THE POLLEN OF CERTAIN TAXODIACEAE

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Pollen of the Taxodiaceae which have been examined are characterized by the absence of bladders or any well marked furrow and by the presence of a thick intine with a thin, fleeted (except in *Sciadopitys*) exine which becomes easily ruptured and often completely cast off when the grains are placed in water. Of the eight genera of this family which Pilger (1) lists, size ranges and descriptions of the pollen for certain species of five genera are given by Wodehouse (2) together with illustrations of each one of the five with the exception of *Glyptostrobus*. The size ranges are as follows:

1. *Cryptomeria japonica*
   D. Don 23.9–31.9*μ*
2. *Cunninghamia sinensis*
   R. Br. ..... 34.2–40. *μ*
3. *Glyptostrobus heterophyllus* Endl. 29.6–30.8*μ*
4. *Sequoia gigantea* Torr., and *S. sempervirens* (Lamb.) Endl. ..... 38.5–41. *μ*
5. *Taxodium distichum* (L.) L. C. Rich. ..... 27.4–31. *μ*

These measurements are those of expanded pollen. The writer in preparing pollen for examination followed Wodehouse's (3) methyl-green-glycerine-jelly method in order to obtain comparable material and to prevent the rupturing of the exine which was found to persist in water mounts. Material of the following species has been examined: *Cryptomeria japonica*, *Cunninghamia lanceolata* (*C. sinensis*), *Sciadopitys verticillata*, *Sequoia gigantea*, *S. sempervirens*, *Taxodium ascendens*, and *T. distichum*.

Difference in the size of the pollen of the two species of *Sequoia* were noted, *S. sempervirens* having the larger pollen. Pollen of *Taxodium ascendens* is quite similar to *T. distichum* except possibly in size. The size range of *T. ascendens* pollen, although within the limits given by Wodehouse (2) for *T. distichum*, is generally somewhat smaller in various samples tested. Results of a statistical study of the size ranges of these forms are to be published elsewhere.

Since the pollen of *S. sempervirens* was collected more recently than that of *S. gigantea* (though both were samples from "mature" cones), there appeared the possibility that the difference might be accounted for on this basis. However, Wodehouse's (3) smaller oil gentian violet method for observing pollen in the

unexpanded condition also revealed consistent size differences. Assuming the two specific grains to be a perfect sphere and using the average of the volume of five hundred grains for each species, the total volume of *S. sempervirens* was found to be a little more than twice that of *S. gigantea*. It is interesting in this connection to note that the chromosome number of the former species is twice that of the latter one.

Numerous fresh collections of *Taxodium distichum* were sent to the writer through the kindness of Dr. DeVoe Demaree of Monticello, Arkansas. The increase in the size of the microspores from the time of their escape from the microspore mother cell wall up to the time of shedding from the sporangia could be measured in this species. By measuring the longest diameters of the microspores, which were mounted in the same kind of medium, it was found that the increase was from about 20μ to 30μ within a period of approximately five days.

Sciadopitys verticillata (Thunb.) S. & Z. pollen was examined with special care since no published description can be found in the literature by the writer. The grains are unusual in that the exine, although thin as in other members of the group, is distinctly granular rather than flecked in appearance. Dry pollen show very deep folds, a condition often observed in unexpanded grass pollen. There is present one small thin ungranulated region on the exine which may represent the vestige of a germinal furrow. The intine is excessively thick. The size of the grains varies considerably. Measurements varied from approximately 36-44μ in diameter, the maximum being larger than the maxima of any other genus of the Taxodiaceae. Only a few days after his book on "Pollen Grains" had gone to press Dr. Wodehouse succeeded in obtaining pollen of this species. His description agrees with the writer's own findings and he makes the following additional observations: "They differ from those of all other conifers in the texture of their exine which resembles the ventral surface of the grains of Tsuga."

Thick intines are present in pollen of all of the genera examined. Even in pollen treated with analine oil followed directly by xylol and then Canada balsam, this inner layer or intine appears much thicker than the exine. In the methyl-green-glycerine-jelly medium the grains become fully expanded and here again the dye stains the exine, leaving the thicker intine unstained though markedly visible by contrast. In water mounts the intine swells enormously and sometimes quite rapidly in some cases. A thick intine is often associated with grains having a thin exine. It is without doubt a distinguishing characteristic of the grains of this family so far examined, of the Cupressaceae, and of the Gramineae in general. Both of these latter groups, as well as the Taxodiaceae, have pollen with thin exines.

An extraordinarily thick intine is also observable in *Cunninghamia* (the thickest of any of the Taxodineae examined), but the pollen of this species has a somewhat more conspicuous "pore" than does *Sciadopitys* pollen which shows only a thinner spot on the exine and which appears smooth in contrast to the granular portion surrounding it.

Some confusion exists as to the presence or absence of a furrow or pore in *Cunninghamia*. Wodehouse (2) on page 248 of his "Pollen Grains" states that "in those (pollen) of *Cunninghamia* there is no trace of furrow or pore. . . .", whereas on page 271 of the same publication he lists *Cunninghamia sinensis* and states that the germ pore is a minute papilla, frequently not apparent. In recent correspondence Dr. Wodehouse writes, after examination of a sample of this species sent to him by the writer, that "the grains are similar to those of *Juniperus*, with exceptionally thin exine and thick intine. In spite of this, however, the germinal furrow *is represented* (Italics mine) by a thin rounded pore in the exine through which the intine may occasionally bulge slightly as a flattish papilla." My own observations are in full accord with the latter statement. As has been noted above, a thick intine is also observable in pollen of other members of the family. The swollen intine observed in water preparations showed a positive reaction when tested with Ruthenium Red. It was impossible by this method to detect whether or not the intine consists of more than one layer. It appeared homogeneous in all cases examined. The capacity of this cellose material (3) to swell greatly in water is

thought by some botanists to be a pollination mechanism. The entire surface of such grains functions as a furrow, for the exine may be completely removed as a result.

By arranging the various genera examined in a linear series based on the "pore" character alone this sequence may be listed:

Cryptomeria—single germinal furrow represented by a projecting papilla; papilla longer than in *Sequoia* and less bent

Sequoia—single germinal furrow represented by a projecting and bent papilla

Taxodium—single germinal furrow represented by a germ pore less prominent than in genus above, conical and unbent

Cunninghamia—single rounded pore, papilla flattish

Sciadopitys—germinal furrow represented by a thin spot on the exine

In the character of its exine, however, *Sciadopitys* appears unique. It is of interest in this connection, to note that this genus is placed in a separate subfamily (Sciadopityoideae) by Pilger (1), and on the basis of its embryogeny in a separate family by Buchholz (4). Pope (5) has shown that in angiosperms pollen the shapes and sizes of grains in the various genera of a family are generally similar, although some families show striking differences.

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