80 and VG 81 possessing high yield were compared with released cultivars. They were also compared with fungicide sprayed variety JL 24. Except CO 2 all the cultivars were statistically on par in yield. The yield potentials of VG 80 and VG 81 were similar to JL 24 when the disease was controlled (Table 3). The spraying cost of Rs.690 could be easily saved by growing these resistant cultures.

These cultures are also less susceptible to late leaf spot and possessed higher shelling percentage and similar oil content of other cultivars. Till harvest the resistant cultivars were green without defoliation which may be better utilized as fodder for cattle.

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POST INFECTIONAL CHANGES IN GROUNDNUT LEAVES INDUCED BY GROUNDNUT BLIGHT PATHOGEN

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ABSTRACT

Post-infectional change in contents of total carbohydrate, total nitrogen, total phenolics, nucleic acids and chlorophyll fractions in the leaves of three groundnut genotypes with varying levels of resistance to blight caused by *Phoma microspora* Balasubrm. *et* Narayan., was studied. Total carbohydrate contents of the resistant variety, Ah 8446 and the tolerant variety, POL 2 showed only a marginal variation, while the highly susceptible OSN 2 registered significant increases. There was no appreciable change in total nitrogen content in the resistant variety consequent on inoculation. Increase in the total phenolics contents was significantly greater in the highly susceptible OSN 2 than others. There was no significant alteration in the contents of RNA and DNA in the resistant and tolerant varieties while reduction in the contents of chlorophyll was maximum in the highly susceptible variety.

KEYWORDS : Groundnut blight, Resistance mechanism.

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The occurrence of a new blight disease of groundnut (*Arachis hypogaea Linn.,*) caused by *Phoma microspora* Balasubrm. *et* Narayan., has been recently reported (Balasubramanian and Narayanasamy, 1980). Several groundnut genotypes were screened for their resistance to the blight disease and the resistant sources were identified (Balasubramanian and Narayanasamy, 1983). This paper deals with the post-infectional changes in the leaves of groundnut genotypes with different levels of resistance in response to infection by *Phoma microspora.*

MATERIALS AND METHODS

Thirty-five day-old plants of resistant (Ah 8446), tolerant (POL 2) and highly susceptible (OSN 2) groundnut genotypes were inoculated with the pathogenic fungus. The method of inoculation on to the groundnut leaves has been described elsewhere (Balasubramanian and Narayanasamy, 1983). Third and fourth leaves from apex of groundnut plants were chosen for uniformity in all the genotypes and used for inoculation. Samples of both healthy and inoculated leaves of different genotypes at different intervals *viz.,* 1, 3, 5 and 7 days after inoculation were used for estimation of various fractions.

Leaf sampled (5 g) were chopped into small bits, plunged into 80 per cent ethanol, boiled in water bath for 10 min. and cooled in running tap water. The tissues were crushed thoroughly using a pestle and mortar and squeezed through two layers of cheese cloth and the fluid was collected in a beaker. The residue was re-extracted with 80 per cent ethanol and squeezed through cheese cloth again. Both the extracts were pooled together and made up to 25 ml. in a volumetric flask with 80 per cent ethanol.

The total carbohydrate content of leaf samples was determined as per the method developed by Somogyi (1952). The standard microkjeldahl's method developed by Jackson (1962) was followed for estimating total nitrogen. Total phenalics were estimated by the method described by Bray and Thorpe (1954). The DNA and RNA contents of the leaf samples were determined by the method described by Schneider (1957). The total chlorophyll, chlorophyll a and chlorophyll b fractions were estimated spectrophotometrically by the method detailed by Smith and Benite (1955).

RESULTS AND DISCUSSION

An analysis of the contents of total carbohydrates showed that the healthy leaves of OSN 2, the highly susceptible genotype, were found to have lesser amounts than the resistant and tolerant varieties (Table). This is in accordance with the finding of Rowell (1953) who claimed that mature leaves became susceptible to *Alternaria solani* only when the sugars were low while young leaves with high sugar concentrations were not. In another study by the same authors it was found that the mature groundnut leaves at bottom were more susceptible to *P. microspora* than top and middle leaves (Balasubramanian and Narayanasamy, 1983).

The total carbohydrate contents of the resistant variety, Ah 8446 and the tolerant variety, POL 2 showed only a marginal variation when compared to the highly susceptible variety which registered a significant increase with increase in time after inoculation. The higher levels of sugars might help to offer resistance. It is also possible that accumulation of carbohydrate might be due to the disruption of normal transport caused by the pathogen (Okasha *et al.*, 1968).

Comparatively healthy tissues of OSN 2 were found to contain greater amounts of total nitrogen when compared to healthy leaves of resistant and tolerant varieties and on inoculation the tolerant and the highly susceptible genotypes registered a significant increase in the total nitrogen content (Table). Shaw and Colotelo (1961) found that as the rust fungus developed in the susceptible wheat tissues, there was a two fold increase in protein nitrogen content, in contrast to the behavior of an infected resistant variety which showed a reduction in protein nitrogen content. However, In the present study there was no appreciable change in the total nitrogen content in the resistant variety. This indicates that the effect of infection of nitrogen metabolism may not be quite similar in all host-pathogen interaction. This view is further supported by the report of Tanaka (1963) who did not find any differences in the total nitrogen content of the susceptible and resistant rice plants infected by *Pyricularia oryzae*.

The total phenolics contents of the highly susceptible OSN 2 were remarkably less while that of Ah 8446 was the highest (Table). Late blight resistant varieties contained about twice as much phenolics as in susceptible potato (Rubin *et al.*, 1947). The total phenolics content increased in infected tissue consequent on infection and it was the highest and significantly high in the highly susceptible genotype while the alteration was to a minimum extent in resistant and tolerant varieties. This trend has been reported in various host pathogen interaction (Farkas and Kiraly, 1962; Rahe *et al.*, 1969; Matta *et al.*, 1969).

There were no significant alteration in the contents of RNA and DNA in the resistant and tolerant varieties while there was a conspicuous accumulation of the nucleic acid in the highly susceptible tissues on the third day after inoculation. However, the tolerant POL 2 registered a marginal increase in RNA contents at 5 and 7 days after inoculation. The increase in DNA contents could be detected even one day after inoculation in the case of the highly susceptible genotype, while the resistant and tolerant genotypes did not undergo any marked change following inoculation (Table). The susceptible wheat genotype infected with *Puccinia graminis* var. *tritici* registered an increase in the amount of RNA and DNA while the resistant genotypes did not show any variation (Quick and Shaw, 1964). Millerd and Scott (1963) also found a progressive increase in the amounts of RNA in infected barley leaves by *Erysiphe graminis* while the resistant variety showed very little difference.

The chlorophyll contents of the resistant and tolerant varieties were greater when compared to the highly susceptible genotype. The leaves of resistant Ah 8446 contained significantly higher amounts of chlorophyll *b* than the other two varieties. The reduction in the contents of chlorophyll was maximum in the case of the highly susceptible OSN 2 (Table).

The role of sugars in resistance to the blight disease may be indicated by the observed increased resistance of top leaves of the highly susceptible variety (Balasubramanian and Narayanasamy, 1983) and also the *de nova* presence of higher concentration of carbohydrates in resistant genotype. The accumulation of sugars was more rapid in the case of highly susceptible OSN 2 leaves when compared to Ah 8446 and POL 2. Subrahmanyam *et al.*, (1976) also reported that there was an accumulation of total soluble sugars in the rust-infected groundnut leaves. A reduction in carbohydrage contents might

Table. **Changes in contents of total carbohydrates, total nitrogen, total phenolics, nucleic acids and Chlorophyll fractions in leaves of different groundnut genotypes, following inoculation with *Phoma microspora***

Groundnut genotype	Days after inoculation							
	1 day		3 days		5 days		7 days	
	Healthy	Inoculated	Healthy	Inoculated	Healthy	Inoculated	Healthy	Inoculated
	Total Carbohydrates (mg/g of dry weight)							
Ah 8446	156	157	160	160	161	162	163	163
POL 2	136	136	140	141	142	143	143	145
OSN 2	119	120	121	126	123	134	125	156
	Total nitrogen (mg/g of dry weight)							
Ah 8446	23	23	23	23	23	23	23	24
POL 2	24	24	24	24	25	25	25	25
OSN 2	28	28	29	30	30	30	28	29
	Total Phenolics (mg/g of dry weight)							
Ah 8446	365	455	405	560	395	485	350	425
POL 2	295	375	375	530	325	420	315	400
OSN 2	125	165	240	435	255	360	230	320
	RNA (mg/g fresh weight)							
Ah 8446	453	464	471	487	467	493	448	468
POL 2	441	465	466	498	460	504	453	491
OSN 2	488	539	482	609	461	662	442	586
	DNA (mg/g of fresh weight)							
Ah 8446	73	74	76	80	73	76	70	72
POL 2	70	73	74	86	73	79	73	76
OSN 2	75	87	79	123	72	102	69	95
	Total Chlorophylls (mg/g of fresh weight)							
Ah 8446	2.0	1.9	2.0	1.9	1.8	1.6	1.4	1.3
POL 2	2.0	1.7	1.7	1.6	1.5	1.4	1.3	1.2
OSN 2	1.7	1.6	1.6	1.4	1.3	0.9	1.1	0.5
	Chlorophyll a (mg/g of fresh weight)							
Ah 8446	1.2	1.2	1.2	1.1	1.1	1.0	0.8	0.7
POL 2	1.2	1.1	1.2	1.1	1.0	0.9	0.8	0.7
OSN 2	1.0	0.9	0.9	0.8	0.7	0.5	0.6	0.3
	Chlorophyll b (mg/g of fresh weight)							
Ah 8446	0.8	0.8	0.8	0.7	0.7	0.7	0.6	0.6
POL 2	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5
OSN 2	0.7	0.7	0.7	0.6	0.6	0.4	0.5	0.2

CD (P = 0.05)	Total Corbohy drates	Total nitrogen	Total pheno lics	RNA	DNA	Total chloro phylls	Chloro phyll a	Chloro phyll b
Variety	4	0.2	38	29	6	0.1	0.04	0.05
Days after Inoculation	1	0.01	44	24	7	0.1	0.05	0.06
Healthy & inoculated	3	0.01	31	41	5	0.004	0.04	0.04
Variety x days after inoculated	NS	0.3	NS	NS	NS	NS	NS	NS
Variety x Healthy and inoculated	6	0.2	NS	NS	NS	NS	0.06	NS

be expected because of lower levels of chlorophyll in the infected leaves; yet there was an accumulation of carbohydrates in the infected tissues right from the initial stages of disease development indicating a differential response of the highly susceptible tissue to infectioned aimed at containing the pathogen.

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