Micro-organisms and Plant Growth

THE correspondence (references in the letter by B. Viswa Nath and M. Suryanarayana[1]) between one Finnish and two Indian groups of workers, on the effect of organic substances upon plant growth, is accenting the need for collaboration between scientific workers. It is indeed curious to note how in this field of plant accessory substances, as in the field of work upon the effects of plants grown in association, workers have remained in ignorance of prior publications even within one country. I make no claim to priority, but, being fortunate in having access to the library of Rothamsted Experimental Station, I am familiar with the papers of most of the workers in both these fields.

A review entitled "The Derivation of the Nitrogen of Crop Plants, with Special Reference to Associated Growth" will appear in *Biological Reviews* in October. A section on "Accessory Factors and the Growth of Plants" does not pretend to be exhaustive, but contains references to work by the schools of Viswa Nath, Virtanen and others.

I think it important to point out that vitamins produced by plants, and required by animals, need not be identical with those accessory substances which may be required by plants for their own growth. This possible distinction does not appear to have been appreciated by Virtanen[2] and was tentatively rejected by Rowlands and Wilkinson[3]. It seems likely, as Indian workers have suggested, that the accessory substances required by plants are produced by micro-organisms with or without the aid of animals and animal secretions (Isaachsen[4]). A scheme has been put forward in my review, wherein the word 'phytamin' has been proposed for such true plant growth organic accessory substances.

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[1] B. Viswa Nath and M. Suryanarayana, NATURE, **134**, 27, July 7, 1934.
[2] A. I. Virtanen, "Ueber die Stickstoffernährung der Pflanzen". *Ann. Acad. Sci. Fenn.*, Ser. A, **36**, No. 12. Helsinki, 1933.
[3] M. J. Rowlands and Barbara Wilkinson, *Biochem. J.*, **24**, 199; 1930.
[4] H. I. Isaachsen, "Effekten av husdyrgjødsel kontra kunstgjødsel". *Tidsskr. norske Landbr.*, 225; 1933. Abstract in *Nordisk Jordbrugsforskn.*, 67; 1934.

IN connexion with the correspondence in NATURE[1] on the effect of yeast extract on plant growth, writers upon this subject may be interested to know that yeast has for a long time been recognised as a fertiliser on the Keuper Marls around Burton-on-Trent. Thirty years ago it was a very common dressing on grassland, giving an effect resembling that of nitrogenous manure.

Credit for the discovery seems to belong to a certain farmer who carted 'barm' for his stock and then washed out his cart beside a pond in one of his pastures.

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[1] NATURE, **134**, 27, July 7, 1934.

Respiratory System of the White-Fly, *Dialeurodes dissimilis* Quaint. and Baker (Homoptera, Aleurodidæ)

ACCOUNTS of the post-embryonic development of the tracheal system of any insect are extremely meagre. The development of the breathing folds (organs peculiar to the Aleurodidæ and some of the Coccidæ) has never been studied completely in any white-fly. I have carried out a study of the development of the respiratory system of the nymphal stages of the white-fly *Dialeurodes dissimilis* Quaint. and Baker, which occurs on *Ixora parviflora* in India, without doing any apparent damage to the host plant. Some extremely interesting and wholely unexpected results have thus come to light. The only previous account of the development of the tracheal system of a white-fly is that of Woodworth[1], which, however, is inaccurate in many respects.

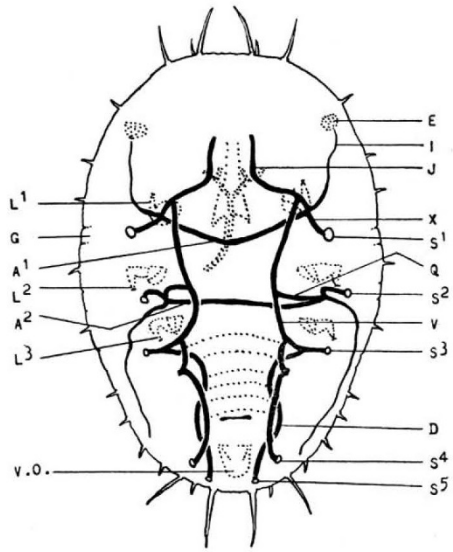

FIG. 1. First instar nymph showing tracheal system seen from the ventral side. Camera lucida drawing. × 185.—A^1, anterior-dorsal commissural trachea; A^2, posterior-dorsal commissural trachea; D, dorsal-longitudinal tracheal trunk; E, eye; G, thoracic breathing fold; I, ocularo-breathing fold trachea; J, oral trachea; L^1, L^2, L^3, first, second and third legs; Q, palisade trachea; S^1, S^2, S^3, S^4, first, second, third and fourth spiracles; S^5, probable fifth spiracle; V, ventral-longitudinal tracheal trunk; V.O., vasiform orifice; X, spiracular trachea.

The number of spiracles in *Dialeurodes dissimilis* in all the nymphal instars is four (probably five in the first instar); they lie on the ventral surface of the nymphs, but their exact position varies in the different instars. The third pair of spiracles is replaced by an entirely *new* one in the third instar. The spiracles, as studied in the pupa, are of a simple type, and have no closing mechanism.

The tracheal system consists fundamentally of paired dorsal- and ventral-longitudinal trunks, two dorsal commissural tracheæ, the spiracular and palisade tracheæ and the various branches of the main system, the most important ones being those belonging to the ventral-longitudinal tracheal trunks and are the following: ocularo-breathing fold trachea dividing into an ocular branch and a breathing fold branch; oral trachea; mycetomal trachea; and several other smaller branches. Growth of the