**Table 2. The scenario of foliar diseases at seedling, flowering and pod-filling, and near-maturity stages of groundnut in farmers' fields during 1999 rainy season surveys in Andhra Pradesh, Karnataka, and Tamil Nadu states of India.**

| District | No. of fields observed | Disease score[1] (range) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ELS | | LLS | | | Rust | | |
| | | SS | FP | SS | FP | NM | SS | FP | NM |
| **Andhra Pradesh** | | | | | | | | | |
| Mahbubnagar | 12 | 1–3 | 2–4 | 1–2 | 3–4 | 4–8 | 2–4 | 3–7 | 5–8 |
| Kurnool | 16 | 1–3 | 2–4 | 1–2 | 2–3 | 4–7 | 2–3 | 2–6 | 4–7 |
| Anantapur | 21 | 1–2 | 2–5 | 1–3 | 1–3 | 4–7 | 1–3 | 1–4 | 4–9 |
| Cuddapah | 16 | 1–2 | 3–4 | 1–2 | 2–3 | 5–7 | 1–2 | 2–3 | 5–7 |
| Chittoor | 20 | 1–3 | 3–5 | 1–2 | 1–3 | 2–6 | 1–3 | 1–4 | 2–7 |
| **Karnataka** | | | | | | | | | |
| Raichur | 18 | 1–3 | 3–6 | 1–2 | 3–6 | 5–7 | 2–5 | 5–8 | 7–9 |
| Kolar | 26 | 1–3 | 2–4 | 1–3 | 1–5 | 4–8 | 1–2 | 1–5 | 4–8 |
| **Tamil Nadu** | | | | | | | | | |
| Dharmapuri | 10 | 1–2 | 2–4 | 1–2 | 2–4 | 6–8 | 1–2 | 2–4 | 6–9 |
| Mean | | 1–3 | 2–5 | 1–2 | 2–4 | 4–7 | 1–3 | 2–5 | 5–8 |

1. Rating on 1–9 scale where 1 = no disease, and 9 = maximum disease.
ELS = Early leaf spot; LLS = Late leaf spot; SS = Seedling stage; FP = Flowering and pod-filling stage; NM = Near-maturity stage.

foliage in the susceptible groundnut cultivars commonly grown by farmers. The intercropping pattern currently followed by the farmers, irrespective of the crop species involved, did not have any influence on the incidence and severity of diseases of groundnut. However, groundnut rows adjacent to the intercropped row had more disease than the groundnut crop farthest from the intercropped row.

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# Evaluation of Wild *Arachis* Germplasm Accessions for In Vitro Seed Colonization and Aflatoxin Production by *Aspergillus flavus*


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A high level of stable resistance to aflatoxin contamination (infection by *Aspergillus flavus* and production of aflatoxin) has not been identified in cultivated groundnut (*Arachis hypogaea*), although several genotypes are reported to possess resistance to seed colonization, seed invasion and/or aflatoxin production (Mehan 1989, Waliyar et al. 1994, Upadhyaya et al. 1997). ICRISAT has a collection of 413 accessions of wild *Arachis* spp, the majority of which, have not been evaluated for resistance to aflatoxin contamination. Previously 16 species (9 belonging uniformly to section *Arachis*, 3 to *Erectoides*, 2 to *Rhizomatosae*, and one each to *Extranervosae* and *Triseminatae*) were

**Table 1. In vitro seed colonization severity by *Aspergillus flavus* and aflatoxin production in 35 wild *Arachis* accessions.**

| Accession no. | Section | *Arachis* species | Colonization severity[1] | Aflatoxin production[2] |
|---|---|---|---|---|
| ICG 144 | *Arachis* | *A. villosa* | 4.0 | H |
| ICG 190 | *Arachis* | *A. hoehnei* | 3.5 | M |
| ICG 8125 | *Arachis* | *A. stenosperma* | 4.0 | H |
| ICG 8137 | *Arachis* | *A. stenosperma* | 4.0 | H |
| ICG 8139 | *Arachis* | *A. duranensis* | 3.5 | M |
| ICG 8193 | *Arachis* | *A. valida* | 2.5 | M |
| ICG 8195 | *Arachis* | *A. duranensis* | 2.5 | L |
| ICG 8197 | *Arachis* | *A. monticola* | 3.5 | H |
| ICG 8201 | *Arachis* | *A. duranensis* | 2.5 | H |
| ICG 8206 | *Arachis* | *A. ipaensis* | 4.0 | H |
| ICG 8210 | *Arachis* | *A. batizocoi* | 4.0 | H |
| ICG 8959 | *Arachis* | *A. kempff-mercadoi* | 2.5 | H |
| ICG 8960 | *Arachis* | *A. magna* | 2.0 | H |
| ICG 11551 | *Arachis* | *A. benensis* | 1.5 | M |
| ICG 13173 | *Arachis* | *A. stenosperma* | 3.0 | M |
| ICG 14861 | *Arachis* | *A. kuhlmannii* | 3.0 | H |
| ICG 14855 | *Caulorhizae* | *A. pintoi* | 2.0 | M |
| ICG 8130 | *Erectoides* | *A. paraguariensis* | 2.0 | M |
| ICG 8192 | *Erectoides* | *A. oteroi* | 2.0 | L |
| ICG 8215 | *Erectoides* | *A. stenophylla* | 3.5 | H |
| ICG 8973 | *Erectoides* | *A. paraguariensis* | 4.0 | H |
| ICG 13262 | *Erectoides* | *A. major* | 3.5 | M |
| ICG 13212 | *Heteranthae* | *A. pusilla* | 1.0 | N |
| ICG 14897 | *Heteranthae* | *A. pusilla* | 4.0 | H |
| ICG 8127 | *Procumbentes* | *A. appressipila* | 2.0 | M |
| ICG 8128 | *Procumbentes* | *A. appressipila* | 2.5 | H |
| ICG 8129 | *Procumbentes* | *A. appressipila* | 2.5 | M |
| ICG 8191 | *Procumbentes* | *A. kretschmeri* | 3.0 | H |
| ICG 8904 | *Procumbentes* | *A. rigonii* | 2.0 | H |
| ICG 8945 | *Procumbentes* | *A. appressipila* | 3.5 | H |
| ICG 11557 | *Procumbentes* | *A. matiensis* | 1.5 | M |
| ICG 11560 | *Procumbentes* | *A. chiquitana* | 1.0 | N |
| ICG 8131 | *Triseminatae* | *A. triseminata* | 1.0 | N |
| ICG 13261 | *Triseminatae* | *A. triseminata* | 1.5 | L |
| ICG 14875 | *Triseminatae* | *A. triseminata* | 1.0 | L |
| J 11 (control) | *Arachis* | *A. hypogaea* | 4.0 | H |
| JL 24 (control) | *Arachis* | *A. hypogaea* | 4.0 | H |
| Mean | | | 2.74 | H |
| SEm | | | ±0.64 | |

1. *Aspergillus flavus* colonization severity on 1–4 rating scale (see text).
   Mean of 2 replications, with 30 seeds in each replication.
2. Aflatoxin estimation was done using 5 g seed per replication.
   H = High (>5000 μg kg$^{-1}$ seed); M = Moderate (1001–5000 μg kg$^{-1}$ seed); L = Low (100–1000 μg kg$^{-1}$ seed); and N = Negligible (<100 μg kg$^{-1}$ seed).

evaluated and found to support the production of aflatoxin (34–110 μg $g^{-1}$ seed) (Mehan 1989).

We report the evaluation of 35 germplasm accessions of wild *Arachis* belonging to 24 species in six sections for in vitro seed colonization by artificial inoculation with a recently identified highly aggressive and toxigenic strain of *A. flavus* (isolate *Af* 11-4) and for aflatoxin production (Table 1). Sixty seeds (weighing 4–10 g depending on seed size) from each accession were surface sterilized with 0.1% aqueous solution of mercuric chloride for 2 min and washed in two changes of distilled sterilized water. Seeds were uniformly wounded by pricking with a sterile needle, to allow invasion by *A. flavus* spores. Seeds were placed in a sterilized petri dish (9 cm diameter) and spray inoculated with *A. flavus* spore suspension ($1 \times 10^6$ spores $mL^{-1}$) using an atomizer. The petri dishes were shaken vigorously to roll the seeds allowing uniform distribution of inoculum on the seeds. The experiment was conducted in two replications with 30 seeds per replication. The petri dishes were placed at high humidity (>95% RH) in semi-rigid plastic boxes, lined with wet cotton wool and blotting paper, with closely fitting lids, and incubated at 25°C in the dark for 10 days.

Individual seeds were scored for surface colonization by *A. flavus* and for colonization severity using the following rating scale: 1 = <5% seed surface colonized with scanty mycelial growth and no sporulation; 2 = 5–25% seed surface colonized with good mycelial growth and scanty sporulation; 3 = 26–50% seed surface colonized with good mycelial growth and good sporulation; and 4 = >50% seed surface colonized with heavy sporulation. The seeds were then sprayed with ethanol and washed before using for aflatoxin estimation. An indirect competitive enzyme-linked immunosorbent assay (ELISA) method was used (Devi et al. 1999).

Large variation occurred both for seed colonization severity (1 to 4) and aflatoxin production [high (>5000 μg $kg^{-1}$ seed) to negligible (<100 μg $kg^{-1}$ seed)] among accessions belonging to different sections and species (Table 1). Accessions ICG 13212 (*A. pusilla,*), ICG 11560 (*A. chiquitana*), and ICG 8131 and ICG 14875 (*A. triseminata*) recorded low colonization severity and relatively low aflatoxin content compared with those of control susceptible cultivars J 11 and JL 24. Resistance of the above accessions needs to be evaluated for seed infection by *A. flavus*.

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# Identification of Elite Short-duration, Rosette Resistant Lines in World Germplasm Collections

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Groundnut rosette is a major constraint to groundnut production in sub-Saharan Africa and its offshore islands (Subrahmanyam et al. 1991, 1997, Naidu et al. 1999a). It is caused by a complex of three agents: groundnut rosette assistor virus (GRAV), groundnut rosette virus (GRV), and satellite RNA of GRV. The disease is transmitted by aphids (*Aphis craccivora*) in persistent manner (Naidu et al. 1999a). Groundnut rosette is estimated to cause annual