THE NEW MALADY OF COFFEE IN SOUTH INDIA

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IS there a new malady of coffee? Perhaps there is. Table I gives the acreage of Arabica Coffee and the crop in tonnes from the Mysore State in the last 8 years, which is apparently stagnant.

TABLE I

Arabica coffee acreage and yields in Mysore State

Year	Acreage	Yield
1960-61	..	33,0 3
1961-62	..	21,481
1962-63	1,14,712	26,752
1963-64	1,10,028	32,671
1 64-65	1,26,040	33,165
1965-66	1,29, 74	31,704
1966 67	1,2 ,608	33. 00
1967-68	1,28,317	31,570

The crop for 1969-70 is likely to be around 30,000 tonnes.

With the greater care and attention now being bestowed on coffee plantations from 1950 onwards, together with the increased acreage and the considerably large stand of high yielding station selections (30% or more of Arabica) a great increase in the crop is naturally expected. In 1960–61 the Arabica crop was 33,073 tonnes. The crop on average for the last seven years is only about 30,000 tonnes. The 1966–67 is a bumper year for the coffee crop, which totalled 76,000 tonnes, of which 33,500 tonnes was Arabica for Mysore and Coorg. Though this is a record crop, the Arabica contribution is about the same for 1960–61 and 1964–65 seasons, in spite of the complement of high yielding station selections being more by at least 15,000 to 16,000 acres.[1]

From observations conducted over several years we find the death of leaves one or two nodes below the terminal bud as the leading symptom of the new malady.

There are many types of die-back in coffee-Overbearing die-back, leaf disease die-back, hot and cold, Lyamungu die-back, Top die-back and Elgon die-back. Of these Elgon die-back has certain striking similarities with the new malady. The one characteristic feature of Elgon die-back[2] is the death of nodal and inter-nodal tissues usually several nodes from the apex. This appears to be the basic characteristic of the die-back seen in Mysore also. In the case of Elgon die-back no particular association between the death of leaf and the initiation of a nodal lesion has been noticed, but, at least on occasions it does occur and in Mysore more often than not this is the case. Thorold considered this as a form of carbohydrate deficiency and was able to ameliorate it to a certain extent by providing adequate shade. But, Dr. J. C. F. Hopkins (*in litt.*), the then Director of the Commonwealth Mycological Institute in the U.K., observed plenty of starch reserves in the affected twigs and isolated a strain of *Colletotrichum* which produced the perfect stage, *Glomerella cingulata* (Stonem,) Spauld. *et* V. Schrenk, in culture. The same fungus occurs in South India also. Nutman *et al.* (1966 *in litt.*) found that strains of *Colletotrichum* which caused coffee berry disease could invade a branch tissue and produce symptoms like those of Elgon die-back, but, as these strains are not isolated from Elgon die-back occurring regions or from a locality which is free from coffee berry disease, it is doubtful whether the coffee berry disease strain is the natural cause of the die-back.

A whole gamut of the following symptoms has been described for the new malady of Coffee in South India.

(1) Death of the terminal bud or leaves on tertiary system of branches (new years cropping wood). (2) Blackening of the petiole on one or more functional leaves usually on one side of the node. (3) Malformation of new flush like crinkle leaf reported from Kenya[3] (*loc. cit*). (4) Nodes get twig closer towards the top of branches. (5) From the above nodes numerous new laterals arise giving a fan-shaped appearance. These growths are brittle. (6) Abortion of the primary and some axillary buds. (7) Goose necking of the tertiary branches. (8) Brown to black discoloration of the pith with or without cell disorganisation. (9) Scorching of the flower-buds and blossom. (10) The non-development or uneven development of berries. (11) Chlorosis of the functional leaves.

The obvious characteristic of the new malady as stated earlier is the death of a node and this localisation of symptom very strongly suggests the entry of a pathogen particularly through the leaf base and/or leaf scar.

In microscopic preparations of the twig marked decay of pith was observed although

the twig for all external purposes was healthy. This suggests that the onset of the condition took place perhaps before the external symptoms are manifested. In some instances the water-conducting tissues are plugged with gum and tyloses both of which are associated with wound reaction. Die-back is present almost in all places where Arabica is grown, but, it would appear that it is less on plantations of rust-resistant coffee and worst on old coffee which generally suffers from heavy defoliation, due to leaf disease.

Any cultural practices which increase the stored nutrients of the coffee bush relative to the crop level can be expected to ameliorate the die-back. The increase in food reserves can be brought about by judicious cultural methods that might tend to increase the leaf complement on the trees and/or by lengthening of the life of the coffee leaves themselves.

TABLE II

Percentage occurence of colletorichum coffeanum

	Dead plants	Plant parts apparently healthy	
	Surface sterilized	Surface sterilised	Surface not sterilized
Root ..	Nil	Nil	Nil
Twig (internode)	14	Nil	22
Twig (node) ..	78	3	19
Lamina ..	18	Nil	38
Petiole ..	64	Nil	27

In our studies we have isolated *Colletotrichum coffeanum* Noack from plant parts both surface sterilised and surface not sterilised.

From Table II it will be clear that the roots are free from the fungus. In dead twigs, *Colletotrichum* is the predominant fungus that has colonised. Its presence on surface sterilized nodes of apparently healthy plants would mean that the fungus is in a latent phase and its occurrence in the lamina and petiole of apparently healthy plants not surface sterilized would mean that the fungus is an important member of the phyllosphere.

For all practical purposes apart from trying to discover the causative agents it might be worthwhile to concentrate more on the control measures at this stage.

It is true that nowadays more than 2 fungicidal sprays are necessary to keep coffee bush in good health. It is not because any phenomenal increase in the crop returns are achieved by these sprays, but, purely to prevent progressive deterioration of the bushes in affected areas. The increased number of sprays are not because the planters have become fastidious about the standards of health of their coffee bushes, but they are afraid of an unknown condition in coffee which they fear is withholding their crops. Planters are above all becoming aware of the need to spray selections also although they may not get the leaf disease to the same degree as the old coffee. They feel that a copper spraying does them good.

It has always been intriguing to see small holdings not suffering from ravages of the new malady, which may be due to thorough drenching of the bush by Bordeaux mixture (800–1,000 gallons per acre).

In our observations we have seen that there is heavy sporulation of fungi particularly *Colletotrichum* with the first showers in April/May period. In order to reduce the initial inoculum a pre-blossom spray in March was advocated on the results of our trials and this seems to have considerably improved the health of the bushes. Recent work by Hocking (1966)[4] on the general role of *Colletotrichum coffeanum* other than the coffee berry disease strains indicated that the fungus is confined to colonisation of dead, moribund tissues with sporadic active parasitism, under some local conditions. Any recommendations on disease control should be based on the consideration of economics particularly in the light of present trends of increasing costs of labour, manure, pesticides, etc. For example in the coffee leaf disease it is necessary to know to what level the rust should be controlled to prevent crop losses of economic importance. The low volume spraying techniques now employed even in East Africa have not reduced the leaf disease to the same extent as could be achieved by the conventional high volume sprays, but, there even at 20 gallons per acre, the rust is as low as 20% or even lower. From the dosage response curves it is evident that considerably higher concentrations than what are generally used may be necessary to achieve a really higher degree of control. The leaf disease control in India, it is true, leaves much to be desired. How many estates in Mysore are able to achieve a 50% control of the leaf disease? May be none. The best of the estates are probably achieving 30 to 40% and the others hardly 20% control on their old coffee.

With reference to coffee berry disease, the work done by Wallis and Firman[5] reveals that the volume of spray did not affect greatly the deposit retained on the branch surfaces.

Branches were able to retain upto 250 ml. copper per sq. meter and it is considered that a volume equivalent to 100 gallons per acre would provide the greatest margin of safety to compensate for inaccuracies in application. In East Africa there have been reports of increased coffee berry disease with increasing number of sprays which may be due to increased leaf retention creating favourable microclimate for the multiplication of the pathogen.

Insufficient application, wrong timing and dosage, all these invariably result in a disease incidence greater than on trees which have not been sprayed at all. Strange as it might appear this is nevertheless true. Maybe this is a result of retention of infected leaves with heavy source of inoculum, which otherwise would have normally fallen. In India the close spacing of coffee and the forgotten practice of pruning make leaf disease control extremely difficult and perhaps ineffectual. The following few suggestions deserve critical reconsideration as far as the new malady is concerned :

(1) Establishment of the causative agent and its life-cycle.
(2) What is the optimum time, quantity of copper to be put in ? Maybe 3 full sprays are necessary, the first being a pre-blossom one.
(3) It may be necessary to increase the number of spraying to 4 to 5 as the residual effect of copper formulations wear off in 3 to 4 weeks. A clearer picture can emerge only when we have decided upon the optimum spacing of the bushes. Trials are necessary to find if the degree of leaf retention has anything to do with the freedom from the new malady.
(4) Protection of leaves from the ravages of pests such as thrips at a time when bushes which have suffered heavy defoliation or bushes which have been heavily pruned are recovering.
(5) Manurial requirements of coffee under different conditions to offset the disadvantages of heavy carbohydrate drain during an acute leaf disease incidence or heavy crop or both. Apart from mere soil analysis data the need for plant analysis is stressed.
(6) The need for a thorough investigation of optimum shade requirements for coffee in different districts in South India and a reassessment of the necessity of pruning bushes on individual merit as a corrective sanitation practice.

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IMPACT OF QUENCHING FROM MELT ON EQUIATOMIC ALUMINIUM-GERMANIUM ALLOY

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ABSTRACT

Rapid solidification of equiatomic aluminium-germanium alloy is shown to result in the formation of a new non-equilibrium intermediate phase that can be indexed on the basis of a large tetragonal cell ($a = 14{\cdot}98$ Å, $c = 16{\cdot}03$ Å, $c/a = 1{\cdot}070$) with a possible 208 atoms. The structure of this phase is discussed in relation to the equilibrium f.c.c. solid solution.

INTRODUCTION

QUENCHING of liquid metals and alloys at extremely high cooling rates (10^6 to 10^9 deg.c/sec) has been shown to lead to the formation of a large number of new intermediate phases, supersaturated solid solutions and microcrystalline as well as amorphous phases, in various binary and ternary systems. This technique, generally referred to as 'liquid quenching', 'splat quenching', or 'splat cooling', has been found very effective in filling up gaps in metallurgical equilibrium diagrams, which