Aflatoxin-Producing Potential of Various Strains of *Aspergillus flavus* from Groundnut Fields in Different Soil Types

V K Mehan, S V Reddy, S Nahdi, D McDonald, and **S Jayanthi** (ICRISAT Asia Center, Patancheru 502 324, Andhra Pradesh, India)

There are numerous reports that *Aspergillus flavus* isolates from groundnut produce aflatoxin in culture media or on a groundnut substrate. However, only a few workers (Joffe 1969, Maggon et al. 1969), have reported aflatoxin production by *A. flavus* isolates obtained from soils, and there is no information on the possible association between soil type and the aflatoxin-producing potential of these isolates. This paper discusses the aflatoxin-producing potential of various isolates of *A. flavus* from groundnut fields in different soil types, and the relationship between aflatoxin production levels and production of sclerotia.

Forty-eight single-spore isolates of *A. flavus* obtained from six fields differing in soil type (red sandy loam, light sandy soil, Vertisol) and management/cultivation practices were tested for sclerotial production and aflatoxin production. Field conditions and soil types are summarized in Table 1. In the irrigated fields groundnut was rotated with pearl millet, while the rainfed fields in light sandy and red sandy loam soils were kept fallow. In Vertisol fields, groundnut was rotated with sorghum. Eight isolates from each field/soil type were tested; these included two isolates belonging to each of the four sclerotial production groups—high, moderate, low, and nil sclerotial production.

Isolates were tested for sporulation and sclerotial production on 0.7% yeast extract medium. Groundnut seeds (cv TMV 2) were used as a substrate for aflatoxin production tests (Mehan et al. 1982). Two replicates were used for each isolate. Sclerotial production of *A. flavus* isolates on groundnut seeds was recorded 5 and 10 days after inoculation. Aflatoxins were determined using the method described by Pons et al. (1966).

All isolates produced aflatoxin B_1 at levels ranging from 1 to 290 µg g^{-1} (Table 1). Significant differences ($P = 0.05$) were observed between soil types/fields for aflatoxin-producing potential of isolates. Isolates from a Vertisol field produced significantly lower overall mean aflatoxin (42.2 µg g^{-1}) than isolates from red sandy loam and light sandy soil fields; isolates from the latter two types of fields did not differ significantly in their aflatoxin-producing abilities (overall means 70–81.5 µg g^{-1}).

Table 1. Aflatoxin production by various strains of *Aspergillus flavus* varying in sclerotial production, ICRISAT Asia Center.

Strain	Sclerotial production	Aflatoxin B_1 (µg g^{-1} seed)
Light sandy soil (Field 1, rainfed)		
AF 3	High	150.0
AF 20	High	90.0
AF 2-1	Moderate	80.0
AF 24-1	Moderate	11.3
AF 2	Low	80.0
AF 12	Low	16.5
AF 48	Nil	110.0
AF 210	Nil	16.3
Light sandy soil (Field 2, rainfed)		
AF 191	High	45.0
AF 58	High	65.0
AF 194	Moderate	250.0
AF 69	Moderate	75.0
AF 124	Low	90.0
AF 131	Low	85.0
AF 183	Nil	9.0
AF 197	Nil	4.7
Light sandy soil (Field 3, rainfed)		
AFA/TN	High	100.0
AFA/TP	High	150.0
AFA 41	Moderate	55.0
AFA 8	Moderate	135.0
AFA 33	Low	1.6
AFA 38	Low	70.0
AFA 2	Nil	90.0
AFA 7-1	Nil	50.0
Red sandy loam soil (Field 1, rainfed, unsprayed)		
AF 162	High	65.0
AFA 20	High	115.0
AF 136	Moderate	210.0
AF 149	Moderate	50.0
AF 144	Low	45.0
AF 141-B	Low	70.0
AF 135	Nil	1.2
AF 140	Nil	60.0
Red sandy loam soil (Field 2, irrigated, sprayed with fungicide chlorothalonil and insecticides)		
AFA 26	High	110.0
AFA 29	High	215.0
AFA 27	Moderate	150.0
AFA 30	Moderate	125.0

Continued.....

Table 1. *Continued....*

Strain	Sclerotial production	Aflatoxin B_1 (μg g^{-1} seed)
AFA 28	Low	150.0
AF 107B	Low	235.0
AFA 24	Nil	290.0
AFA 25	Nil	80.0
Vertisol (irrigated)		
AFA 17	High	2.2
AF 87A	High	70.0
AFA 17-1	Moderate	2.5
AFA 21	Moderate	90.0
AFA 22	Low	80.0
AF 83	Low	90.0
AF 96	Nil	1.7
AF 99	Nil	1.0
SE (fields)		± 12.81
SE (isolates)		± 10.46

There was no association between sclerotial production and aflatoxin production. Some previous reports have suggested that isolates that produced abundant sclerotia were also highly aflatoxigenic (Maggon et al. 1969, Mehan and Chohan 1973). It is possible that among strains which produce both aflatoxin and sclerotia, similar growth conditions would favor their simultaneous production in certain culture media used in several studies. None of the isolates produced sclerotia when grown in vitro on surface-sterilized scarified groundnut seeds.

All isolates tested produced only aflatoxin B_1, confirming our earlier observations that most *A. flavus* isolates from groundnut fields in India produce only aflatoxin B_1.

Our (limited) studies indicate clearly that strains from Vertisols produce lower aflatoxin levels than do strains from light sandy and red sandy loam soil. These results are important in the light of reports indicating low risks of aflatoxin contamination in Vertisols (Mehan et al. 1991). The results of this study emphasize the need to understand and control soil/environmental factors that could influence the aflatoxin-producing potential of *A. flavus* isolates. The cumulative effect of the presence of various toxin-producing strains and their populations, together with the factors influencing the predominance of each strain, is an interesting but complex subject for future investigations.

References

Joffe, A.Z. 1969. Aflatoxin produced by 1626 isolates of *Aspergillus flavus* from groundnut kernels and soils in Israel. Nature 221:492.

Maggon, K.K., Viswanathan, L., and **Venkitasubramanian, T.A.** 1969. Aflatoxin production by some Indian strains of *Aspergillus flavus* Link ex Fries. Journal of General Microbiology 59:119–124.

Mehan, V.K., and **Chohan, J.S.** 1973. Aflatoxin B_1 producing potential of isolates of *Aspergillus flavus* Link ex Fries from cotton, maize and wheat. Mycopathologia Mycologia Applicata 49:263–274.

Mehan, V.K., McDonald, D., and **Gibbons, R.W.** 1982. Seed colonization and aflatoxin production in groundnut genotypes inoculated with different strains of *Aspergillus flavus*. Olèagineux 37:185–191.

Mehan, V.K., Mayee, C.D., McDonald, D., and **Jayanthi, S.** 1991. Preharvest seed infection by *Aspergillus flavus* group of fungi and subsequent aflatoxin contamination in groundnut in relation to soil types. Plant and Soil 136:239–248.

Pons, W.A., Jr., Cucullu, A.F., Lee, L.S., Franz, A.O., and **Goldblatt, L.A.** 1966. Determination of aflatoxins in agricultural products: use of aqueous acetone for extraction. Journal of Association of Official Analytical Chemists 49:554–562.

Host Races of *Meloidogyne javanica*, with Preliminary Evidence that the 'Groundnut Race' is Widely Distributed in India

S B Sharma, D H Smith, and
D McDonald (ICRISAT Asia Center,
Patancheru 502 324, Andhra Pradesh, India)

Root-knot disease caused by *Meloidogyne* spp is the most important nematode disease of groundnut. The causal agents are *Meloidogyne arenaria, M. javanica, M. hapla,* and *M. incognita. Meloidogyne arenaria* Race 1 is the most widespread and destructive of the groundnut root-knot nematodes; *M. hapla* is also important, particularly in North Carolina, Oklahoma, and Virginia (USA), north-