Status of Cotton Boll Rot in the San Joaquin Valley of California Following Simulated Pink Bollworm Injury

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ABSTRACT

Ten experiments were conducted in the San Joaquin Valley of California to determine the potential contribution of the pink bollworm to development of boll rot diseases of cotton. Simulated exit tunnels of larvae of this insect predisposed immature bolls to infection. Bolls with one perforated carpel were less likely to be infected than bolls in which all carpels were perforated. Results of these tests suggest that presence of this predisposing factor would change the status of boll rots, including disease from *Aspergillus flavus*, from minor to major importance.

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In the San Joaquin Valley of California, boll rots due to fungi, and aflatoxins of cotton seed have been historically of little importance. Due to the prevailing low relative humidity which allows mature bolls to open and dry quickly, cotton grown in the San Joaquin Valley commonly escapes boll infection by *Aspergillus flavus* (4, 5). Studies in the Imperial Valley of California have shown that establishment of the pink bollworm, *Pectinophora gossypiella* (Saunders), can change the status of boll rots and seed infection by *A. flavus* from endemic to epidemic importance. Tunnels produced in carpel walls when mature larvae emerge from bolls predisposed immature bolls to infection by microorganisms including members of the *Aspergillus flavus* group (6). The present study was prompted by recognition in 1967 of a sparse, but apparently persistent, infestation of the San Joaquin Valley by the pink bollworm (7). We report here experiments conducted to determine whether this insect has similar epidemiological potential in the San Joaquin Valley.

MATERIALS AND METHODS.—Inoculum density of *Aspergillus flavus* in soil and on immature bolls was determined in six cotton fields located in Tulare and Kings counties. Numbers of conidia per boll were determined by dilution platings of sterile water rinses of bolls (60 bolls per field) on malt-salt agar containing 200 μg/ml streptomycin sulfate. Presence of soil-borne inoculum was based upon determinations of the amount of infested organic debris particles as described in a previous report (3).

Holes approximating the size of pink bollworm exit tunnels (1.5 mm diam) were simulated by use of a battery-driven drill. Two levels of pink bollworm infestation were simulated. One locule per immature boll was perforated in four tests, and all locules were perforated in six tests. Each test had six replications of 10 plants with 20 to 97 bolls per replication. Amounts of naturally occurring infection were determined at boll maturity. Visual evaluation was made for locule rot and greenish-yellow fluorescence under ultraviolet light. The association between fiber fluorescence and *A. flavus* infection has been established in previous studies (2, 5). Other discolored locules were considered to be damaged by other fungi (6) or by bacteria (1).

RESULTS AND DISCUSSION.—Soil-borne and boll-surface inoculum of *A. flavus* was detected at all locations at the time experiments were initiated. Inoculum densities were variable, ranging from 3 to 143

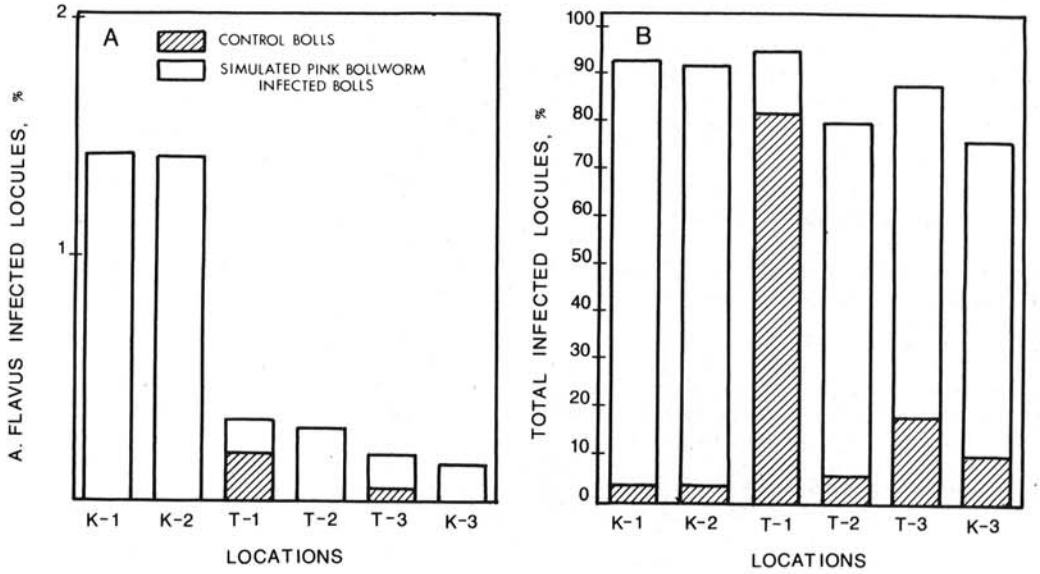

Fig. 1. The influence of simulated pink bollworm exit tunnels in carpel walls of immature cotton bolls upon: **A)** infection of locules by *Aspergillus flavus*, and **B)** upon total locule infection by microorganisms in Tulare (T) and Kings (K) counties, California.

conidia per boll and from 40 to 3,200 infested debris particles per 2.83×10^{-2} m^3 (= 1 ft^3) of soil. These results show that inoculum of *A. flavus* is commonly present on the surface of immature cotton bolls, and is in agreement with an earlier report on the prevalence of *A. flavus* in soils of the San Joaquin Valley (3).

Simulated exit tunnels of the pink bollworm, like authentic tunnels (6), were found to predispose immature bolls to infection by microorganisms. With regard to *A. flavus,* one perforated carpel per boll was not effective since three experiments showed no infection in treated and untreated bolls and 0.19% and 0.08% infection in treated and untreated bolls, respectively, in the fourth experiment. However, other boll-rotting microorganisms rotted an average of 44% of the locules having one perforation per boll. A mean of 6% of the locules of control bolls were affected by rots other than caused by *A. flavus*. Infection was greater where all carpels had simulated larval tunnels. Infections from *A. flavus* were absent from untreated bolls in four of six tests. In contrast, infection by this fungus ranged from 0.16% to 1.46% of the locules of perforated bolls (Fig. 1-A). Infection by other microorganisms was greatly enhanced when all carpels were perforated (Fig. 1-B). Significant amounts of infection by *A. flavus* (Fig. 1-A) and by other microorganisms (Fig. 1-B) occurred in the absence of perforated carpels in one test. This result suggests that factors other than larval damage may favor the occurrence of severe boll rot disease in the San Joaquin Valley.

Results of these tests indicate that boll rot diseases in general would increase in importance if the pink bollworm became a prevalent pest of cotton in the San Joaquin Valley. Likewise, the incidence of damage from *A. flavus* could lead to unacceptable amounts of aflatoxins in cottonseed used for feedstuffs (5, 6).

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