Mealy Bugs. Their Effect on Cane Culture and Manufacture in Natal.

By G. C. Dymond

Mr. G. C. Dymond read the following paper on the above subject.

The difficulties encountered in sugar manufacture in this country are due to certain specialised factors associated with the growth of Uba cane.

Only in recent years has it been realised that our problems are peculiar to the particular conditions of this country, and that the importation of accredited specialists and processes has done little in solving either the cause, or in finding the remedy for our peculiar conditions.

Once having realised this fact, the first step in the development of a scientific consciousness, which is progress, was evolved; without this realisation we should have continued to suffer from an inferiority complex and merely continued to refer our specialised problems to the worn text-books of the old established industries of other countries.

The reason for the varying conditions in sugar is of course due to the fact that sugar technique is not an exact science, because its raw material is a living plant, affected as are all living things by a multiplicity of factors. Thus, for example, the wines of France and of the Cape are never quite the same, because their bouquet, or the qualities and quantities of their non-alcohols, are dependent upon the vagaries of living organisms, together with the geographical situation and species of the vine. In much the same way is growing cane affected, while the non-sugars resulting from such conditions control the efficiency of the industry.

Looking ahead with the belief that large developments in Empire sugar production will take place, we have two lines of scientific development on which to work.

First, the alteration of the cane itself by irrigation, or by substitution with other varieties, thereby making our factory problems easier and comparable with those of the more fortunately placed sugar countries; or, secondly, by accepting the Uba cane and concentrating on more efficient methods of treating its juices than are in vogue to-day. The first is for the present to a large degree beyond our individual control, though we may each assist in developing that scientific consciousness in all sections of the industry, and thereby enable the Experiment Station to get that financial support which at present it so sadly lacks.

The second line of development is one largely dependent on individual efforts, and open discussion of our problems at the annual meetings of the Technologists' Association. Now, before attempting any research on our Uba cane problems, it is necessary that the broad principles of what is required shall be clearly understood.

The fundamental principle of any process dealing efficiently with Uba juice is the elimination of certain non-sugars before the action of high temperatures and chemicals convert them into a filterable form.

The difficulty of filtering our juices is notorious, while past and present methods overcome these conditions by actions which render the obstructing non-sugars filterable.

The easing of the filter press station by boiling up with lime is such an action engendered by the inefficiency of the defecation process to deal effectively with Uba juice.

The defecation process may be described as a chemical process with a low physical value, and by physical value is meant a low percentage of an efficient filtering medium for the easy elimination of all suspended and colloidal matter in the juice. Carbonatation is the only process with a high physical value in practice to-day, but owing to well-known factors its general application to our industry is impracticable.

What are these non-sugars? Their quantity is by no means excessive as our purities compare favourably with any country in the world. It follows, therefore, that their quality must be objectionable in the extreme.

THE MEALY BUG.

There is evidence, collected during the last few months, that the Mealy Bug (Pseudococcus sacchari) is to an unknown but very definite extent responsible for the production of a dextro-rotatory gum together with colloidal matter of a particularly objectionable nature.

In Louisiana a closely related pest has been the subject of at least two bulletins published from the Sugar Experiment Station at Baton Rouge, the agricultural aspect alone being considered.

In this country nothing has so far been done in investigating the damage caused by this pest, while any connection between its depredations and factory problems has apparently been overlooked, even in those other countries in which it has rightly been considered a serious cane pest.

LIFE HISTORY.

The mealy bugs derive their name from the white mealy-like secretion with which they cover themselves. The adult females are about one-fifth of an inch in length and of a pink fleshy colour. Their minute legs enable the young larvæ to move freely about the cane stalks, but are of little value to the mature insect, which passes the remainder of its life within the selected cane sheath.

The white waxy secretion which usually covers the insects is the repository for their numerous eggs.

The adult male is a winged insect and not usually recognised.

Propagation continues intermittently throughout the year, but is greatly increased during the spring and summer. Frost kills them, but at this time of the year a large percentage may be found safely ensconced among the roots of the cane, from whence they emerge with the young shoots in spring.

This explains why the practice of burning in this country has not effected their eradication, though it is highly probable that this practice does effect a certain measure of control on their activities.

They live on any part of the cane except the leaves, and are transported to new cane fields with the plant cane.

Their life history as worked out in Louisiana is bound up with the activities of the Argentine ant which protects it for the honey dew which it secretes. In fact by suppressing the ant by poison syrup the natural enemies of the mealy bug are sufficient to effect an efficient control in Louisiana.

In this country the small black ant is frequently found among the more exposed colonies of bugs, but affords no protection in return for the honey dew. The Uba cane itself with its resistant trash affords admirable protection against its natural enemies.

It is noticeable in this connection that irrigated cane, bull shoots or any fine cane grown under good conditions and from which the trash readily falls, shows little, if any, mealy bug infection; whereas cane grown under poor conditions and to which the trash firmly clings shows heavy infections.

Such cane germinates badly, for the eyes have frequently rotted, whereas the former gives a maximum germination on planting.

The natural enemies of the mealy bug are fairly numerous, but many no doubt would be rendered impotent by Uba trash protection.

Several species of lady bird beetles feed greedily upon the eggs, while in a recent edition of a scientific American paper comment is made upon the exportation of beetles from California to orchardists in South Africa to control the mealy bug in their plantations.

In damp weather an Aspergillus fungus does efficient work among the colonies, especially when the honey dew is still adhering to the cane. This fungus is well known to us in South Africa and is not necessarily a sign of fermented old cane, but rather of humid conditions suitable for its development on the surface of the cane.

The above outline of a few facts in the life history of the mealy bug refer to the agricultural side of the industry. On the manufacturing side no connection has apparently been paid to mealy bug incidence and filtration difficulties, etc.

Analysis of mealy bugs show the following:—

Moisture	50%

	Fresh.	Week old.
Ether Extract, after drying	27%	53%
Chloroform, Carbon tetrachloride and Acetone give extracts	60-75%	

Hot Water Extract after Ether Extraction	10%
Insoluble and Ash	13%
Polarization of Macerated Bug	7%
Polarization after Ether Extraction	4%
Glucose	1.2%
Melting point of Ether Extract	36°—40°C.

Now an ether extract from mixed juice and bagasse yields a low melting point greasy substance, very similar in appearance to that obtained from the mealy bug.

Mixed Juice Ether Extract melting point	40°—45°C.
Bagasse Ether Extract melting point	45°—47°C.

The admixture of cane wax in these two extracts is to be looked for and would raise the melting point.

The most notable fact in carrying out this work was the extreme difficulty in filtering any extract of these insects in water.

From 16 grammes of bugs 300 c.cs. of water extract maintained at 90° C. in a hot water jacketted filtering apparatus, were obtained after 10 hours, and this after the dried bugs had been extracted with ether. It is certain that a very small quantity of this objectionable substance would soon make itself felt in the filter press station.

Is it only a coincidence that these difficulties do arise at the only times when conditions centreing round the mealy bug and its deposits make them possible? Thus, for example, filtering troubles, together with low recoveries, are usually noticeable in the spring and the commencement of summer, also a few days after rains, which cause the swelling up of deposits, a greater proportion getting into the mixed juice than is normal.

From these observations it is highly probable that the manufacturing troubles in the boiling-house associated with Uba cane are at least partly caused by the mealy bug.

THE PRESENCE OF DEXTRO ROTATORY GUMS IN BAGASSE AND MIXED JUICE.

The presence of these gums has been definitely established. This fact is of importance for two reasons:—

First, that their presence affects the polarimetric determination of sucrose in cane.

Secondly, the danger attending hot maceration, or diffusion methods in which hot water is used.

PRESENCE IN BAGASSE.

If bagasse be dried, extracted with ether, the residual ether evaporated off and the sucrose then determined in the usual way, a drop in the sucrose values of 0.5—0.6 is obtained.

Mixed juice also shows the same lower polarization if first shaken up with ether, the non-sugars going into the ether occasioning a rise in purity up to 5 per cent.