# THE COMPOSITION, OCCURRENCE AND ORIGIN OF LERP, THE SUGARY SECRETION OF *EURYMELA DISTINCTA* (SIGNORET)

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*Synopsis*

The sap-sucking insect *Eurymela distincta* extracts the phloem-sap from its host plant *Eucalyptus* or *Angophora* and secretes a white, waxy, saccharine material known as lerp. This paper discusses the occurrence of lerp ; its composition is given and compared with that of the sap of the host. A suggestion is advanced and evidence given to support the suggestion that the saliva of the insect contains an enzyme which decomposes pectin of the cell-wall and the galactose so formed condenses with the sugars of the sap to form the more complex sugars of lerp.

The Sugar Lerp insect, *Eurymela distincta* (Signoret), secretes a sugary substance which collects on the leaves, twigs, and often in considerable amount on the ground beneath a tree infested with these insects. This substance, lerp, has often been confused with manna but it differs from manna both in its composition and mode of formation. Manna is a naturally occurring or physiologically induced secretion from certain trees, but which has not passed through the alimentary tract of an insect. Lerp and honey-dew, on the other hand, are the secretions of an insect which has ingested the phloem-sap, extracted the elements it needs, and excreted the remainder either with or without change in composition.

*Eurymela* appears to attack only certain species of *Eucalyptus* and *Angophora*. The writer has collected it from *E. punctata* and from *Angophora floribunda*.

Lerp occurs in nodules and masses varying in weight from 0·05 to more than 4 grammes. These nodules are composed of colourless interlaced acicular crystals 1 mm. to 2 mm. long, the nodule itself being white and waxy. It is almost completely soluble in water, the insoluble amounting to only a fraction of 1%. The composition of lerp varies slightly from sample to sample, apparently depending on the composition of the phloem-sap which forms the food of the insect. The compounds present in the phloem-sap of eucalypts vary in quantity and in composition with the season of the year, a character which they share with several other plants (Peel and Weatherley, 1959).

The sugars in the phloem-sap of several eucalypts consist of 70% to 85% sucrose, 10% to 20% glucose and 5% to 10% raffinose (Basden, 1965). In lerp the sugars occur in a different form and proportion. The analysis of a sample of lerp is given in Table 1.

The following sugars have been identified in lerp :—stachyose, raffinose, planteose, melibiose, planteobiose, sucrose, glucose and fructose. It contains nearly 70% raffinose and in decreasing order, melibiose, stachyose and sucrose, with only minor amounts of the others. It is noteworthy that it contains no free galactose although 0·031% of galactose-1-phosphate was found. The significance of this will be referred to later in the paper.

Lerp is entirely free from amino-acids although the sap on which the insect feeds contains a considerable amount and of several kinds. In this character lerp differs from the honey-dew secreted by aphids (von Dehn, 1961 ; Mittler, 1953) and by *Eriococcus coriaceus* (Basden, unpublished) in which the kinds of

amino-acids occurring in the phloem-sap of the host plant are unchanged but the proportions are reduced to about one quarter. This reduction of the amount of amino-acids occurring in the secretion may have some relation to the protein needs of the insect. It has been suggested (Gray, 1952) that, in order to obtain sufficient nitrogenous matter for its metabolism, the insect must take in an amount of carbohydrate much in excess of its needs. This excess carbohydrate is secreted, generally with considerable modification, as lerp or honey-dew. In the case of *Eurymela*, apparently all the amino-acid is absorbed and only the excess carbohydrate secreted, and in a markedly changed form.

It is noteworthy that all the new sugars occurring in lerp (and in honey-dew) are made by the addition of a molecule of galactose to a molecule of one of the pre-existing sugars : stachyose from raffinose, raffinose from sucrose, planteose from sucrose, melibiose from glucose, and planteobiose from fructose. It is also important to observe that no galactose exists normally in phloem-sap.

TABLE 1

*Analysis of Lerp*

| | | |
|---|---|---|
| Moisture .. .. .. | 3·2 | |
| Ash .. .. .. .. | 0·64 | |
| Reducing sugars (as melibiose) .. .. | 9·7 | |
| Non-reducing sugars (as raffinose) .. .. | 69·3 | |
| Methanol insoluble (pectin, uronic acids etc.) | 9·4 | |
| Amino-acids, protein etc. .. | nil. | |
| The ash contains .. .. | $P_2O_5$ | representing 0·01% of the original lerp |
| | $Na_2O$, $K_2O$, CaO | trace of each |

The processes by which the sugars of lerp are formed are probably as follows : The pectins of the cell-wall are hydrolysed by a pectin-splitting enzyme in the saliva of the insect and are broken down to galactose, uronic acids, etc. The galactose is converted to galactose-1-phosphate which in turn and with the aid of another enzyme condenses with the sugars existing in the sap to form new sugars in the lerp. There is considerable evidence to support this theory. It has been shown (Adams and McAllan, 1958) that the saliva of many sap-sucking insects contains pectinase which breaks down the pectin to galactose and uronic acids. No free galactose occurs in the lerp but, as mentioned above, a small amount of galactose-1-phosphate has been detected. There is thus no doubt that galactose-1-phosphate is present in the system. The small amount occurring in the lerp is probably that caught up in the stream of alimentary fluids and secreted before it could react with the other sugars.

It is very significant that in all the sugars formed by the condensation of the pre-existing sugars with galactose, the condensation takes pace in the 1–6 position. It should also be observed that the sugars of the phloem-sap are almost completely involved in this change. The approximately 70% of sucrose of the sap yields about 70% raffinose in the lerp. The 10% glucose in the sap yields about 10% melibiose and so on.

*Experimental*

The various components of the phloem-sap and of the lerp were identified by descending paper chromatography using Whatman's no. 1 paper and butanol : acetone : water 3 : 4 : 2 as solvent. After 18 to 24 hours action the

paper was dried at 110° and sprayed with diphenylamine-aniline phosphate (Bailey and Bourne, 1960). The sugars were identified by comparison of their $R_f$ and colour of the spots given by the reagent with those of authentic sugars. The identity of the less common sugars planteose, planteobiose and melibiose was further confirmed by submitting them to hydrolysis and recognition of the fragments.

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