

REPORT

ON

DISEASES OF THE RUBBER TREE IN KEDAH

BY

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During February 1933 the writer made an extended tour of the main rubber growing areas of the State of Kedah, visits being paid to twelve estates in the central and southern districts. The following report embodies the general observations made, and the opinions formed during the course of the tour, in relation to problems concerning the diseases of the rubber tree in Kedah. Since the tour lasted only fifteen days, and took place at a time when the weather conditions were extreme (see Section III), it is realized that some of the opinions and generalizations may require modification.

SECTION I—MAIN PROBLEMS ENCOUNTERED

The individual problems encountered have been discussed in detail in special reports written to the estates concerned. The present report is in the nature of a summary in which only general aspects will be considered.

The problems will be dealt with under the following headings:—

- A. Root Diseases
- B. Stem and Branch Diseases
- C. Diseases of the Tapping Panel

Since the visit took place at the height of the wintering season no observations on Leaf Diseases could be made.

A. Root Diseases

The root disease problems in Kedah, in rubber areas planted directly after jungle, are of exactly the same type as exist on similar areas in other parts of Malaya.

This statement is based not merely on general observations, but on precise information the writer has been fortunate enough in obtaining from two estates in the district, which have recently

undertaken systematic tree-to-tree examination for root disease in young rubber and mature rubber respectively.

With regard to the former, the estate in question has for the past two years carried out an intensive programme of root inspection and treatment for the control of White Root Disease caused by *Fomes lignosus*. The data collected by the manager during the course of the operations have been of great value, and will be embodied shortly in a new publication on the subject of root disease control in young rubber. It may be mentioned here, however, that the information obtained on this particular estate, besides showing that the root disease complex in young areas in Kedah is of a normal type for Malaya, also confirms the discovery, made about a year ago at our Experiment Station, that, in Malaya, Red Root Disease, caused by *Ganoderma pseudoferreum*, is as inseparable from the root disease complex in stands of young rubber as it is from the root disease complex in mature areas. The disease does not cause much damage to the young stand, the loss of seedlings due to Red Root being barely one tenth of the loss caused by White Root Disease, but, if neglected, the disease often plays appalling havoc in the stand from the fifteenth year onwards, and is, in fact, one of the chief factors limiting the economic life of rubber plantations in Malaya. A severe, but by no means exceptional example of the damage caused by Red Root Disease in mature rubber is provided by the results of the root inspection carried out on the second of the estates mentioned above. The rubber on this estate is only about twenty years old, but certain fields are already infected by the disease beyond hope of treatment. In one field of 54 acres, tree-to-tree inspection revealed over 50 per cent infection, and yet all this damage might have been prevented if the disease had been detected and treated before maturity, when the cost of treatment would have made but an insignificant addition to the cost of control of White Root Disease.

Both diseases originate from jungle trees which were infected at the time of felling, and preventive treatment consists simply in discovering the offending root systems while they still retain their identity (i.e. before they rot away too far) by making routine tree-to-tree inspection in the seedling stand, and in completely eradicating these root systems from the soil. The experiments in progress on the first of the estates mentioned above indicate clearly that such treatment can be carried out efficiently, and at an economic figure, even in these days of financial difficulty, while the benefits to be derived from the treatment are incalculable.

The root disease problem is abnormal on many Kedah estates, because the present stand was not established in new jungle

clearings, but in old clearings, the soil of which had been cultivated for many years previously by Chinese and others for the production of tapioca and other crops. Quite a high percentage of the European-owned rubber areas in Kedah were established in this way on old tapioca land, and on these areas the centres of infection of both Red Root and White Root Diseases were removed by cultivation, or rotted away, before the rubber was planted, so that the incidence of root disease is practically unknown. It was striking to see the completeness of the stand on some of these areas.

The evidence obtained from the old tapioca lands offers strong confirmation of the theories which the writer* has advanced to explain the origin of root diseases on rubber estates. Briefly, these theories state that a rubber tree can only be invaded by the causal organisms of Red Root or White Root Disease if its roots are in contact with buried timber which is in the process of being rotted by one or other of these fungi. If spread of root disease by wind blown spores were of any practical significance, then the entire absence of root disease from plantations established on old cultivated land could not be explained satisfactorily.

Where previous cultivation was of short duration some root disease was observed, but it was confined chiefly to Red Root Disease, the damage done by White Root Disease being well below normal. This fact was of interest, as it supports a suggestion made by the writer* in order to account for the normal relative distributions of these two diseases in young and old plantations, viz. that *Ganoderma pseudoferreum* is a more slowly acting wood-destroying organism than is its near relative *Fomes lignosus*.

The only other root disease of economic importance which was observed was the root and collar rot caused by *Ustilina zonata*. This disease was found to be as prevalent in Kedah as in the F.M.S. and arises from the same causes, the most important of which is failure to keep the collars of rubber trees free from earth scrap. If earth scrap is allowed to accumulate at the collar over long periods, thick pads of coagulated latex of considerable area form over the bark in certain places. Beneath these pads the bark tends to become asphyxiated, and the incipient wounds so formed are particularly suitable for the development of the wound parasite *Ustilina zonata*. Periodic cleaning up of the collar of each tree will go a long way towards eliminating this type of root disease.

B. Stem and Branch Diseases

The most important stem and branch diseases in South Kedah are Pink Disease caused by *Corticium salmonicolor*, and Patch

*Annual Report, 1932, R.R.I. of Malaya, pp. 95—98

Canker caused by *Phytophthora faberi* (or some closely allied fungus).

PINK DISEASE

Pink Disease is one of the most important diseases in the areas visited. It is generally distributed over the whole of South Kedah, and the adjoining Selama district of North Perak, its severity varying with the rainfall. The highest infections occur on the foothills of Gunong Bintang and Gunong Bongsu, the severity of the disease falling off with increasing distance from these hills. Even in the Sungei Patani district, where the rainfall is comparatively low, the disease is more prevalent than in Selangor. Climatic factors will probably account for this state of affairs, for the climate in Kedah is more truly seasonal than the climate further south along the western coast of the Peninsula, and the greater intensity of the wet season probably enables the disease to accomplish more damage during its period of active growth in Kedah than it does in Selangor, while the ability of the fungus to withstand drought counteracts the compensating effect of the more intense dry season which Kedah enjoys.

Continuous records of the incidence of Pink Disease for several years have been obtained from an estate on the Perak side of Gunong Bintang. These records show, in a striking fashion, that the disease in that district is most severe on young trees between the ages of three and seven years, and falls off towards the tenth year. It was noticed, on one area similarly situated on the Kedah side of the mountain, that the disease can persist in a destructive manner up to the fifteenth or twentieth year. There was some evidence, however, in this case, that the persistence was due to neglect, and the impression was obtained that, given normal and conscientious treatment, the attack would have passed its peak by the tenth year.

One of the most serious features of Pink Disease noticed in South Kedah was its tendency to pollard trees, even large trees up to twenty years old, by ringing them at ten to twenty feet from the ground. This type of damage, again, seemed to be connected with neglect of treatment.

Systematic treatment of the disease was found to be general in Kedah, although in these days of economy the frequency of treatment is often insufficient to provide adequate control. Plain tar is most frequently used in treating the disease, and gives good results. A number of complaints were received, however, about the recent variability of even the best grades of tar, some samples being difficult to apply, and others not adhering properly to the infected surfaces. A tar of unknown composition is a dangerous

weapon in the hands of coolies, and in order to prevent the possibility of wholesale bark burning a general change-over to the Asphalt-Kerosene mixture recommended by the Institute was advocated. This mixture has a known composition, and can be brought to any consistency which is desired. Moreover, its cost is only slightly higher than that of tar and, if Solar Oil is used instead of kerosene, the cost is even below that of good tar. If Solar Oil is introduced into the mixture the question of variability crops up again, but the mixture still remains a more satisfactory one than tar of doubtful composition and, if tried out first on healthy bark, may be used with confidence.

Satisfactory control of Pink Disease in seedling rubber was reported from one estate by the use of weak solutions (5 per cent in water) of Brunolinum Plantarium, mixed with a colouring agent to aid supervision.

PATCH CANKER

Of the stem and branch diseases in South Kedah, Patch Canker ranks next to Pink Disease in importance. Its distribution is similar to that of Pink Disease, being obviously more severe in districts of higher rainfall. The fact that the disease is more prevalent in South Kedah than in the neighbourhood of Kuala Lumpur can probably be explained along the lines followed in discussing Pink Disease, but little is known of the manner in which the causal fungus overwinters during the dry season in Kedah, for the bark cankers caused by the disease are very susceptible to drought, and are usually sterilized completely during the wintering period.

Infection normally takes place on the main stem within five or six feet from the ground. It does not usually occur on trees under five years of age, but specimens have recently been received from one of the estates visited which may possibly represent Patch Canker on very young material. When the disease occurs on young trees, the patches appear close to the ground, and on bud-grafted material this position coincides with the junction of stock and scion. The disease under these circumstances has the appearances of an ailment peculiar to budgrafts, and it was even suggested that this might be further evidence of that "inherent weakness" which some planters feel convinced must necessarily exist in budgrafted trees. No conclusive opinion on the matter was formed, but there certainly exists a possibility that the disease may be influenced by the operation of budgrafting while being independent of any "inherent weakness" on the part of the budded tree, for the kink in the stem at the "elephant foot" may provide a ledge

on which spores and moisture can lodge and so bring about local infection.

In connection with Patch Canker a special problem arose during the visit which will be dealt with in Section II of this report.

C. Diseases of the Tapping Panel

The most important panel diseases encountered were Black Stripe caused by a fungus of the *Phytophthora* type, Mouldy Rot caused by *Sphaeronema fimbriatum*, and Brown Bast. Sun scorch of the newly tapped bark was also met with occasionally.

BLACK STRIPE

Black Stripe is prevalent in South Kedah, and has a distribution practically identical with that of Patch Canker. This is not surprising when it is remembered that these two diseases are caused by two very closely allied fungi.

The disease appears chiefly during the wet season, and its mark is left on infected trees as a broad band of wounds stretching across the strip of bark tapped during the months of October to December. Considering the prevalence of the disease the extent of the damage observed was small, and this must be attributed to the fact that the disease is treated promptly and efficiently as soon as it is detected. When treatment is neglected, the disease often spreads into the untapped cortex below the tapping cut, the resultant damage to the panel being frequently irreparable; but of the many hundreds of infected trees examined during the tour, only one was permanently disfigured in this way, and this tree had in fact been overlooked during treatment. The usual type of damage observed was a band of wounds, often not much more serious than tapping wounds, disfiguring the area of the panel tapped over during the wettest months of the year. In February, when the panels were examined, the progress of the fungus had been entirely arrested by the drought, and the wounds were already beginning to heal. It is possible that a little local research on strengths, and rates of application of various fungicides, might enable even this small amount of damage to be avoided.

MOULDY ROT

This ubiquitous disease was well established in kampongs in the Kulim district at least as early as 1930, but it is interesting to note that it has not yet been reported as causing serious damage on European estates in South Kedah. From the information obtained, the opinion was formed that the disease does not flourish so easily in the climate of Kedah as it does in the

climate of the rubber-growing areas further south; probably the disease is too severely checked by the intense drought during the wintering period in Kedah to be able to develop epidemic proportions in normally planted estate rubber.

These opinions were formed after investigating the only instance of attack on normal estate rubber which was brought to notice. The estate on which the attack occurred has an experimental area in which an investigation of the effect of planting density on yield is being carried out. Mouldy Rot has been firmly established in the closely planted plots of this area for the past three years, and appears to flourish there, but, so far, the spread of infection beyond the limits of the experimental area has been inconsiderable.

An interesting feature of this particular attack was that the application of an Asphalt-Kerosene mixture to infected panels, as soon as the first signs of the mould appear, has proved successful in entirely preventing bark loss.

The bark damage observed on untreated panels closely resembled the damage caused by Black Stripe. It is possible that these two diseases have been confused to some extent in the past, and that some estates which have reported attacks by Black Stripe have really been suffering from a mild attack of Mouldy Rot. The significance of this possibility will be discussed in Section II. It is unlikely, however, that a heavy attack by Mouldy Rot would be mistaken for Black Stripe, for the appearance of the mould developing on infected tissues is very characteristic and can be seen in dry weather as well as in wet. In fact, even during the severe drought which was in progress at the time of the visit, the causal fungus of Mouldy Rot was very easy to identify, and was even then observed to be causing new infections.

With regard to the existence of other infectious panel diseases in Kedah, it was suggested to the writer, on two different occasions, that certain panel infections might be due to species of *Fusarium*, similar to the fungus which has recently been reported as causing a panel disease in Java. While there is little doubt that species of *Fusarium* have frequently been seen on infected panels in Kedah, this does not necessarily mean that they have caused direct parasitic attack on the newly tapped bark. Species of this genus are everywhere of frequent occurrence as secondary organisms growing on dead or moribund plant tissues, and can almost invariably be found contaminating panels damaged by sun scorch or attacked by diseases such as Mouldy Rot. With regard to the two instances brought to the notice of the writer in Kedah the first was probably a case of Black Stripe infection, and the second undoubtedly an attack of Mouldy Rot.

BROWN BAST

Brown Bast is of common occurrence in Kedah, a fact which appeared to be closely associated with the heavy tapping systems which have been in vogue in the past. It has been the custom to tap alternate daily for very long periods, even up to ten years, without rest, and the development of Brown Bast under such circumstances is not difficult to explain. More conservative systems are now rapidly becoming popular, and, with their adoption, a considerable reduction in the incidence of Brown Bast will probably be noticed.

SUN SCORCH

Wounds on the tapping panels caused by sun scorch of the delicate, newly tapped bark during the wintering period, were seen on a few occasions; but, for a district which experiences such a very sharp wintering, when the whole stand is practically leafless and the panels exposed to a fiercely hot sun for two or three weeks in succession, the amount of damage observed was surprisingly small. Perhaps more would have been noticeable three or four weeks later.

SECTION II—SPECIAL PROBLEMS WHICH MAY NEED FURTHER INVESTIGATION

Most of the pathological problems encountered in Kedah differed to a greater or less degree from the corresponding problems in the rubber-growing areas further south, and some seemed to stand in need of special local investigation.

Among the latter the two following problems appeared most pressing:—

BRANCH CANKERS

When discussing branch cankers, a certain planter voiced the opinion that many of the branch cankers on his estate were caused by Patch Canker and not by Pink Disease. During the wintering period, when the causal organisms are dormant, the cankers associated with these two diseases are very similar, and the writer was therefore unable to give an opinion on the matter at the time, but has raised the point with other planters in the same district, and it is hoped that the matter will be cleared up when a consensus of opinion is obtainable.

The common view is that Patch Canker does not occur except on the main trunk, and that cankers in the forks and branches are invariably due to Pink Disease. There appears to be no

adequate reason, however, why Patch Canker should be confined to the trunk to the exclusion of branch infection (unless infection takes place solely by the up-splashing of contaminated soil water during heavy storms, which is unlikely when it is remembered that the causal organism gives rise to leaf and fruit infection in some countries), and if it really happens that branch cankers are often due to this disease and not to Pink Disease, the fact will have an important bearing on the treatment of Pink Disease.

Both diseases react in a similar way to the influence of weather conditions, but with this important difference: whereas, under the conditions obtaining in Kedah, the drought during wintering almost completely checks Patch Canker and sterilizes infected tissues, Pink Disease is more resistant to drought, and the cankers caused by this disease often recommence activity when the rains return.

It is of the utmost importance, therefore, to keep Pink Disease under rigid control in an area where conditions during certain periods of the year are so favourable for its development. In the absence of control, cankers once established may continue their activity from season to season, rapidly ringing the tree at the points of infection, and causing serious damage. Patch Canker cankers, on the other hand, usually exist for one season only, being sterilized during the dry weather and rapidly healing over. Treatment of such cankers from the point of view of the general health of the tree is probably, therefore, waste of effort, since such an excellent means of control is provided by the weather. Treatment of Patch Canker when it appears on the trunk is, of course, of vital importance from the planters' point of view, as it is necessary to minimise the damage done by the disease to the tapping panel, and to ensure that the wounds which are formed shall heal as rapidly and as evenly as possible.

If, therefore, it is shown, as it might well be, that the branch cankers so common in certain parts of Kedah and North Perak are frequently due to Patch Canker, considerable saving may sometimes be made under the heading of "Pink Disease Control". It is perhaps a significant fact that certain planters in Kedah voiced the opinion that an enormous amount of money is continually being wasted on the control of Pink Disease, because, even if left untreated, the actual damage done is small; while others contended with equal conviction that, in their experience, neglect of Pink Disease treatment is a very dangerous policy. If two types of branch canker exist, these apparently conflicting opinions might be reconciled.

There are certain risks to be taken if the treatment of Patch Canker in the branches (if it exists) is abandoned. In the first

place, such a policy may lead to an increasing incidence of the disease on the tapping surfaces, and in the second place it may give rise to an outbreak of leaf and fruit disease since Patch Canker is caused by a species of *Phytophthora* (or a closely allied genus) which has been shown to cause secondary leaf fall and fruit rot in Ceylon. These risks could be evaluated by means of simple experiments. Increase in incidence of the disease on the tapping panel through neglect of treatment of branch cankers is not unlikely, but the risk of secondary leaf fall is small. Both Black Stripe and Patch Canker are caused by species of *Phytophthora* which have been identified with serious secondary leaf fall in other countries with a more typical monsoon climate than that of Malaya, but although both diseases have been well established for many years in Kedah, where the climate is more profoundly influenced by the monsoons than it is in other rubber growing districts of Malaya, secondary leaf fall due to *Phytophthora* attack has never yet developed there to any visible extent.

PANEL DISEASES

If, as is suggested in Section I C, the Black Stripe and Mouldy Rot diseases have been confused in the past, the latter disease may be more widely distributed and economically more important in Kedah than has hitherto been realized. In view of the recent apparent increase in the severity of the Mouldy Rot disease in the south, it will be in the interest of the planting community in Kedah to determine with greater accuracy the local status of the disease, and the amount of increase in infection, if any, which has occurred in the district during the past few years.

SECTION III—OBSERVATIONS ON SOME TOPICS OF GENERAL INTEREST

CLIMATE

The climate in Kedah differs considerably from the climate in the central and southern rubber growing districts of Malaya. It is influenced to a much more marked degree by the monsoons, having a sharper, and more intensely dry and hot wintering period, and a greater concentration of rainfall in the "wet season."

As has been shown above, these climatic differences have a profound effect upon the course of plant diseases, giving rise to problems which differ widely from the corresponding problems in the main rubber growing areas in central and southern Malaya, where the climate is more uniform.

It is the extremes of climate in Kedah, and not the average weather conditions, which are effective in modifying the course of disease, for the latter differ but little from those of the main rubber growing areas of the country, and the powerful modifying effects of the extremes of drought or rainfall, experienced at the dry or wet seasons respectively, are apt to pass unnoticed during a short visit unless the visit happens to coincide with the height of one or other of these seasons.

It is most important, however, that the significance of these effects should be realised before an attempt is made to deal with disease problems in Kedah according to methods which have become established in regions of more uniform climate, such as is experienced, for instance, in Selangor where most of the investigational work has been carried out.

It was fortunate, therefore, that the writer's visit to Kedah coincided with the wintering season, when the contrast between the climate of Kedah and the climate of southern Malaya is more striking than at any other period of the year. As a matter of fact, the drought experienced before and during the visit was of exceptional intensity, even for Kedah. When the tour began at Baling, on February 6th, no rain had fallen there for more than thirty days, and no rain occurred en route until nearly a fortnight later. The visit appeared at first to be most inopportune. The intense drought in progress had brought fungal activity to a standstill (even root disease fungi being dry and difficult to identify) and it was feared that on this account the tour might not be a success. Fortunately, however, these fears proved to be groundless, for although serious difficulties were encountered in handling certain individual problems, the drought interfered surprisingly little with advisory work in general and, as has been indicated above, offered exceptional opportunities for observing and appreciating the peculiar climatic conditions of the district, and their effect upon rubber tree diseases.

As these observations continued during the course of the tour, it became more and more apparent that methods of plant disease control devised in the central and southern districts of Malaya are not necessarily applicable in Kedah without modification. Before such methods can be employed for the control of plant diseases in Kedah the climatic conditions peculiar to the district must be given careful consideration. This dictum applies more especially to stem, branch, leaf and panel diseases, root diseases being less easily influenced by the vagaries of the weather.

Superimposed upon the influence of the monsoons are the influences of the large mountain masses which govern the magnitude of local precipitation. In central and south Kedah the chief topographical features influencing climate are Gunong Jerai

(Kedah Peak), Gunong Bintang and Gunong Bongsu (with Bukit Sungei Ular).

Little information was obtained with regard to Kedah Peak, but its effects on local climate did not appear to extend far out into the surrounding plain. The other two mountain masses, however, have a widespread effect on rainfall on rubber estates in their vicinity, and it is around the foothills of these mountains that most of the trouble is experienced with fungal diseases of the aerial portions of the tree.

Although Gunong Bongsu is only an insignificant hill compared with the mighty bulk of Bintang, yet its effect on local rubber cultivation is more intense than that of Gunong Bintang, as the plantations on its slopes reach much nearer to the centre of the zone of high rainfall than do the plantations on the slopes of the latter mountain. It is on the foothills of Gunong Bongsu that estate rainfall figures reach their maximum, one such estate registering 175 inches in 1932 (an abnormal year in that particular district it is true).

Gunong Bongsu is, in fact, the northern extremity of a belt of high rainfall which extends northward from the Taiping Hills, crossing an area of rubber cultivation at Selama (Perak), and creating conditions there similar to the conditions on the slopes of Gunong Bongsu over the border. In Kedah, the effects of Gunong Bongsu on the incidence of disease are felt in Selama (Kedah), Serdang, Terap, Sungei Ular, Karangan and Mahang, merging into the Gunong Bintang effects on the east, and dying away to the west and north into the plains beyond the foothills.

YIELDS, COSTS AND CONDITION OF CULTIVATION

It was of interest to note the high level of the yields and the low level of the costs on the properties visited, and the high general level of cultivation which has been maintained in spite of the difficulties of the present financial situation.

BUDGRAFTING

Budgrafted rubber is superseding seedling rubber in all new plantings, and there are large budgrafted areas already in bearing and giving excellent yields.

FORESTRY METHODS

Considerable critical interest was shown in the "forestry system" of rubber cultivation, and the effects of the recent "forestry" campaign on plantation practice were evident in many quarters. The general feeling towards the system was slightly

antagonistic, the dislike not being entirely due to prejudice (in spite of the somewhat cynical attitude often assumed when referring to the system) but to a realization of the fact that the scheme may be excellent in theory but that it will be expensive to put into practice, and will inevitably lead to considerable trouble through the increase in incidence of stem, branch and panel diseases.

SUMMARY

1. A general report is made on an extended tour of the main rubber growing areas of the State of Kedah which took place during February 1933.

2. The main problems of pathological interest encountered during the tour are discussed, particularly in relation to their dependence on local climatic conditions.

3. Certain of these problems, which appear to be peculiar to the district, and may need special local investigation, are considered in some detail.

4. Observations are made on various topics of general interest.