Bulletin No. 28.

THE

Indian Lac Research Institute

CONSERVATION OF THE BAISAKHI BER (Z. JUJUBA) BROOD OF THE LAC INSECT, AND POSSIBILITIES OF EFFECTING BETTER RETURNS FROM LAC CULTIVATION ON BER.

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Calcutta:

PRINTED AT THE CRITERION PRINTING WORKS,

8, JACKSON LANE.

1937.

Price Annas Four.

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Conservation of the Baisakhi Ber (Z. Jujuba) brood of the lac insect, and possibilities of effecting better returns from lac cultivation on Ber.

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Introduction.—The piteous sight of many a thousand feet of dead lac on *Ber* (*Z. Jujuba*), one of the two most common hosts of the lac insect and the stark nakedness of this useful tree during the greater part of the summer months (April-June), not only attracts the attention of a casual observer but calls for a remedy from the entomologist and the agriculturist

While trying to grow the lac insect asexually on *Ber* in the Institute plantation in the year 1926-27, it was noticed that, if the tree was partially pruned at the time of infecting with brood lac in October-November and again at the time of male emergence in February, it remained ever green, and the lac insects growing on it did not die in large numbers prematurely. But due to paucity of suitable plants in the Institute plantation and various other unfavourable circumstances, the problem could not be taken up then. However, continuous work on producing asexual generations of lac insects year after year, further confirmed the observation that if Ber trees could be provided with green foliage during the summer months, the heavy mortality in the Baisakhi crop could be reduced considerably.

In November 1931 and again in May 1932, the author was sent to Malda district in Bengal to investigate into the causes of deterioration of lac cultivation and to make recommendations for its improvement. In this district, lac is cultivated only on *Ber*. Nicholson (8) says 'in the Western Bengal districts where the tree is ever green there is no difficulty in growing a successful crop'. But my investigations and observations showed that among other causes, heat and hot winds of the summer months, when the host is practically naked and unable to manufacture fresh food, rendered it difficult for the cultivators to grow their own brood lac to infect sufficient trees for the Katki (June-July to October-November) crop, consequently the Katki crop serves mainly as a brood (seed) crop to grow the Baisakhi; and as there had been a heavy fall in the prices of lac, many a people had given up lac cultivation. It was not possible for the poor cultivators to purchase brood lac which is usually scarce in the summer season at a comparatively high price from their more fortunate neighbours. Along with other recommendations (5) It was, therefore, suggested, that to shorten or to completely do away with the autogenic resting period of *Ber*, a light pruning should be given to the infected trees in the months of January or February.

In October 1932, opportunity was availed to try the experiments in the Institute plantation, even though the trees at Namkum were not big enough and satisfactory.

Position of Ber—(Z. Jujuba) as a lac host and its draw backs.— *Zizyphus Jujuba* (Ber) is the second largest cultivated host of the lac insect in India, *Palas* (*B. frondosa*) being first, and the quality of lac produced by it falls, with others, in the second class. From the reports of Mr. N. K. Sarkar, the Crop Statistician of the Lac Cess Committee, *Ber* would seem to form over 40% of the lac cultivated host plants and it stands first among them in Bihar, *Palas* (*B. frondosa*) being the close second. In Bengal, as stated before, it is practically the only host plant used for lac cultivation, and same is the case in U. P., Punjab, Rajputana etc., where lac is cultivated on a smaller scale. Though it is such an important host, and used extensively to cultivate both the Katki (June-July to October-November) and Baisakhi (October-November to June-July) crops, even in Bihar where *Palas* is also used for lac cultivation, very little of the Baisakhi crop grown on it reaches maturity, with the result that in the various districts of India, most of the crop on it has to be cut *Ari* (immature) from the middle of April to middle of May. So much so, that most cultivators do not get from their trees sufficient brood to infect the trees for the Katki crop. And in years when the summer is particularly severe, the brood from it as well as from other Baisakhi hosts becomes very scarce and difficult to obtain by purchase even from a distance. Many a cultivator, therefore, even in a province like Bihar, where Baisakhi crop is usually grown on more than one type of host, have to go without infecting their plants, and nothing to say of provinces like Bengal where it is the only host plant used for cultivation of lac.

Causes of mortality in the Baisakhi crop and their scrutiny.—Besides the attack of predators and parasites, the other causes attributed by a layman to the heavy mortality in the Baisakhi crops are:—

1. Death of the lac insect due to rain, fog and excessive cold in the months of January and February.

2. Scanty showers of rain and hot winds from end of March to middle of June or so.

Cold, rain and fog do not seem to cause any appreciable damage to the crop at this stage, as the lac larvæ have by this time settled and advanced to second and third instar stage of development, are covered with their resinous coats, and the lac insect can stand fairly low temperatures, high humidity and heavy rains [Negi (6) and (3); Glover, Negi, Misra and Gupta (1)]. Moreover, in most of the lac-growing areas there is not much rain fall during these months. The average rain fall, on the basis of 17 years' (1915—1931) data, of Malda, Bengal for the month of December, January and February, is 0·05″, 0·60″ and 0·50″ respectively and in Namkum on the basis of 10 years' (1927—36) the average rain falls for the corresponding months are 0·37″, 0·97″ and 0·85″.

The mortality in lac insects (Table I), in the Baisakhi crop on Ber for the last nine years does not also show much increase in these two months (January and February) as supposed by the cultivator, if 32·9% the average first instar mortality (from about the middle of October to end of December) which probably is mainly due to close settling

I. L. R. I. Bulletin 28. Plate I.

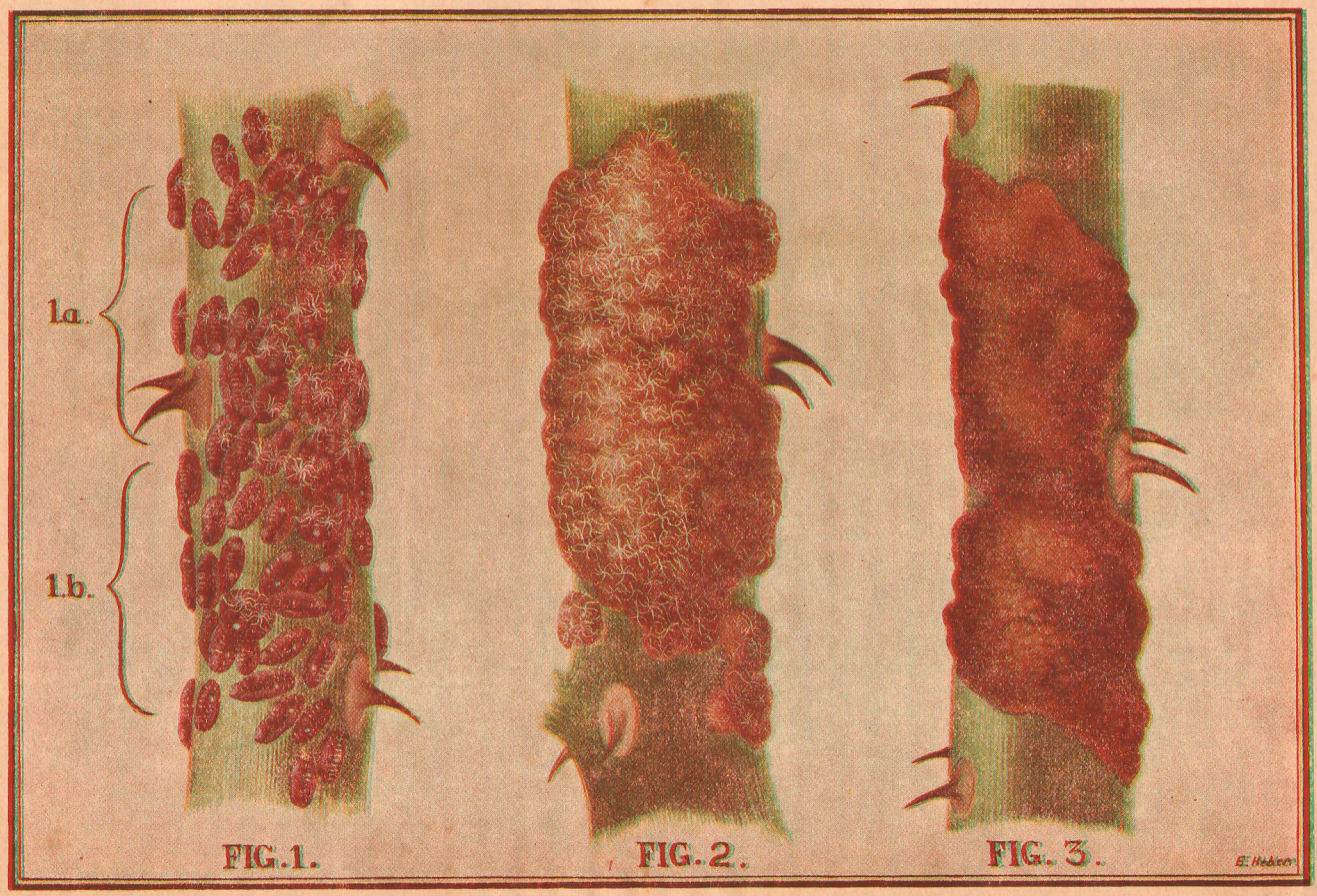

Fig. 1 : 1a Oblong cells second and third instar males ; round cell third instar female.
Fig. 1b Oblong cells without white wax filaments and oval opening at one and are empty male lac tests.
Fig. 2 Healthy lac near maturity.
Fig. 3 Dead lac ; killed by hot winds, and insufficiency of food.

of the lac larvæ and competition for food betwen them, is left out of consideration. The figures (Table I) would show that the rise in mortality in January is only 5·1% over that of December and in February 7% over that of January. It, therefore, follows that rains, fog and excessive cold in the months of January and February do not adversely affect the Baisakhi crops as believed by the lay man. The reason for this erroneous statement is that there is always a preponderance of males in the Baisakhi crop than in the Katki. The average percentage of the living males in the third instar Katki crop based on nine years' data is 20·2% and in the Baisakhi 39·1%, *i.e.* the ratio of the living third instar males in the Baisakhi is nearly double that of the Katki. In certain years, it happens that the preponderance of males in the Baisakhi crop is unusually large, and as January to February is the period in most of the lac-growing tracts for the 2nd and 3rd instar stage (Pl. I, fig. 1*a*) and the male emergence, the empty male lac cells (Pl. I, fig. 1*b*) do not any more show white wax filaments and look like dead and dry cells. The cultivator, who is unaware of the existence of two sexes in the lac insect and difference in their development and habits of life, imagines that the lac insects have been killed by rain, fog and cold. While the main causes of the heavy mortality in the Baisakhi crops are:—

1. Excessive heat and hot winds in summer season (April-June), specially when there is scanty rain fall and uneven distribution of rain over these three months when it is not scanty.

2. Ber is a deciduous plant and the general leaf-fall time in Northern India is from about the beginning of March to the middle of May, and the new leaves on lac bearing trees in the absence of regularly distributed and sufficient rains do not appear till about the second half of June.

It, therefore, happens that in the total or partial absence of leaves due to excessive heat and direct attack of very hot winds the resinous covering of the lac insect melts and as the lac insects lie close together, their breathing orifices and some times the anal also are blocked by the melted resin (p. I fig. 3.) Hence a fairly large number of insects die of suffocation. Again, in the absence of green leaves, the plant is not able to manufacture fresh food, so the tree and lac insects on it have to depend for their wants on its reserved food supply. But as the plant is not able to cope with the demands of its numerous branches and the insect feeding on their juice, hundreds of thinner shoots dry up and the lac insects thriving on them also meet the inevitable death; in others, the supply of food is insufficient and, therefore, only very healthy ones survive and the remaining either die or become unhealthy. This state of affairs naturally ends in a poor yield of brood lac. This fact is amply illustrated by the mortality figures for April-June (Table I), when the rise in the percentage of the developed female mortality alone over that of first instar is 37·9%, 40·0% and 49·1% as against 12·8, 17·9 and 24·9 of December, January and February which include the male mortality too. If one deducts the male mortality the rise in the mortality of the females would have been still more marked. It will be noticed that there is not a marked rise in mortality in May over that of April. It is so, because in May to tide over the excessive hot period, the insect tries to æstivate but only succeeds in becoming unhealthy and subsequently succumbs in June.

Cultivator's method of preserving brood and its defects.—Negi (5) says that in certain years when the hot wheather is too severe and the lac insects on the trees begin to die in very large numbers, the cultivator in certain parts of India *e.g.*, Bengal and portions of Bihar cuts off even his brood lac from the trees about four to six weeks before the usual swarming time and stores it safely in some cool place or pits in his house and at intervals wets the sticks with cold water.

Negi (3) has pointed out that this procedure cuts off the mother insect from nourishment about one and a half month before swarming and the vitality of the mother, without food, goes down considerably and makes her unfit for the delivery of hundreds of young ones. The result is that most of the mothers die without delivering a single egg, others give birth to a few, and the young ones being of low vitality die in large numbers. Even if some survive, the progeny gets weaker.

Importance of leaves in the nutrition of plant.—In order to understand the importance of the implications of the method adopted to combat the difficulties in the cultivation of the Baisakhi lac crop, it will not be out of place to repeat the well known fact that leaf is as necessary as the root in the nutrition of a plant. It is the leaf that obtains for the plant what is quantitatively and qualititatively its principal food. The green leaf absorbs carbonic acid gas from the atmosphere and in the presence of sun light, with water pumped up by the roots, sugar is formed which reacts with the nitrates in solution and the amino acids, which lead to the final preparation of food of the plant, are formed. The evaporation from the leaves which constantly draw water from the aerial parts of the plant is, therefore, the principal reason for the absorption of fresh quantities of water from the root into the stem. It is only in the conjoint and uniform fulfilment of all these functions that the activity of the plant will be completely normal. The balance is upset otherwise.

Yearly periodicity of Ber.—In temperate climates plants exhibit a pronounced yearly periodicity due to the alteration of a period of activity in summer with a resting winter. This is mainly due to the low temperature during winter. But in the plains of tropical countries like India, the periodicity is mainly due to drought and light. In dry seasons the plants loose their leaves, and rest partly owing to the direct action of the deficiency of water and partly owing to an autonomic periodicity induced by its regular occurrence.

Ber shows its autogenic periodicity right in the summer months. Though a xerophyte, it has a strongly developed root system. Fig. 4. shows the root of an 11 year old tree. It would, therefore, appear that atmospheric drought and light, and not the soil drought are mainly responsible for the autogenic periodicity.

How to render Ber green during the hot weather.—Several well known workers have suggested various methods by which resting period in plants may be shortened, *e.g.* with anæsthetics, by change of temperature or by transitory dessication etc. But the best method suited to the cultivator is the removal of winter and spring foliage.

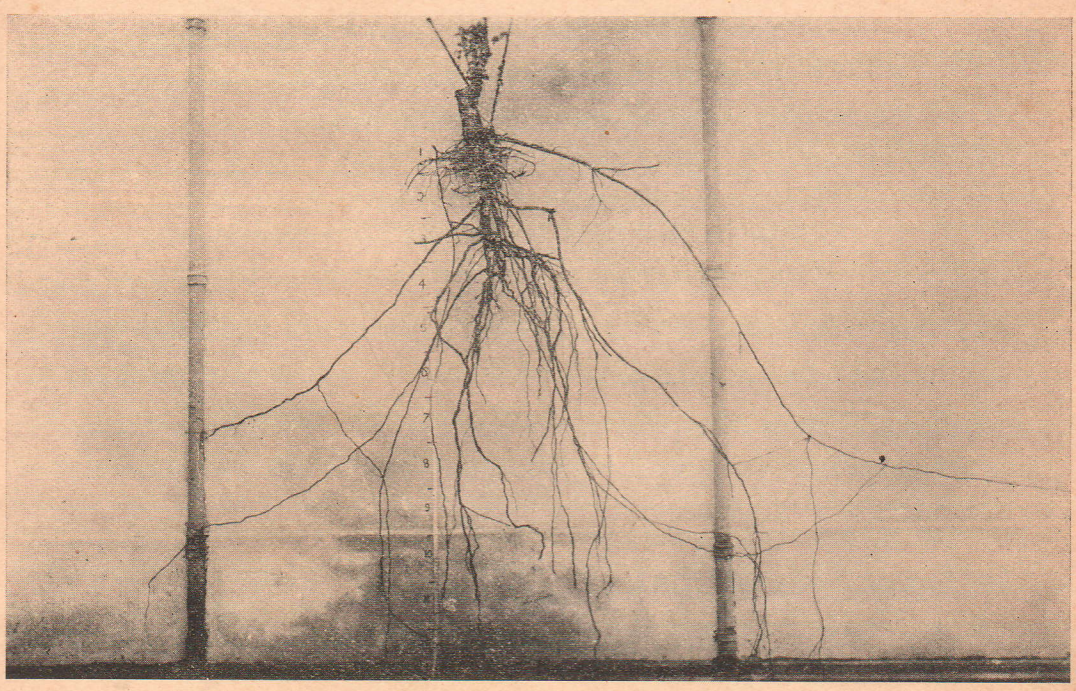

Fig. 4 Root of an 11 year old Ber tree, the primary root in the centre went down to a depth of 5 ft. 8 inches, portion of the root was found actually under water. The secondary roots spread over 22 ft. length and went down to about 4 ft. deep.

FIG. 5 DIAGRAMMATIC.

Fig. 5 Diagrammatic sketch showing how the tree should be partially pruned. Red marks show the place where the shoots have to be cut.

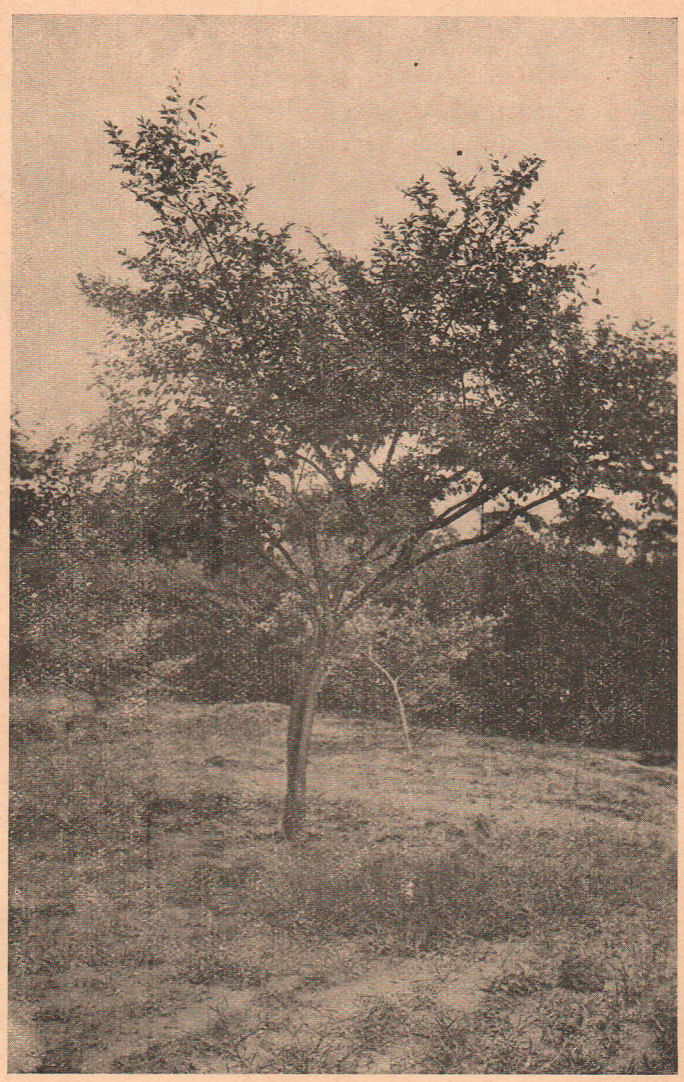

Fig. 6 A Ber tree before partially pruned.

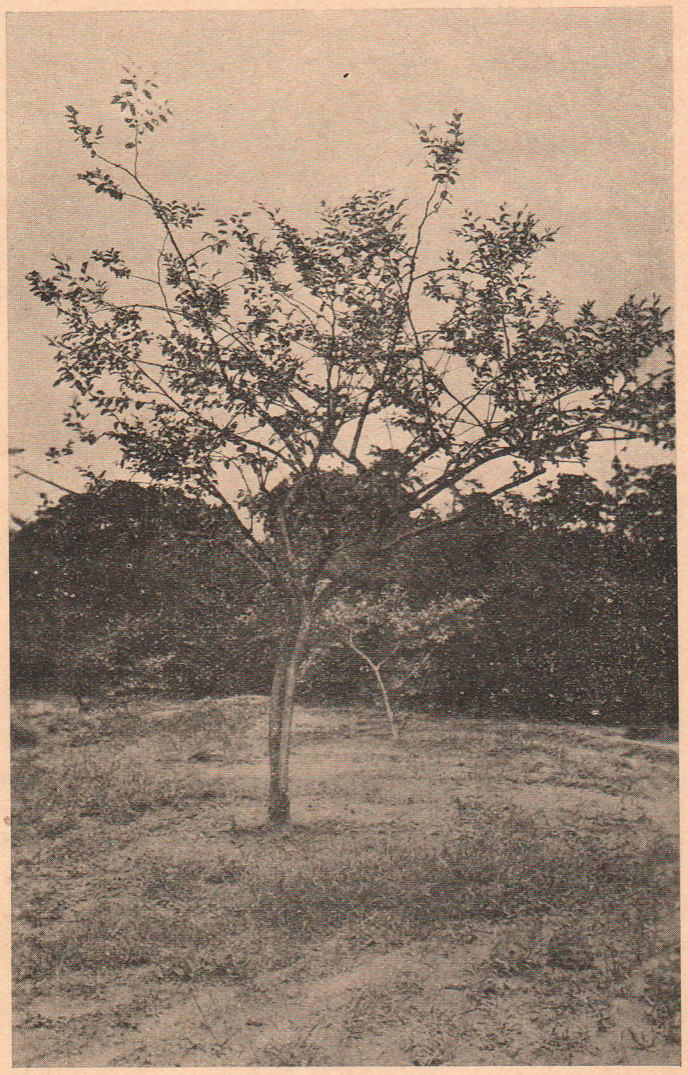

Fig. 7 Tree in fig. 6 after partial pruning.

In Ber, like other deciduous plants, it causes immediate development of new buds. And the object is best achieved by removiug some of the shoots from the plant.

Choice of partial pruning period —January to first half of February would seem to be the suitable period for partial pruning. By this time the males in the Baisakhi crop in certain localities as in some parts of the Malda district, Bengal, have swarmed out and in others like Ranchi in Bihar are about to swarm. The male lac insect is practically of little economic importance as its produce of lac is almost nil, and its presence in the crop to keep the continuity of the race is not absolutely necessary has been shown by Negi's researches on the sexual development of the lac insect for the last 11 years (4). Moreover, in localities where it has swarmed by now, it has produced all the lac that it was capable of, and in others where it is about to swarm, its lac secreting activity is almost at an end by this time.

Removing of mainly male bearing branches will also help to a great extent in reducing the prevalence and attack of chalcid parasites of lac insect, as due to quicker development of lac males than the females, they are mostly found at this stage of the crop in the former than in the latter. The percentage of male and female parasitisation by chalcids from 21st January to 15th February on the basis of seven Baisakhi crops on Ber is 5·99% and 2·04% respectively.

Technique of partial pruning.—As far as possible all the branches under three-fourth inch diameter not bearing lac and the branches and shoots very sparsely covered with lac irrespective of their size should be cut off flush. So also, the branches and shoots mainly covered with male lac insects (pl. I, fig. 1). And from the branches and shoots having preponderance of females some of the thin shoots (thinner than the little finger of man) that have no chance of surviving even the early part of the summer and are conveniently approachable should be removed flush in such a proportion that two-third of such shoots are left on the plant and only one-third removed. Fig. 5 give the idea how the pruning is to be done.

Experimental studies and results.—This method of rendering *Ber* green during the summer months was tested in the Institute plantation for the four Baisakhi crops (1932-33, 1933-34, 1934-35 and 1935-36), the results of which are given in table II and briefly stated below. All along, the trees used as control were the one with larger frame, better growth, and healthier than the experimental ones. During the last crop, the disparity between the two was kept so great that the length of the lac bearing sticks in the control was 1,622 feet and 5 inches (nearly 541 yards) more than the experimental.

The experimental trees were partially pruned as stated under technique for the first two years (1932-33, 1933-34) about the middle of February and for the next two years (1934-35, 1935-36) in the last week of January. Fig. 6 shows, the photograph of a tree before partial pruning and fig. 7 after pruning. The amount of scraped lac obtained from the prunings (Table II) was negligible and, therefore, not worth the time and labour spent on scraping it. It is, therefore, suggested that the prunings may be burnt soon after the operation in localities where the emergence of males takes place about the

suggested partial pruning time and scraped where the emergence of males has taken place long before. Either procedure will kill the parasites and predators and prevent them from emerging and attacking the crop afresh.

Table II, on the average based on the four years' work, shows that in the month of April, May and June respectively, the percentage of old leaf bearing trees (fig. 8) in the control was 64, 16 and 11, and in the experimental 26, 1 and 1; the percentage of stark naked trees (fig. 9) in the control was 14, 43 and 37 and in the experimental it was 4, 10 and 7 only. The table also shows that in the same months, the percentage of the control trees which put forth new leaves in large numbers (figs. 10) was only 7, 23 and 30, while in the experimental (fig. 10*a*) it was 36, 69 and 74.

From Table II, it will also be seen that the ratio of brood lac obtained from the control trees to that of the experimental was 1:4·52 and 1:4·11 in the 1933-34 and 1934-35 Baisakhi crop when the hot weather was very severe (Table III), and the total length of the lac covered sticks in the control crop was 168 ft. (*i.e.* 3%) and 139 ft. (*i.e.* 6%) more than in the experimental including the length of the lac covered sticks pruned in January and February and almost at par even in the 1935-36 Baisakhi crop when the hot weather was milder and the total length of the lac covered sticks in the control was 1,622 feet (24%) more than in the experimental. The table also shows that the ratio of the scraped lac from the brood infected to brood lac obtained is in every case higher in the experimental than in the control. The gain and loss column in the same table shows that except the loss in 1935-36, there has always been a high percentage (43-53) of gain in the monetary value of the brood lac obtained from the experimental trees over that of the control after deducting the cost of labour involved in partial pruning. The reasons for the loss in 1935-36 crop are, too great a disparity in the frame, health and actual lac covered length of the control and experimental trees on one hand and mild hot weather on the other. Because in the mild hot weather with distributed rains in the summer months even without pruning a larger number of plants put forth new leaves from the beginning of the hot weather and retain old leaves in a healthy condition for a longer period. It will, however, be seen that this loss of 31% is practically the cost of pruning, as the brood yield, in spite of all the advantages in favour of the control trees, is almost the same in both.

Discussion and Conclusions.—The observation on the foliage showed that the abscission of leaves in the majority of Ber plants begins to take place from about the middle of March; and in the months of April, May and first half of June leaves wither, die and are removed by the winds and the rains. Under such conditions, neither the stomata nor the chloroplasts of the leaves are healthy. Moreover, according to Maximov (2) 'the amount of water obtained by the plant through active root suction though not negligible is inconsiderable in comparison with that sucked in passively by the roots under the influenee of the strong suction transmitted to the roots from the transpiring leaves'. This would mean that in the month of April, May and first half of June and especially the latter two months, the old leaves can hardly prepare and transmit any food for the use of the plant and consequently of the insect thriving on its sap. Not only this, due to reduced rise of nutrient sap from the root to the extremeties of the plant, the thinner

Fig. 8 A Ber control tree showing condition of leaves in May in spite of extremely mild hot weather.

Fig. 9 A leafless Ber control tree in May.

Fig. 10 A Ber control tree showing new leaves in May.

Fig. 10a A Ber partially pruned (experimental) tree showing development of new leaves in May. Mark the difference in the number of leaves in 10 and 10a.

branches and shoots on which the lac insects are thriving also gradually die and along with them the lac insect which is a parasite on them.

Besides the above, in the absence of soil drought, the leaves both directly and indirectly to a certain extent protect the tree and the lac insect thriving on it from the atmospheric drought which is so high in these months. The leaves to a great extent cool the hot winds before they meet the shoots and the lac insect growing on them and thus lessen the chances of lac tests melting and blocking up the brachial and anal pores of the closely coalesced lac insects. The shade on the ground underneath the trees lessens radiation of heat from it and probably also reduces the rate of evaporation of water from the soil. It, therefore, naturally follows that the lac insect would thrive better on trees with green leaves than those with either old withered and dead leaves or without them. And the presence of the former in larger number of the experimental trees than the control explains the difference in the output of brood lac in the two.

The Baisakhi crop from most of the hosts including Ber is removed *Ari* (immature) from about the middle of April to the middle of May. This is the period when the percentage of the leafless trees rises to 43%. By the middle of May on the average an individual healthy Baisakhi lac female on *Ber* secretes about 0·012 grammes of lac, and up to the time when it actually commences egg laying in June-July, *i.e.* about 4 days before the emergence of larvae (6), it secretes about 0·029 grammes of lac. In other words by the middle of May or in places where development is quicker by the end of April a healthy lac female secretes only about half the quantity of lac it is capable of. The resin secretion tables of Venugopalan (9) on the whole confirm these figures. It is, therefore, evident that the cultivator due to unfavourable conditions to Ber in the Baisakhi crop gets from it practically only half the quantity of lac that he would get otherwise.

It has already been stated elsewhere that the experimental trees resulted in preserving more brood lac than the control; and a further reference to Table II will show that inspite of the control trees being more healthy, bigger in frame, and having the greater lac covered length, and inspite of some of the shoots covered by female lac insects having been pruned from the experimental trees, the ratio of the scraped lac from the brood infected to the total scraped lac yield obtained from the experimental trees is about one hand a half times more in 1932-33 and 1933-34 crop and almost at par in 1934-35 and 1935-36. Of these four crops the first and partly the last had a mild hot weather (Table III) while the second and third had a very severe one. The meteorological data in Table III also show that for a successful Baisakhi crop, rain in the second half of March, distributed rains in May and the first half of June are conjointly essential.

Other conditions being the same for both the group of trees, it follows that the growth of new foliage on most of the experimental trees as a result of partial pruning enabled the lac insects on them to receive a continuous supply of food and protection from direct hot winds, and survive in large numbers to produce their full quota of lac.

The cultivator, therefore, would be better advised not to remove practically the whole of his crop *Ari*, all at a time, as he does at present, but remove at intervals of a fortnight only those branches on which the lac insect is actually dying (pl. I, fig. 3).

Due to dearth of brood lac in the Baisakhi crop, in practically all the lac growing areas where *Ber* is a host, only a small percentage of trees is generally infected to grow the Katki crop. The result is that the cultivator, inspite of the most favourable season for the growth of the lac insect and the host, gets a crop just enough to provide him brood to infect his trees for the Baisakhi crop, which as stated before gives him only half the output of lac that the insect is capable of. But now with the partial pruning method recommended to preserve the Baisakhi brood, it would be possible for the cultivator to divide his trees more equitably between the Baisakhi and Katki, and thus derive much more profit from his Ber trees than he was doing till now; and also ensure continuity in lac cultivation without a recourse to pruchase of brood lac from others, and to unfruitful method of cutting of brood lac six weeks earlier and preserving it in cool places. It is also possible that in certain localities with the help of partial pruning as recommended in this paper, it may even be possible for him to convert the Baisakhi crop on Ber as the brood (seed) crop and the Katki as the yield.

Summary.

1. *Ber* is the most common lac host in India.

2. The main causes of mortality in Baisakhi *Ber* crop are:—

(*a*) Atmospheric drought in summer months.

(*b*) Nakedness of the tree in hot weather.

(*c*) Shortage of food supply to the plant and the lac insect thriving on its sap.

3. Removing the brood lac about 6 weeks earlier than actual emergence is injurious.

4. Partial pruning of *Ber* in the last week of January provides the plant with leaves in the hot weather and thereby reduces the mortality, and enables the cultivator to get more brood lac and better returns in crop in general than he is having at present.

In partial pruning, branches and shoots under $\frac{3}{4}$th inch diameter not bearing lac, very sparsely covered with lac, and mainly covered with male lac insects are to be cut off flush. And so also the shoots thinner than the little finger of a man from branches mainly covered with female insects in a proportion that about one-third of such shoots are removed.

5. The female lac insect produces only about half the quantity of lac it is capable of by the time (15th April—15th May) the crop is removed *Ari*. The cultivator, therefore, gets only half the output of lac than he would get at the crop maturity, if the Baisakhi crop survived normally.

6. Removing most of the crop *Ari* all at a time should be avoided, and instead crop to be removed *Ari* at fortnightly intervals from 15th April onwards only from those branches on which the lac insects are actually dying, *i.e.* have pitted and dry appearance (fig. 3).

7. Partial pruning to a great extent will reduce the scarcity of brood lac in Baisakhi crop. Therefore a more equitable distribution of trees between the two crops is suggested, and thereby make lac cultivation on Ber more profitable than at present.

8. Rains in second half of March, distributed rains in May and first half of June are essential for a successful Baisakhi crop.

Acknowledgments.—I am thankful to Dr. H. S. Pruthi the Imperial Entomologist, New Delhi and to Mr. J. C. M. Gardner, the Officiating Forest Entomologist, Dehra Dun, for their helpful suggestions on the manuscript of the paper, to Dr. H. K. Sen the Director of the Institute for the interest he took in the preparation of this paper, and to Mr. Ranganathan the Assistant Chemist for giving me the meteorological data for Namkum. I also wish to express my thanks to Mr. E. Heber the Artist for the photographs and the accompanying plate and to Messrs. Ramprasad, A. C. Chatterjee, Saheb Ali and B. Tirkey of the department for helping me in the routine work connected with the data presented in the paper.

Table I.

Average percentage mortality in Baisakhi (Oct.-Nov. to June-July) crop, and percentage of increase in mortality over 1st instar average mortality.

Average 1st instar mortality *.	Average percentage of mortality in									
	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	July.
32·9%	6·4	24·9	45·7	50·8	57·8	60·6	70·8	72·9	82·0	86·4
Increase in mortality over 1st instar mortality.	nil.	nil.	12·8	17·9	24·9	27·7	37·9	40·0	49·1	53·5

*The 1st instar stage in Baisakhi crop lasts for about 7 weeks after settlement of the larva. The brood is left on plants for about three weeks. The average 1st instar mortality is, therefore, based on 9 years mortality figures from about the middle of October to end of December.

Table II.

Comparative results of foliage, yield and gain or loss in the control and

Crop & No. of trees used.	Weight of brood lac infected.		Trees partially pruned on.	Lac covered Length pruned.		Length.	Labour charges on partial pruning.	Percentage of trees in round numbers showing condition of foliage in the month of:										
								April.				May.				June.		
	Lac sticks.	Scraped lac		Wt. of Lac sticks.	Wt. of scraped lac.			Many new leaves.	Few new leaves.	Many old leaves.	Naked.	Many new leaves.	Few new leaves.	Many old leaves.	Naked.	Many new leaves.	Few old leaves.	Many leav
	Srs. Ch.	Srs. Ch.		Srs. Ch,	Ch.	Ft. In.	Rs. A. P.											
Baisakhi 1932-33																		
Control 50	24 2	5 14	...	...	...	...	..	Not counted.	Not counted.	Not counted.	Not counted.	6	20	50	24	12	40	30
Experimental 50	24 2	4 12	17·2·33 18 2 33	6 7	1	Not measured	1 9 0	Not counted.	Not counted.	Not counted.	Not counted.	78	16	...	6	84	14	...
Baisakhi 1933-34																		
Control 78	10 8	2 12	...	...	...	...	...	16	36	40	8	23	39	..	39	23	39	...
Experimental 75	10 8	2 2	10·2·34 11·2·34	0 11	1/3	119 0	2 13 6	44	40	13	3	41	45	...	13	41	45	...
Baisakhi 1934-35																		
Control 74	13 4	3 4	...	...	...	...	...	7	8	59	12	25	18	9	34	29	8	2
Experimental 74	11 6	2 15	25·1·35 26·1·35	1 0	1/5	154 5	2 10 0	54	19	13	...	69	11	...	6	73	7	...
Baisakhi 1935-36																		
Control 217	65 12	20 10	...	...	...	...	...	3	9	71	17	24	12	15	49	36	17	13
Experimental 217	44 10	18 11	29 1·36 30·1·36	2 0	1	731 0	5 13 9	24	35	34	6	73	13	2	11	78	14	2
Average total percentage control ...								7	14	64	14	23	19	16	43	30	22	11
,, ,, ,, experimental ...								36	34	26	4	69	19	1	10	74	19	1

N. B.—A seer (Sr.)—2 lbs.
16 Chattaks (Ch.)—1 seer.
40 seers—1 maund (82 lbs.)

Table II.

ld and gain or loss in the control and experimental trees for four Baisakhi crops.

showing condition of foliage in the month of:							Yield obtained.						Length of lac sticks.		Total length.	Ratio of scraped brood to scraped yield.		Ratio of control brood to exptl. brood.		Price of Ber brood per md. in June-July.	Approx. gain (+) or loss (−) in price of brood lac by partial pruning after deducting cost.
							Weight of lac at maturity.														
May.			June.				Fit for brood.				Unfit for brood & dead.										
v new ves.	Many old leaves.	Naked.	Many new leaves.	Few old leaves.	Many old leaves.	Naked.	Lac sticks.		Scraped lac		Lac sticks.		Scraped lac.		Fit for brood.	Unfit for brood & dead.		Fit for brood.	Total yield.	Lac sticks.	Scraped Lac.		
							Md.	Sr. Ch.	Sr.	Ch.	Md.	Sr. Ch.	Sr.	Ch.	Ft. In.	Ft. In.	Ft. In					Rs. A. P.	
30	50	24	12	40	30	18	1	16 13	13	11	3	15 13	27	8	Not measured		...	1 : 2·32	1 : 7·00	1 : 2·20	1 : 2·51	10 8 0	+50%
16	...	6	84	14	...	2	3	4 2	33	11	2	25 9	16	2	,,	,,	...	1 : 7·10	1 : 10·50				
9	..	39	23	39	...	39	0	4 8	0	11	3	4 12½	14	15	131 7	5263 7	5395 2	1 : 9·25	1 : 5·67	1 : 4·52	1 : 4·86	30 0 0	+53%
5	...	13	41	45	...	19	0	20 5½	3	5½	2	18 14	13	8	513 0	4595 4	5108 4	1 : 1·57	1 : 7·92				
8	9	34	29	8	2	46	0	3 1½	0	4½	0	36 5½	2	2½	135 0	2046 10	2181 10	1 : 0 08	1 : 0·75	1 : 4·11	1 : 3·55	23 0 0	+43%
1	...	6	73	7	..	6	0	12 11½	1	0	0	24 9	1	2½	487 0	1401 3	1888 3	1 : 0·34	1 : 0·73				
2	15	49	36	17	13	35	1	17 5½	12	6	2	37 9	13	1	1703 4	4990 10	6694 2	1 : 0·6	1 : 0·23	1 : 0·98	1 : 1·06	11 8 0	−31%*
3	2	11	78	14	2	6	1	16 11	13	2½	1	30 10½	6	6	1706 9	2634 0	4340 9	1 : 0·7	1 : 1·05				
	16	43	30	22	11	37																	
	1	10	74	19	1	7																	

* For explanation see text page 6.

Table III.

Meteriological data.*

Date.		1st to 10th.				11th to 20th.				21st to month end.				Remarks on weather.
Month.	Year.	Temperature.			Rain-fall.	Temperature.			Rain-fall.	Temperature.			Rain-fall.	
		Highest max.	Aver. max.	Aver. min.		Highest max.	Aver. max.	Aver. min.		Highest max.	Aver. max.	Aver. min.		
March ...	1933	92·0	84·9	57·5	...	95 0	92·1	62·5	...	96·0	92·09	65·4	0·32	Good
	1934	92·0	87·3	56·8	0·06	91·0	87·8	58·5	...	100·0	96·2	67·4	...	Bad
	1935	86·0	84·0	55·3	0·18	97·0	92·85	60·3	...	99·0	95.27	71·8	1·14	Bad
	1936	92·0	91·1	63·3	0·86	95·0	88·5	58·4	...	97 0	94·8	63·8	0·32	Bad for lower temperature
April ...	1933	103·0	97·6	67·5	...	98·0	90·1	63·8	1·52	103·0	96·4	70·1	0·09	Good
	1934	105·0	101·5	69·4	...	105·0	100·1	69·1	0·81	105·0	99·6	70·5	...	Bad
	1935	96·0	90·5	74·7	0·49	97·0	94·15	64·9	0·47	104·0	98·0	68·6	0·04	Good
	1936	100·0	95·3	67·7	0·03	104·0	100·5	66·3	...	105·0	103·7	72·6	...	Bad
May ...	1933	103·0	94·1	67·2	1·36	99·0	96·4	72·1	0·06	102·0	97·18	74·0	3·61	Good
	1934	106·0	103·2	75·7	...	108·0	105·3	75·85	0·03	109·5	106·99	85·6	...	Bad
	1935	108·0	105·2	74·3	...	107·5	105·1	76·3	...	110·0	108·5	85·1	...	Bad
	1936	109·0	102·1	72·9	2·52	104·0	98·3	73 7	0·11	94·0	90·9	74·6	3·62	Good
June ...	1933	103·0	98·3	78·2	0·34	91·0	86·8	73·9	5·25	90·0	86·3	74 2	4·79	Good
	1934	107·0	101·1	75·7	1·10	102·0	96·95	75·0	1·85	93·0	87·6	74·0	4·68	Bad (first ten days)
	1935	111·0	109·2	81·6	...	106·0	99·15	74·0	1·81	101·0	92·9	75·0	1·17	Bad
	1936	101·0	96·3	75·2	0·37	92·0	84·7	72·3	6·29	91·0	93·4	73·0	7·26	Good

* The rainfall and temp. is given in inches and F. It is divided into three groups for each month to give a correct idea, when the crop is greatly affected.

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