

PERIDERMIIUM KURILENSE DIET. ON PINUS PUMILA PALL., AND PERIDERMIIUM INDICUM N. SP. ON PINUS EXCELSA WALL.¹

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INTRODUCTION

There appear to be only three species of *Peridermium* which attack the stems of five-needled or white pines: *Cronartium ribicola* Fischer (*Peridermium strobis* Kleb.) on *Pinus albicaulis* Engelm., *P. aristata* Engelm., *P. ayacahuite* Ehrenb., *P. balfouriana* Balfour, *P. cembra* L., *P. excelsa* Wall., *P. flexilis* James, *P. koraiensis* Sieb and Zucc., *P. lambertiana* Douglas, *P. monticola* Douglas, *P. parviflora* Sieb and Zucc., *P. peuce* Gris., *P. strobiformis* Engelm., and *P. strobis* L. (5, 6)^{2 3}; *Peridermium kurilense* Diet. (4) on *Pinus pumila* Pall.; and *Peridermium indicum* n. sp. on *Pinus excelsa*. The life history, morphology, and parasitism of *Cronartium ribicola* are now fairly well known. Either or both of the other two species, *Peridermium kurilense* and *P. indicum*, might become serious parasites if introduced into this country. At any rate their invasion would certainly complicate the problem of differential diagnosis in the western part of the United States, where *Cronartium ribicola* and *C. occidentale*, the piñon pine rust, are already present.

SOURCE OF MATERIAL

The material of *Peridermium kurilense* available for study consisted of one small piece of bark measuring approximately 17 × 10 × 3 mm., bearing a few broken aecia. The specimen is No. 19047 in the herbarium of J. R. Weir. It is labelled as type material.

Two specimens of the species which is here named *Peridermium indicum* were lent for examination through the courtesy of E. J. Butler and W. McRae. The first specimen was sent by Butler to W. Stuart Moir, in 1921, and subsequently the writers had an opportunity to see it. The second specimen, sent directly from Pusa, India, by McRae, consisted of a single piece of twig about 2½ inches long and one-quarter of an inch in diameter, bearing 14 aecia. Both specimens were part of the same collection. The label with the second specimen reads, "*Peridermium complanatum* Barc. on *Pinus excelsa*. Kulu, N. W. Himalaya. 3-6-14 (June 3, 1914). Coll. R. S. Troup." However, Barclay's original description (1) of *Aecidium complanatum* refers definitely to an aecium on the needles of *Pinus longifolia* Roxb.; and the name is therefore not applicable to the stem *Peridermium* on *Pinus excelsa*.

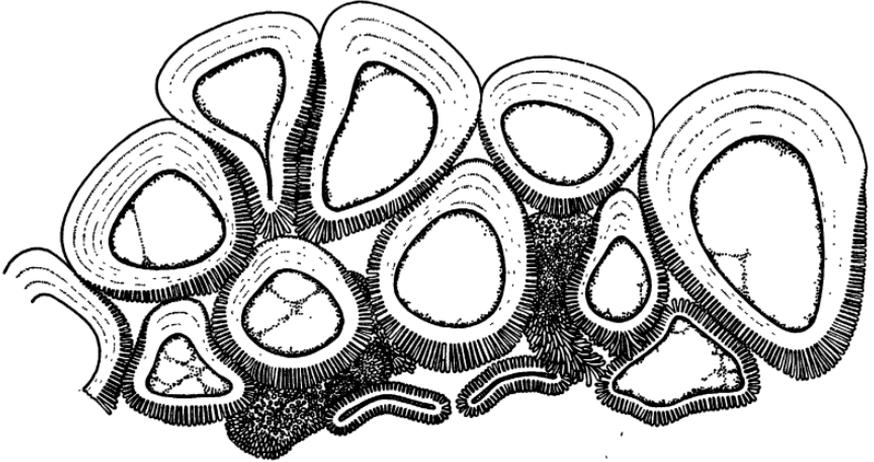
¹ Received for publication Nov. 17, 1926; issued April, 1927.

² Reference is made by number (italic) to "Literature cited," p. 330.

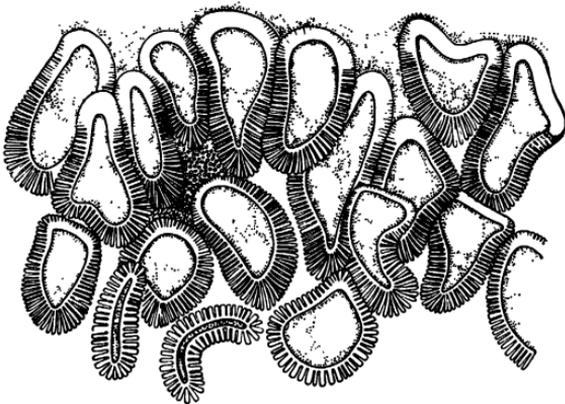
³ SPAULDING, P. NOTES UPON THE WHITE PINE BLISTER RUST IN EUROPE AND UPON CONDITIONS AFFECTING ITS STATUS THERE. [Unpublished manuscript.]

METHODS AND MEASUREMENTS

The aeciospores were mounted for study in the glycerin and glycerin-jelly mounting media used for mounting the urediniospores and aeciospores of *Cronartium ribicola* and *C. occidentale* (2, 3). All measurements were made with a filar micrometer. The thickness of wall reported refers to the thickest part of the side wall of the spores. The peridial cells were studied in sectional view. The wall thickness of the peridial cells refers to the wall thickness of the



A



B

FIG. 1.—Sections through the peridia in the region near the dome: A, *Peridermium kurilense*; B, *Peridermium indicum*. $\times 625$

outer or outside wall of the outer layer of cells in the peridium. The results of the measurement study are presented in Table 1. For the sake of comparison, data on species means of *C. ribicola* and *C. occidentale* (3) are also included.

Sectional views of the peridial cells made from material which appeared to be normal for the specimens are shown in Figure 1, A and B. The drawings do more to bring out the differences between the two species than any amount of description; and a comparison of the illustrations with others representing similar sections

from the peridia of *Cronartium ribicola* and *C. occidentale* (3) yields convincing evidence of the value of peridial-cell characters in diagnosis.

TABLE 1.—Data on the size of the aeciospores, aeciospore tubercles, and peridial cells of *Peridermium kurilense*, *P. indicum*, *Cronartium ribicola*, and *C. occidentale*

Aeciospores, aeciospore tubercles, and peridial cells	Basis	Length		Width		Wall		Ratio Mean length Mean width
		Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation	
Aeciospores:								
Peridermium kurilense.....	200	27.3	3.5	21.4	2.3	4.24	0.89	1.27
Peridermium indicum.....	200	27.0	3.4	20.3	2.3	4.33	.93	1.33
Cronartium ribicola.....	(a)	24.2	2.26	18.3	1.66	3.41	-----	1.32
Cronartium occidentale.....	(a)	26.8	2.79	19.0	2.12	3.85	-----	1.41
Aeciospore tubercles, end view:								
Peridermium kurilense.....	100	1.43	.31	1.05	.23	-----	-----	1.36
Peridermium indicum.....	100	1.41	.28	1.05	.23	-----	-----	1.34
Cronartium ribicola.....	(a)	1.52	.31	1.10	.21	-----	-----	1.38
Cronartium occidentale.....	(a)	2.29	.64	1.33	.27	-----	-----	1.72
Peridial cells:								
Peridermium kurilense.....	200	53.3	8.0	38.3	7.7	13.77	2.98	1.39
Peridermium indicum.....	200	38.4	5.9	24.9	4.6	3.69	.91	1.54
Cronartium ribicola.....	(a)	41.4	5.5	28.5	5.3	7.16	1.36	1.45
Cronartium occidentale.....	(a)	27.4	4.1	19.1	3.5	4.68	.89	1.43

^a Species means based on numerous specimens. For detailed data see (3).

DESCRIPTION

The following descriptions combine the biometric and morphologic data:

Peridermium kurilense Diet.

Aecia usually discrete, occasionally confluent.

Peridia apparently persistent, 2 to 3, occasionally 4, cells thick; outer layer of cells in region near dome, sectional view, long and short dimensions (basis 200 measurements from 1 specimen) $53.3 \times 38.3\mu$, standard range $45.4 - 61.3 \times 30.6 - 46.0\mu$, ratio mean length divided by mean width 1.39; outer wall of cells in outer layer smooth, 13.77μ thick, generally somewhat thicker than inner wall of the same cells; walls striated; inner wall marked with thin tubercles which are 5 to 10 times as long as they are broad; walls of cells in the second layer marked with tubercles over their entire surface, the tubercles, however, being very short on the ends of the cells toward the outside of the peridium and full length on the ends of the cells toward the inside of the peridium; outer walls of the cells in the second layer often thicker than the inner walls of the same cell; walls of cells in third layer generally uniform in thickness, marked over entire surface with uniformly distributed tubercles.

Aeciospores obovoid to ellipsoid, sometimes subspherical, generally smoothly curved in outline, (basis 200 spores) $27.3 \times 21.4\mu$; standard range $23.8 - 30.8 \times 19.1 - 23.7\mu$; ratio mean length divided by mean width 1.27; wall 4.24μ thick, standard range $3.35 - 5.13\mu$; wall partly smooth and partly marked with tubercles. the smooth area fissured near junction with tubercles; tubercles fairly regular in outline in view, (basis 100 measurements) $1.43 \times 1.05\mu$, standard range $1.12 - 1.47 \times 0.82 - 1.28\mu$; ratio mean length divided by mean width 1.36.

On twigs of *Pinus pumila* Pall. (= *P. cembra* var. *pumila* Pall.), Kurile Island, Japan. Specimen No. 19047 Herb. J. R. Weir.

Peridermium indicum n. sp.

Aecia usually discrete.

Peridia persistent, 3 to 4 cells thick; outer layer of cell in region near dome, sectional view, long and short dimensions (basis 200 measurements) $38.4 \times 24.9\mu$,

⁴ The lower and upper limits of the standard range differ from the mean by the amount of the standard deviation.

standard range $32.5-44.3 \times 20.3-29.5\mu$, ratio mean length divided by mean width 1.54; outer wall of cells in outer layer smooth, 3.69μ thick, generally somewhat thinner than the inner wall plus its tubercles; outer wall sometimes fissured but bearing no tubercles; inner wall marked with thin tubercles which are five to ten times as long as they are broad; walls of the second and third layers of cells marked essentially the same as the cells in the outer layer, except that the walls on the outer ends of the cells are sometimes studded with short tubercles; walls of cells in the inner layer nearly uniform in thickness, marked with uniformly distributed tubercles.

Aeciospores obovoid to ellipsoid, generally smoothly curved in outline, (basis 200 spores) $27.0 \times 20.3\mu$, standard range $23.6-30.4 \times 18.0-22.6\mu$; ratio mean length divided by mean width 1.33; wall 4.33μ thick, standard range $3.40-5.26\mu$; wall partly smooth and partly marked with tubercles, the smooth area fissured near junction with tubercles; tubercles fairly regular in outline in end view, (basis 100 measurements) $1.41 \times 1.05\mu$, standard range $1.13-1.69 \times 0.82-1.28\mu$; ratio mean length divided by mean width 1.34.

On twigs and branches of *Pinus excelsa* Wall., Kulu, N. W. Himalaya, India, collected by R. S. Troup, June 3, 1914. Specimen from the Pusa herbarium.

Through the courtesy of E. J. Butler one-half of the smaller specimen of *Peridermium indicum* has been deposited in the Pathological Collections of the Bureau of Plant Industry, United States Department of Agriculture.

POINTS OF SIMILARITY AND MEANS OF DIFFERENTIATION

Dietel (4) has already noted the similarity between the habit of *Peridermium kurilense* and the aecial stage of *Cronartium ribicola*. This resemblance is also to be observed between *P. indicum* and *C. ribicola*. The aeciospores of the two Asiatic specimens examined are very similar. Their relatively large size is obvious. Their position with respect to the specimen means of *C. ribicola* and *C. occidentale* may be determined easily by plotting their mean spore sizes on Figure 2 in the earlier paper (3). Both appear to be well without the *C. ribicola* range; but they might be confused with *C. occidentale*. The characters of the peridial cells are so different, however, that separation of the four species on the basis of these characters alone seems to be a relatively simple and certain method of diagnosis.

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