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Control Methods. This is a pest which is very difficult to contro As stated above, the mealy bugs are found in a secure position betwee the stalks and leaf sheath. It is not possible, therefore, for any insec ticide to reach the pest. So, spraying is out of the question.

Attempts were made to see whether heaping of affected paddy seedlings in bundles (in conical heaps) and covering them with we gunny bags had any effect on the mortality of the pest. The heap were examined on the 5th day; the mealy bugs were, however, found healthy.

Manurial and varietal trials have also been tried but have not given any conclusive results.

It is proposed to study the natural enemies of the pest to see whether they could be utilised as a practical method of control.

The only method which can be suggested at present is to watch the nurseries for early symptoms of infestation and pull out the affected seedlings and burn them.

The Government Entomologist will be glad to receive any available information regarding the pest from the District staff and also others interested in the subject.

ESTIMATION OF NITROGEN BY OXIDATIVE DIGESTION.*

When an organic substance containing nitrogen—such as a protein —is continuously boiled with concentrated sulphuric acid, it undergoes digestion, yielding carbon dioxide and sulphur dioxide (together with considerable amounts of acid fume) as gaseous products and leaving a residue, which generally contains all the nitrogen as ammonium sulphate. On this reaction is based the well-known Kjeldahl method,[1] which was first introduced in 1883 and which, in one or the other of its several modifications is still most extensively adopted for the estimation of nitrogen. A conservative estimate would indeed show that in scientific research alone—apart from routine analyses in Government laboratories, factories or private practice—a few millions of determinations are being annually carried out by that method.

With increasing experience, it was realized that the acid digestion did not proceed either so smoothly or so quantitatively as was originally expected. It was also soon recognised that in the case of rather resistant materials like soil, yeast or cereal husk, the Kjeldahl method cannot be depended on for very accurate estimates. There was still no remedy and it was not until 1925 when Bal[2] drew attention to the highly discrepant results which he obtained with the black cotton soils of the Central Provinces that some fresh advance was made. Bal

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noticed that the heavy clay soils which he examined were not properly penetrated by the 'dry' (concentrated) sulphuric acid which he used. He therefore first wetted his soils with water and, after ensuring their proper dispersion, followed up with the addition of sulphuric acid. This procedure, which he designated the 'wet' method yielded not only more concordant but also distinctly higher estimates than those obtained by the official Kjeldahl method. This important observation did not, however, receive the attention which it deserved and it was not until 1932 when Sreenivasan[3] observed that the phenomenon observed by Bal was quite general and applied not only to soils but also to a variety of other materials as well. Later researches (4, 5, 6) also showed that in the case of soils - especially those rich in clay—addition of concentrated ('dry') sulphuric acid led to the formation of an impenetrable protective coat of silica around undigested soil particles. Pre-treatment with water or dilute acid prevented the formation of this protective coat and facilitated the digestion proceeding to completion. Other observations also showed that addition of small amounts of oxidising agents such as peroxide, perchlorates, permanganate or dichromate greatly hastened the rate of digestion. With these improvements, digestions which often took 6—8 hours and were generally accompanied by violent bumping, could be easily completed in under 90 minutes.

The foregoing modifications, though important, did not depart from the principle of the original Kjeldahl method. They also shared some of its draw-backs, especially emission of acid fumes, which is perhaps the most objectionable feature of that method. It was not, however, until recently that any systematic attempt was made to overcome that defect. It had been suggested by some workers (7, 8,) that the residue after the 'wet' combustion of carbon can be utilised for the estimation of nitrogen. The related procedure was however very tedious. The results obtained by that method were also low and discordant. This observation was inexplicable, but subsequent enquiry (11, 12,) showed that (a) some nitrogen is lost in the early stages if proper precautions are not taken, (b) a portion of the nitrogen is retained in the acid digest partly as nitric acid and partly in combination with chromium and (c) if halides are present in the material to be digested —such as in an alkali soil—considerable amounts of nitrogen are lost in elementary form. Loss of nitrogen in the earlier stages can be avoided by adding the oxidising agent (chromic anhydride or dichromate) to the boiling mixture of the material to be digested with water and sulphuric acid. Nitric acid and other volatile forms, if any, can be retained by using an air or water-cooled condenser. They can be included in the estimate of nitrogen by treatment with a suitable reducing agent. The same treatment also helps to release the nitrogen present in combination with chromium. As for the interference of halides, this can be completely prevented by addition of small quantity

of a mercury salt (preferably mercuric oxide or sulphate) to the digesting mixture. Based on these observations, a rapid, fumeless method of estimating nitrogen has been developed. The procedure to be adopted in the case of soil may be described as follows:- The soil (10 g.) is weighed out into a large-sized flask—preferably the one to be used subsequently for distillation with alkali--and treated with mercuric oxide (or sulphate ; about 29) and 20 c. c. of water. The suspension is well shaken and then treated with 40 c. c. of pure, concentrated sulphuric acid. The flask is then fitted with an air condenser and the contents raised to boil. After boiling for about 5 minutes, a saturated, aqueous solution of chromic acid (corresponding to about 5 g of the anhydride) is added through the condenser and the digestion continued for 30 mins. The heating is then stopped and the digest treated with pure, solid sodium sulphate in sufficient quantity to completely reduce the excess of chromic acid. A small amount of zinc (2 g.) is then added together with excess of water and the mixture boiled for 15 minutes. It is then cooled, treated with excess of alkali and distilled in the usual way.

The above proceedure has several advantages over the Kjeldahl method.— In the first place it does away with fumes and, with the special type of digestion flasks associated with that method. The digestion proceeds very rapidly and is, in fact, very nearly complete within 5 minutes. after addition of the oxidising agent. The extra boiling is only to ensure complete digestion. A further advantage in the new method is that it includes nitrates in the estimate of total nitrogen. The use of the condenser helps to retain not only the nitrate already present in the soil but also any that may be added to it. Both the digestion and the distillation proceed smoothly and are in fact very much more satisfactory than similar operations in the Kjeldahl method. The related processes are so simple and at the same time, so rapid that a single worker can easily complete about thirty determinations a day.

The method of oxidative digestion though very much in advance of the other known methods, is still capable of improvement. Although reduction in alkaline media has not so far yielded satisfactory results, it should still be possible to so modify the conditions that the need for boiling with sulphite and zinc is obviated. Attempts should also be made to reduce the quantities of reagents used—especially those of acid and alkali. Some indications have already been obtained to show that other oxidising agents such as permanganate or bismuthate act fairly effectively in presence of dilute sulphuric acid. The bismuthate, in particular, also yields a colourless digest so that it should be possible to determine at any stage, whether the digestion is complete. It is hoped that, with these and other improvements, the estimation of nitrogen would be not only very much simpler and more rapid; but also very much less expensive than it is at present.

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THE LEAF-CURL DISEASE OF CHILLIES CAUSED BY THRIPS IN THE GUNTUR AND MADURA TRACTS *

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Introduction Chillies (*Capsicum annum*) is one of the important crops grown widely for use both as a green vegetable and as a dry stored product for condiment, pickles, etc.; it is one of the chief commercial crops in the Guntur district in the Northern Circars and in the Periyakulam area in the Madura district.

In recent years, this crop has been noted to be subject to a serious disease known as the 'leaf-curl' disease. Though there may be other factors causing this leaf curl, one important causative agent noted is a tiny insect called chillies thrips (*Scirtothrips dorsalis*, Hood), about 1/25" in length and having a straw yellow colour. This minute active insect attacks the plant in all its stages, sucks up the sap from the tender portions and causes the leaf to shrivel up. The adult has wings and flies away when disturbed. Specimens of this creature can be easily collected in all stages of growth from plants in any infected field. The description of this insect and some notes on its bionomics are given by Hood (1919) and the senior author (1928.)

The main purpose of this paper is to point out that in additon to proper cultural practices which, of course, influence successful

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