POTENTIAL USE OF LOWER CONCENTRATIONS OF CURRENTLY-USED FUNGICIDES FOR THE CONTROL OF BLACK STRIPE DISEASE OF RUBBER

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Introduction

Leaf fall, bark rot, shoot die-back and pod rot which are caused by *Phytophthora spp.* are present in all countries where rubber is grown. In Sri Lanka, the disease has been reported annually in varying significance and the first *Phytophthora* leaf fall outbreak was detected in 1916 on susceptible clones [1]. Development of *Phytophthora* diseases is common from May to September in each year and they reach to epidemic levels, if the weather and other factors are conductive to the pathogen. As the major rubber growing districts are in the South West monsoon region in Sri Lanka, where the climatic conditions are very conducive for the development of the fungus, the *Phytophthora* epidemics are often reported. *Phytophthora* usually survives on mummified rubber pods, stalks, shoots or soil debris as thick walled oospores or chlamidospores, which can withstand adverse climatic conditions. When the petioles of rubber colonized by *P. meadii* were buried in soil, chlamydospores could be re isolated up to twenty two weeks after burial [2].

Under favorable conditions, initially the fruits rot and abundantly produced zoospores are released from sporangia on pods. They get washed down with rain splashes and cause new lesions on leaf petioles, young shoots and the tapping panels on the main trunk [3]. Due to bark rot (black stripe), the tapping panel is infected and the latex production of the tree is ceased. Consequently, it is serious enough to warrant cessation of the tapping during the monsoon months, causing considerable reduction in tapping days which contributes to the productivity drop [4]. Though a number of clones which can withstand *Phytophthora* infections at least in the moderately level are available at present, as a result of the disease screening procedure, *Phytophthora* bark rot is present in the field due to various factors.

If a clone which is moderately susceptible to black stripe happens to be widely planted or the climatic conditions become much conducive for the development of the fungus, chances of the infection are greatly increased, and preventive measures for elimination of the disease will become necessary. Currently recommended management practices aim at both preventive and curative strategies. Preventive strategies include the use of resistant clones, sanitation of the trunk of the tree, preventing panel opening during the wet season and the use of fungicides after each tapping operation. In a case of a disease occurrence, fungicide application on the diseased portion is recommended as the curative strategy. In both circumstances, the application of Brunolinum Planetarium (tar acid - Xylenols 7-12% v/v and tar oil 30% v/v) at the concentration of 15% or Ridomyl (Mancozeb 640g/kg + metalaxyl

80g/kg) at the concentration of 5g/l is recommended. It is reported that both of these fungicides are much effective as curative applications in the specified concentrations. However, in the views of the cost of production and the environmental sustainability, it is important to seek for management strategies where low inorganic fungicide levels are involved. In this experiment, it was expected to investigate whether these fungicides could be applied in reduced rates as the prophylactic applications. Moreover, Mancozeb (Mancozeb 80% (w/w) WP) was tested for the effectiveness against the disease.

Materials and methods

Fungal isolates

Phytophthora meadii isolate obtained from the diseased petiole of the clone RRIC 100 was used for the chemical screening study. According to the preliminary *in vitro* study, this isolate was identified as a pathogenic isolate among the *Phytophthora meadii* isolate collection of Rubber Research Institute of Sri Lanka. The zoospore suspension was prepared using the technique employed by Sahuthananthavelu *et al,* [5]. The fungus was grown on Lima Bean Agar (LBA) for seven days until the sporangia production and sterilized distilled water was added to the plates. The zoospore suspension was prepared by scraping the sporangia on the surface of ten culture plates into 150 ml sterile distilled water and chilling it at 20^0C for 20-30 minutes and incubating at room temperature for a further 5 to 10 minutes for the release of zoospores. The suspension was then filtered through a sterile muslin cloth to remove the agar and the mycelium. The zoospore suspension used for the inoculation was adjusted to a final concentration of $1x10^4$ spores per ml.

Fungicide application and inoculation of the rubber trees

The experiment was carried out at the Galewatta division of the Dartonfield estate during the southwest monsoon rainy season in rubber clearing of the clone RRISL 102: a moderately susceptible clone to the *Phytophthora* bark rot. The clearing was ten years-old and was under the tapping panel A.

The prophylactic activity of the three systemic fungicides: Brunolinum Planetarium, Ridomyl (Mancozeb+Metalaxyl) and Mancozeb was tested against the *Phytophthora* bark rot disease. The treatments used were: Brunolinum Planetarium at the concentrations of 7.5% and 15%, Ridomyl at the concentrations of 3g/l and 5g/l and Mancozeb at the concentration of 3g/l. The treatments were applied according to Completely Randomized Design with ten trees per each treatment. The fungicide application was initiated 14 days prior to the inoculation of the bark with *Phytophthora.* The respective fungicide was applied on the tapping panel after each tapping action: the trees were tapped every other day, according to the recommended method.

At the Inoculation, a sterile absorbent cotton wool stripe was saturated with 2 ml of the zoospore suspension and was placed on the newly tapped tapping panel. The cotton wool stripes were taken in sterile petri dishes to the experimental site and a

freshly-prepared zoospore suspension was used. After the inoculation, the inoculated portion of the tapping panel was sealed off with budding tape in such a manner to ensure aeration. Inoculation was carried out within half an hour of the preparation of the inoculum and this process was carried out early in the morning to prevent the zoospores of exposing to sunlight which will result in reduced viability. In the control experiment, no fungicide application was carried out, while the fungal inoculation was applied on the tapping panel in the same manner as described above.

Quantification of disease development

Observations were made two weeks after the inoculation of the trees by exposing the bark around the point of inoculation with a sharp object. The lesions were traced on to a tracing paper and area of the lesion resulted after each treatment was measured using a plannimeter.

Statistical analysis

The area of the lesion resulted after each treatment was subjected to analysis of variance with the statistical software SAS (version 9.1). Mean comparison was done using Dunnett's Multiple Range Test (DMRT).

Results and Discussion

Mean area of the lesions resulted after the four treatments with Brunolinum Planetarium and Ridomyl are not significantly different from each other while they are significantly different from those of the Mancozeb treatment and the control. The values of Mancozeb treatment and the control are not significantly different from each other (table 1).

Table 1: The mean infected area under different treatments

Treatment	Mean area infected (m^2)*
Brunolinum Planetarium 15%	0.3470[a]
Brunolinum Planetarium 7.5%	0.5120[a]
Ridomyl 5g/ml	0.1670[a]
Ridomyl 3g/ml	0.2360[a]
Mancozeb 3g/ml	2.9490[b]
Control	2.8320[b]

*Values followed by a common letter are not significantly different according to DMRT (P= 0.05)

When reviewing the formulations of the fungicides, Brunolinum Planetarium is an emulsifiable coal-tar derivative while Ridomyl is a mixture of fungicides combining a non-systemic protectant (mancozeb) with a systemic, curative (metalaxyl) active ingredient.

Mancozeb being a non-systemic protective fungicide, the non-effectiveness of Mancozeb against *Phytophthora,* could be due to the wash off of the fungicide. However, as the protective application against Phytophthora is always demanded at the rainy spell, the application of Mancozeb will not be effective.

Conclusions and recommendations

According to the results, it can be is evident that Brunolinum Planetarium or Ridomyl can be used in reduced concentrations as preventive application against *Phytophthora*. When the cost of production and the environmental sustainability are concerned, these two fungicide concentrations i.e. Brunolinum Planetarium at the concentrations of 7.5% and Ridomyl at the concentrations of 3g/l can be recommended as preventive applications against the *Phytophthora* bark rot of disease of rubber.

References

[1] Jayasingha, C. K. (1991). Review of the Plant Pathology & Microbiology Department. Annual Review of the Rubber Research Institute of Sri Lanka 1991: 29-47.

[2] Liyanage N.I.S. and Wheeler B.E.J. (1991). Survival of *Phytophthora meadil* in Sri Lankan soils. Plant Pathology 1991; 40: 436-444

[3] Jayasuriya, K.E., Wijesundera, R.L.C., Jayasinghe, C.K. and Thennakoon, B.I. (2000). Comparative study of *Phytophthora meadii* isolates from rubber *(Hevea brasiliensis)* plantations in Sri Lanka. Mycopathologia 147: 125-132

[4] Peries O.S. (1964). Review of the Plant Pathology Department. Review of the Rubber Research Institute of Ceylon. 48-69

[5] Satchuthananthavale, V., Satchuthananthavale, R. and Dantanarayana, D. M. (1975). Screening of clones for Black Stripe Disease in *Hevea.* Rubber Board bulletin. 12,2: 50-53.