THE ROLE OF INSECTS IN AFLATOXIN CONTAMINATION OF COTTON SEED

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Pink Bollworm

The possible role of certain insects in the contamination of cotton seed by aflatoxin has been previously reported in the Imperial Valley of California. Studies there implicate the pink bollworm specifically. Good evidence indicates that the pink bollworm exit hole is the major portal by which the fungus Aspergillus flavus enters the boll to ultimately colonize the seed and produce aflatoxin.

Since the original work was conducted under controlled insect and fungal introduction procedures it was decided a more extensive field test was needed where natural insect and fungal infestations prevailed.

A three-year study was conducted at the Yuma Branch Experiment Station to test the influence of two chemically maintained pink bollworm levels and a noncontrol check on ultimate aflatoxin contamination of the seed.

It can be seen in Table 1 that lower populations of pink bollworm were associated with lower concentrations of aflatoxins detected in 1971 cotton seed. Concentrations of aflatoxins from treatments where pink bollworm infestation levels were maintained at 16% and 10% were 52.5% and 83.5% lower respectively than in the 60% infestation-level treatment.

In 1972 lower pink bollworm populations also were associated with lower concentrations of aflatoxins (Table 1). Although similar associations were noted in the 1972 trial, there was no significant difference among concentrations of aflatoxins. Despite the lack of statistical significance among the concentrations of aflatoxins found in 1972 these data appear to indicate a definite trend toward the association of the amount of aflatoxins detected and the number of PBW infested and damaged bolls.

The 1973 aflatoxin analyses have not been completed, but with 60% of the data available and despite the low levels of aflatoxin formed during the 1973 season, a trend toward the association of reduced pink bollworm levels and less aflatoxin is evident.

Table 1. Influence of PBW infestations on aflatoxin concentration in cotton seed.

1971 Seasonal PBW Levels[a]	Aflatoxins
% Infested Bolls[b]	Mean ppb[c]
10a[d]	214a
16a	620a
60b	1302b
1972 Seasonal PBW Levels[a]	**Aflatoxins**
% Infested Bolls[b]	Mean ppb[c]
22a[d]	388a
26a	439a
56b	994a

[a]1971 data based on means from 36 replications and 1972 data based on means from 16 replications.
[b]Number of bolls containing PBW instars/100 counted.
[c]ppb - parts per billion of aflatoxins B_1 and B_2.
[d]Duncan's Multiple Range test at 0.05 probability level. Means in the same column not followed by same letter are significantly different.

Other Insects

Little information is available on how Aspergillus flavus spores are spread from their source to the boll. In some of our studies we noticed that populations of the fungus were considerably higher on bracts than on leaves. It was felt that this occurrence might be associated with preferential visitation by insects. A. flavus has been reported as a pathogen of many insects and it was felt that some of the insects commonly frequenting squares, flowers and bolls might be carrying the fungus.

Collections were made of lygus bug, stink bug, collops bettle, assassin bug, lace wing and pale striped flea beetle from cotton grown in Yuma, Arizona. Isolation from these insects indicated that the A. flavus was closely associated with the stink and lygus bug. In Table 2 the relative frequency of isolation from surface sterilized and nonsurface sterilized stink and lygus bug can be seen. When insects were brought in from the field and placed on an isolation medium without surface sterilization 79% of the stink bugs and 61% of the lygus had A. flavus associated with them. Stink bugs and lygus bugs that were chemically surface sterilized and placed on the medium had A. flavus associated with 37% and 33% of them respectively. This indicated that these two insects probably carry the fungus internally. Dissection and isolation from the gut portion of the insect indicated this was the case.

Table 2. Frequency of isolation of A. flavus from surface nonsterile and surface sterile lygus and stink bugs.

	Nonsurface sterile Associated with A. flavus	Surface sterile Associated with A. flavus
Insect	%	%
Lygus bug	61	33
Stink bug	79	37

It is quite evident from our data and observations that lygus and stink bug carry the fungus internally and externally and could possibly spread A. flavus through direct contact and/or by the deposition of excrement.