THE EVALUATION OF INHERENT RESISTANCE/SUSCEPTIBILITY OF *HEVEA* CULTIVARS TO BLACK STRIPE DISEASE

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ABSTRACT

A standard field inoculation technique for the assessment of inherent resistance/susceptibility of *Hevea* cultivars to Black Stripe disease is described. The technique is simple and direct and can be used for the selection of clones at a very early stage before recommendations are made for commercial planting. The method could also be used as a 'Uniform method' for the testing of future exchange clones.

INTRODUCTION

The most effective and economical means of controlling plant disease is by the use of resistant cultivars. *Hevea brasiliensis* is grown on a large scale in the wet districts of Sri Lanka. The climatic conditions prevailing in these areas during the monsoon rains are very conducive to the development of diseases caused by *Phytophthora palmivora* (Butl.) Butl. of which Black Stripe and Bark Rot are of economic importance. The use of planting material of a known degree of resistance or tolerance to the disease in areas where disease risk is evident, will be highly beneficial to the rubber industry.

At present, clones are screened for resistance to black stripe disease on field observations made during the small scale field trials for assessment of yield potential. The chief drawback in this method of screening for disease resistance is that the susceptible cultivars that escape the disease under the conditions of the field trials could easily be considered as resistant. This could happen either when the trials are conducted in areas where the pathogen is not prevalent or when environmental conditions are not suitable for disease development or are detrimental to the development of the pathogen.

The diseases caused by P. palmivora are not wide spread in estates in Sri Lanka. They are usually found confined to certain localities in the fields. This may be due to the mode of spread of the fungal propagules, which is by rain splash. Disease occurrence is reported each year in these areas. The chances of the pathogen being present in its viable form are thus very limited. Of the climatic conditions, intensity of rainfall appears to be the chief factor for fungal dissemination and disease spread (Satchuthananthavale & Dantanarayana 1973). The relationship of rainfall to disease expression is important and during the years of field observations, if intensity of rainfall is not heavy enough for disease expression then susceptible cultivars undergoing field observations may be easily passed off as resistant to Black Stripe disease. Furthermore, some cultivars are susceptible to Oidium leaf disease. In such cases the pod set is poor. Pods are suitable substrata for the sporulation of the pathogen. In the absence of pods, the leaf fall phase of Phytophthora disease is low and Black Stripe incidence is either absent or very low.

Under the situations noted above the screening of clones by field observations alone is of little value. A typical example is clone RRIC 45. In field trials this clone escaped the disease and was rated as resistant to Black Stripe disease and recommended for large scale planting in wet districts. Recently two estates have reported severe incidence of Black Stripe disease in this clone which questions the validity of screening for disease resistance by field observations alone. The clone RRIC 45 is susceptible to Oidium leaf disease and had probably escaped Black Stripe disease during the time field observations were made.

In order to overcome the shortcomings associated with screening for disease resistance by field observations which are bound to set back the breeding and selection programme, a method was devised to screen clones for their inherent resistance or susceptibility at an early stage during small scale trials. This method is simple, direct and easy to manipulate with the added advantage that it can be standardised for adoption by all rubber growing countries.

MATERIALS AND METHODS

Essentially the technique involves three simple procedures, namely a) opening up a uniform cavity in the bark of a tree by removing a bark plug b) inoculation of a standard suspension of zoospores in sterile distilled water

into the bark cavity and c) observations for external and internal disease symptoms, and assessment of disease spread. The fungus Phytophthora palmivora is grown on a solid medium on which it will sporulate well within a week. The sporangia on the surface of the culture plates are scraped into a known volume of sterile distilled water and chilled at 20°C for 20 to 30 minutes and then incubated at room temperature for a further 5 to 10 minutes for the release of zoospores. The suspension is then filtered through a sterile muslin cloth to remove the agar and the mycelium. The concentration of zoospores is ascertained with the aid of a haematocytometer and field microscope. The zoospore suspension used in our earlier trials ranged from 125,000 to 200,000 zoospores/ml, although in subsequent trials it was observed that a concentration as low as 10 zoospores/ml was sufficient to cause infection in very susceptible clones.

In the morning of the day of inoculation trees are selected, marked and a bark plug of 2.5 cm diameter is removed at a height of 150-170 cm on the opposite side of the current tapping panel. In the afternoon, the zoospore suspension is prepared and a sterile absorbent cotton plug of the same diameter as the bark plug is saturated with 2 ml of the zoospore suspension. The prepared inoculum is immediately taken to the field in sterile petri dishes and after removing the coagulum along the edge of the wound, the saturated cotton plugs are placed in the cavity of the bark plugs and sealed off with budding tape in such a manner as to ensure aeration (Satchuthananthavale et al 1974). The inoculation of trees is completed within half an hour to fortyfive minutes of the preparation of inoculum.

At the end of eight weeks the inoculated point on every tree is examined for enternal symptoms of Bark Rot and opened for inspection. Lesions if any, are measured and the nature of the disease reaction recorded. Depending on the reaction, the clones could be classified as very susceptible, susceptible, moderately resistant and resistant in relation to a treated marker clone which is well known for its susceptibility such as clone PB 86.

RESULTS OF SCREENING TRIALS

In thrice repeated trials the susceptible clones gave a light brown spreading type of lesion and in clones which were very susceptible like RRIM 513 and RRIC 45, the lesions were seen to spread rapidly above and below the point of inoculation. The clones that were resistant showed a

restricted dark lesion round the point of inoculation, which in the majority of cases did not spread over a few cms round the wound. The results of the field trials correlated well with the known susceptibility of resistance of the clones.

The interesting feature was that clone RRIC 45 which had been rated as resistant to Black Stripe and recommended for large scale planting was found to be susceptible to the disease. Nine out of the ten trees that were inoculated showed rapidly spreading lesions above and below the point of inoculation. The inherent susceptibility of this clone was thus brought out by this method of screening for resistance.

The new RRIC 100 series which are still in the test tapping trial stage were included in the preliminary trials and one of this series, clone RRIC 107 gave a susceptible reaction in all the trees that were inoculated. The information at this stage of test tapping should help the Plant Breeder to make a decision as to whether to continue or curtail his programme as regards this particular clone.

DISCUSSION

In testing clones for disease resistance, it is desirable to adopt a standard procedure. At present there is no reliable quantitative method by which inherent resistance or susceptibility to disease could be assessed. The method described above is suitable for testing clones for inbuilt resistance to Bark Rot at an early stage before recommendations are made for commercial planting, particularly in areas which experience heavy monsoon rainfall. The preparation of the inoculum could be easily handled at site. Trials have been carried out in estates as far as sixty miles from the Institute with the inoculum prepared at the site.

The use of a standard method of screening for resistance to Black Stripe should also help in realising the objectives envisaged in the clone exchange programme. Some of the foreign clones that were introduced into Sri Lanka under this programme have succumbed to Black Stripe disease and have been rated as very susceptible on field observations, for example clones IRCI 1, IRCI 6 and TR 1406 (Anon 1972). These clones irrespective of their yield potential will be unsuitable for large scale planting in the wet districts of Sri Lanka.

Phytophthora Black Stripe and Bark Rot are of common occurrence in most of the rubber growing countries. The testing of clones by a universally acceptable standard method as suggested at the IRRDB meeting held in Medan, Indonesia in October 1972 will help in the elimination of disease susceptible material at an early stage in the breeding and selection programme. An artificial inoculation method must be absolutely reliable so as to i) prevent "escape from infection" and ii) bring out differences in susceptibility of the cultivars. To make conditions optimal for infection, the screening is best carried out with inoculum containing a high concentration of zoospores in the range of 100,000 zoospores/ml, under the most suitable environmental conditions for disease development.

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