PRODUCTION OF CONIDIA IN GIBBERELLA SAUBINETII[1]

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The scab fungus *Gibberella saubinetii* (Mont.) Sacc., which attacks wheat, corn, rye, barley, and oats, has been considered as having a vegetative stage and two spore stages. The conidial and perithecial development terminates the active vegetative period. Strains producing abundant perithecia have been described as developing only a few conidia in scattered, sporodochia-like masses.

Cultural studies with a large number of strains of *G. saubinetii* show that in nature, as well as in artificial culture, this species produces conidia at two different periods during its development. Wollenweber[2] suggests this when he states that—

> on steamed potato tuber the conidia form a short-lived pionnotes. The conidia of this pionnotes rapidly swell, separate into cells, germinate, and produce new conidia, which anastomose and form a stroma, while in the other species mentioned the conidia remain perfect, dry out, and are long-lived.

The first period of conidial production is in connection with the early mycelial growth of the culture, while the second occurs at the termination of the vigorous vegetative development. These later conidia are produced in definite sporodochia and are the only conidia generally described for this species. The production of perithecia is the final stage in the development of the culture.

During the summer of 1919, single-spore cultures were made by the authors from sporodochial conidia and ascospores taken from stock cultures and from wheat heads, wheat culms, and cornstalks collected in the field. These specimens were obtained from a number of widely separated points in the central and eastern States. Spores from all sources were placed in hanging drops of distilled water and sterile tap water, on poured plates of potato-dextrose agar and soil decoction agar, and on sterile soil. The subsequent development of the fungus was then studied at frequent intervals.

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[1] The investigations upon which this paper is based were conducted as a cooperative project between the Office of Cereal Investigations of the Bureau of Plant Industry and the Wisconsin Agricultural Experiment Station.

[2] WOLLENWEBER, H. W. IDENTIFICATION OF SPECIES OF FUSARIUM OCCURRING ON THE SWEET POTATO, IPOMOEA BATATAS. *In* Jour. Agr. Research, v. 2, no. 4, p. 278. 1914.

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The spores, both conidia and ascospores, behaved alike in germination. They germinated, as described by Wollenweber, by imbibing water, increasing the number of septa (fig. 1, A, C), and forming several mycelial strands from the different cells (fig. 1, C). When the cultures were grown in a saturated atmosphere, conidia were cut off from lateral branches of mycelial strands in 24 hours (fig. 1, B, D). In 48 hours a copious conidial production took place in definite sporodochia-like clusters (fig. 1, E). On extremely moist plates these clumps occasionally massed together to form a pionnotes. As mycelial development

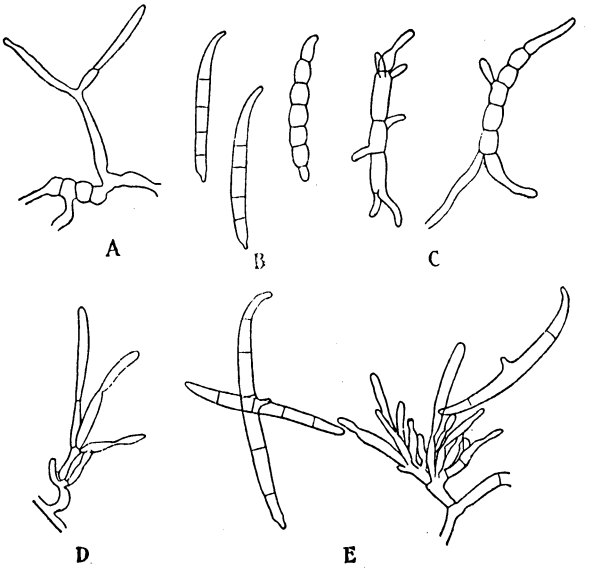

FIG. 1.—Conidial production in *Gibberella saubinetii* (Mont.) Sacc.: A, Ascospores from cornstalk, germinated in distilled water, producing conidia in three days; B, D, typical conidia and conidiophore from a 28-hour-old hanging drop culture from a conidium from A; C, germinating conidia from a 52-hour-old plate culture; E, conidiophore and germinating conidia from a 47-hour-old colony in a Van Tiegham cell. This colony was three generations from an ascospore. Potato-dextrose agar acidified with lactic acid was used unless otherwise stated.

progressed, new conidial masses developed and thus gradually increased the size of the pionnotes.

The conidia were pushed off the conidiophore before septation was completed, and new conidia formed in their place (fig. 1, E). Septation was completed after the conidia had been separated from the conidiophore. The conidia became swollen, septation increased, and germination took place in from 6 to 12 hours after leaving the conidiophore (fig. 1, B, C, E). When the cultures were moderately crowded and moisture and temperature conditions were suitable, all these conidia germinated, forming a stroma; and conidia development ceased until the final development of sporodochial conidia several weeks later. If, however, the conidia were transferred to a suitable medium and were not

overcrowded, they germinated, forming hyphae which bore masses of conidia within two days as previously described for the sporodochial conidia and ascospores. This conidial production went on indefinitely, if the culture did not dry or become crowded. The ninth generation of conidia from a single ascospore was produced in 20 days by transferring each successive generation to new plates of potato-dextrose agar. These conidia were produced only when the spores were transferred to a favorable medium and kept in a moist, warm atmosphere. When the temperature was lowered or when the culture became dry the conidia did not germinate but remained inert on the surface of the culture. Spores kept in this manner were rather resistant to both desiccation and low temperatures. Germination was obtained after several weeks' storage at temperatures of about 3° to 4° C., as well as when stored under dry conditions at room temperature.

Conidia were produced in two days from mycelium plated from infected root and stem tissues as well as from plated conidia and ascospores. Tissues infected with *G. saubinetii* were surface-sterilized and placed on potato-dextrose agar in poured plates. Conidia appeared on the developing mycelium two days after plating and were present in conspicuous sporodochia-like masses the third day. These conidia were identical with those formed on the mycelium from either ascospores or conidia.

The conidia formed during the vegetative development were 4 to 5 septate (fig. 1, B, E) and were of the same shape and size as the sporodochial conidia.

Inoculations on wheat plants showed that these conidia were as virulent in producing scab on wheat as were either sporodochial conidia or the vegetative mycelium. The spores germinated and caused infection within the same temperature range as the sporodochial conidia.

The work here reported shows that repeated crops of conidia of *G. saubinetii* can be produced in abundance in short periods of time from ascospores, sporodochial conidia, vegetative conidia, or mycelium, when favorable moisture and temperature conditions obtain. This ability of the wheatscab organism to produce virulent spores in abundance in short periods of time has an important bearing on the development of wheat-scab epidemics.