leave but little leisure.

During the collecting season seventy-two specimens were collected and examined. Of these eight, or one in nine, contained oospores. Of the species represented a few were observed under conditions which prevented any conclusion as to their distribution through the season, while most of them showed marked seasonal development. *Plasmopara pygmaea* was observed only as an early spring form; *Albugo portulacae*, *A. tragopogonis*, *Rhysotoheca Halstedii*, *Peronospora effusa*, and *P. polygoni* appeared during the latter part of the summer and autumn; *Bremia lactucae*, *Peronospora euphorbiae*, and *P. potentillae* appeared to be early summer forms. The remaining species, when observed more than once, appear to flourish throughout the season.

The abnormally cold spring and summer need no further comment than the following data from the United States Weather Bureau:

METEOROLOGICAL DATA FOR 1907.

Months	New York, N. Y.		Newark, Del.		Indianapolis, Ind.		Fayette, Iowa	
	Rain	Dept.	Rain	Dept.	Rain	Dept.	Rain	Dept.
March	3.89	-0.19	2.62	-1.22	4.07	+0.48	1.33	-0.93
April	3.89	+0.51	3.23	-9.16	2.07	-1.66	1.03	-2.17
May	4.08	+0.90	4.98	+1.09	2.85	-1.28	2.34	-2.50
June	3.29	+0.16	5.72	+2.11	4.68	+0.37	6.99	+1.14
July	1.18	-3.36	2.95	-1.39	4.41	+0.28
Aug.	2.48	-2.05	3.35	-1.01	2.33	-1.00	4.18	+1.28
Sept.	8.00	+4.41	8.06	+4.08	2.31	-0.74	3.58	+0.62

Months	Temp.		Temp.		Temp.		Temp.	
	Temp.	Dept.	Temp.	Dept.	Temp.	Dept.	Temp.	Dept.
March	40.8	+3.3	43.6	+3.0	48.0	+8.4	37.6	+7.4
April	45.0	-3.1	47.2	-3.2	43.3	-9.1	39.9	-7.3
May	55.3	-4.0	57.4	-4.5	56.8	-6.5	51.0	-6.7
June	66.2	-2.3	65.2	-4.5	68.0	-4.4	64.3	-3.9
July	74.9	+1.3	74.6	-0.5	75.1	-1.1	71.6	-0.7
Aug.	72.0	-0.2	71.2	-2.1	72.4	-1.2	67.8	-1.7
Sept.	67.8	+1.3	68.2	-1.0	65.8	-0.9	59.7	-2.8

Last frost of spring	April 21	May 12	April 21	May 27
First frost of autumn	November 12	October 22	October 21	September 22

ALBUGO BLITI (Biv.) Kuntze.

This species was first noted at Newark, Del., where it was not uncommon on *Amaranthus retroflexus* and appeared to have been fruiting for some time. The species was everywhere abundant in Indiana on the same host, as well as on *Amaranthus hybridus*, *A. spinosus*, and *Acnida canabina*. In Iowa the fungus fruited on *Amaranthus* until frost. A total of eleven specimens (Delaware one, Iowa one, Indiana nine), were examined, but no oospores found.

ALBUGO CANDIDA (Pers.) Roussel.

At the time of my visit to Newark this species appeared to be well on in its development, but rather scarce. It was observed only on *Sisymbrium officinalis*, a host upon which it was also found in Indiana. In the later state it was also observed in great abundance on *Brassica arvensis*, *B. nigra*, *Bursa bursa-pastoris*, *Lepidium virginicum*, *Raphanus sativus*, *Roripa armoracca*, and *R. palustris*. As one host passed its prime and began to cast its leaves the fungus appeared upon other hosts. Usually only the leaves were affected, but the pods of *Raphanus* and in addition the stems of *Bursa* were attacked. The only Iowa collection was on *Brassica nigra*, with a much hypertrophied stem. Fifteen collections (Iowa one, Delaware one, Indiana thirteen), were examined and oospores found in the pods of *Raphanus* (two collections), and *Bursa*, and in the stems of *Brassica nigra*.

ALBUGO IPOMOEAE-PANDURANEAE (Schw.) Swingle.

Two collections were made in August on *Ipomoea hederacea* in Indiana. While the fungus had appeared in Delaware much earlier in the season (as evidenced by both conidia and oospores collected by Dr. Cook and Mr. Jackson), the Indiana infections were very sparse and involved only a limited area of a few leaves, while no evidence of oospore galls could be found on the stems.

ALBUGO PORTULACAE (DC.) Kuntze.

During the last third of August this species was abundant in Hamilton and Madison counties, Indiana, the last collections containing oospores. Careful search earlier in the summer failed to reveal this species. It persisted in Iowa until frost, but no oospores were found.

ALBUGO TRAGOPOGONIS (DC.) S. F. Gray.

A single plant of *Ambrosia artemisiacifolia* was found on July 29th near Greencastle, Indiana, with a number of the leaves affected by this fungus, which was not observed elsewhere during the season. Oospores were present.

SCLEROSPORA GRAMINICOLA (Sacc.) Schroeter.

A careful lookout was kept for this species, but it was not observed until after frost, when a single leaf of *Chaetochloa glauca* was found with oospores.

RHYSOTHECA HALSTEDII (Farlow) G. W. Wilson.

This species was first observed July 29th in the vicinity of Greencastle, Indiana, where a few infected leaves were found on one or two plants of *Bidens frondosa*. By August 13th the fungus was fairly abundant in this locality and by the 27th of that month scarcely a plant remained uninfected in all the In-

diana localities visited. The infection was as complete as any seen during the season, all the leaves being affected and the lower ones killed outright, but no oospores were found. A single clump of *Erigeron annuus* was also found infected.

RHYSOTHECA VITICOLA (B. & C.) G. W. Wilson.

This species was quite abundant on both wild and cultivated species of *Vitis* when they were first examined in July. Conidia were collected on leaf, petiole, tendril, and young twigs. In some vineyards the disease was responsible for heavy loss of fruit, but none of the diseased berries were examined for oospores. Among the twelve specimens collected one was upon seedling of cultivated grapes.

PLASMOPORA PYGMAEA (Unger) Schroter.

A single leaf of *Anemone quinquefolia* was found infected with this species in New York in April.

BREMIA LACTUCAE Regel.

Collected on *Lactuca canadensis* in Hamilton and Putnam counties, Indiana, between July 23d and August 3d. All this material had the appearance of being quite old and indicated that the conidia had been produced for some time past. Of the three specimens collected none contained oospores.

PERONOSPORA ALTA Fuckel.

A single infected leaf of *Plantago major* was found in Hamilton County, Indiana, on August 22d. No oospores were found.

PERONOSPORA EFFUSA (Grev.) Rabenh.

Late in July leaves of *Chenopodium album* began to show the yellow spots caused by this fungus and by the middle of August scarcely an uninfected clump could be found. Of the four Indiana specimens examined one contained oospores.

PERONOSPORA EUPHORBIAE Fuckel.

During the later part of July *Euphorbia maculata* was noticeably affected with the conidia of this species which rapidly increased in abundance. The two collections from Indiana show no oospores.

PERONOSPORA PARASITICA (Pers.) Fries.

During the early spring in New York this fungus attacked great numbers of seedlings of *Lepidium virginicum*, but soon run its course. The previous summer the fruit and inflorescence was frequently destroyed during midsummer, but this season no such attack was noted before reaching Newark, Delaware, where the fungus was evidently just making its appearance. The same host was found sparingly affected in Indiana. Here a single clump of *Brassica nigra* and a single bed of *Raphanus sativus* were found infected. No very robust growth of the fungus was observed this season. Of the five specimens (New York one, Delaware one, Indiana three), examined the only oospores found were intermingled with those of *Albugo candida* on a pod of *Raphanus*.

PERONOSPORA POLYGONI Thum.

A clump of *Polygonum scandens* was examined on July 24th and showed rather an abundant infection of this fungus, the majority of the conidiophores being immature. The fungus increased in abundance throughout August. Of the two Indiana collections neither showed oospores.

PERONOSPORA POTENTILLAE de Bary.

This species was first observed on *Potentilla monsepalensis* July 24th, when the infection appeared to be quite old. No more conidiophores were found after August 1st. Neither of the two Indiana collections contain oospores.

While the present paper is not devoted entirely to the Indiana *Peronosporales* the majority of the data was collected in that state. It is perhaps not remiss to add that all the species recorded from that state were collected except seven. Of these six are known only as spring forms and the seventh is confined to more northern portions of the state than were visited.