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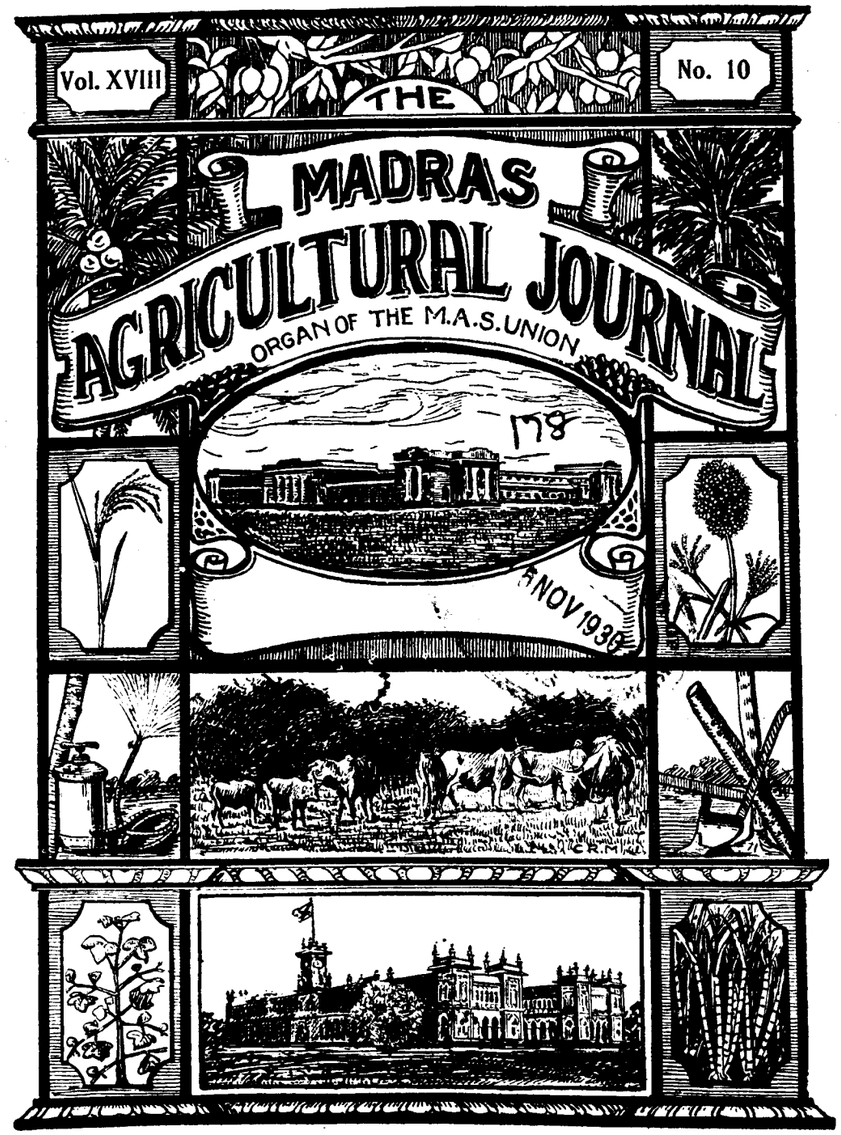


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Farming will never be a success unless the farmer had more voice in the disposal of his produce—P. Morrel.

15 NOV 1930

# The Madras Agricultural Journal

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## A WILT OF ZINNIA CAUSED BY SCLEROTIUM ROLFSII[1]


BY T. S. RAMAKRISHNAN, M.A.

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*Sclerotium rolfsii* has a world-wide distribution and has been recorded from the United States of America, Australia and numerous islands of the Pacific and Atlantic Oceans, China, Ceylon, Bengal, Bombay and Madras in India and from Uganda in Africa. It was first reported by Rolfs in 1893 as being parasitic on tomatoes in the United States. Since then it has been known to cause diseases of several plants—140 varieties and species—including field crops and ornamental plants. As the cause of the rot of potatoes it has been studied by Taubenhas, Edson and Shapovalov. Under the name of *Rhizoctonia destruens* it was investigated by Shaw and Ajrekar in India and it was found to be parasitic on potato, piper-betel, groundnut, *Amorphophallus companulatus*, lucerne, Dianthus, delphenium and rice. In a later communication Ajrekar wrote that *R. destruens* was identical with *S. rolfsii*. Paintin who worked on the parasitology of the fungus found that in addition to these hosts the fungus is capable of infecting many more and has given a list of new hosts containing plants from widely different families. Higgins writes that *S. rolfsii* is a soil inhabiting fungus attacking a number of wild and cultivated plants in the field. It is also a common cause of decay in stored roots and vegetables and of cucurbita and other fruits that rest in the soil. In the nurseries too this fungus causes considerable damage.

During the year 1925 specimens of Zinnia plants were received from the Agri-Horticultural gardens, Madras with the report that the flower beds were affected by disease resulting in the wilting and drying up of grown-up plants. On the surface of the basal portions of the stem and sometimes extending over the roots a number of whitish mycelial strands were present. No

[1] Paper read before the Indian Science Congress, Madras Sessions, 1929.

fructifications or sclerotial bodies were noticed. Sections of the stem were found to be permeated by hyaline hyphae which were distributed both inter and intracellularly. The pith was hollow and in this the mycelium had accumulated to form flocculent cottony masses. From the mycelial growths in the pith region transfers were made on French bean agar. The fungus made a good whitish growth and by the end of a week dark brown mustard-seed-like sclerotia were formed in large numbers. Examination of the fungus revealed it to be *Sclerotium rolfsii*.

In order to establish the pathogenicity of the fungus on Zinnia (on which it has been found for the first time) inoculation experiments were conducted on a number of these plants both in the seedling and mature stages. In addition to Zinnia a few other hosts were also included in the experiments. The plants were grown in pots containing sterilised soil. Inoculations were made with cultures of the fungus 8—10 days old. Both the sclerotia and the mycelium of the fungus were used as inocula. After inoculation the plants were covered with bell jars and the inside of the bell jars were sprayed with water once a day to keep the air inside moist. Control plants were kept in all cases and these remained healthy throughout.

*Results of the inoculation.* (1) Zinnia: On young seedlings 15 days old the fungus caused a rotting of the collar resulting in the characteristic 'damping off' appearance in the course of 4—5 days. But with older plants it took a longer time for the effects of the infection to be externally visible. The plants wilted in the course of 8 days. There was a whitish felt of fungus mycelium formed at the base of the stem and on these a few sclerotia developed. At this place the stem was much shrunk. The parasitism of the fungus on Zinnia was thus confirmed.

(2) Groundnut: The plants were 1½ months old. The mycelium grew over the stem and on reaching the younger portions of the shoots caused them to rot. The leaves turned yellow and the branches exhibited a rotten water-soaked appearance and hung down bent at the rotten portions. The rotting spread to all the younger shoots and the mycelium which grew over the stem and even the surface of the pots produced a number of sclerotia.

(3) On cowpea, lucerne, Bengal gram and linseed (plants 2—3 weeks old) the fungus produced infection and grew over the stem forming a whitish felt of mycelium. The leaves were discoloured and dropped off. The basal portion of the stem was shrunk and the plants bent over at these portions. Sclerotia developed on the mycelium.

(4) Cosmos: The plants wilted and the fungus spread over the collar region as a white felt. Sclerotia developed on the mycelium.

(5) Seedlings of maize and potato easily succumbed to the fungus which produced a rotting of the collar.

(6) Cotton: Cambodia cotton seedlings 20 days old were easily affected by the fungus. But grown up plants (which had developed a thick stem) showed no signs of infection even after 15 days. The mycelium, however, grew on the outside of the stem without producing any signs of wilting of the plants. The fungus is able to infect this host only in the seedling stage.

Besides the specimens of diseased plants the Agri-Horticultural Society had sent a quantity of the soil from the affected plot. Two pots were filled with this soil. In another pair of pots sterilised garden soil was placed. Healthy Zinnia seedlings were planted in all the four pots. In the course of 20 days 7 out of the 8 seedlings planted in the soil received from the society



had wilted and sections of the diseased portions showed the presence of the fungus inside, while all the control plants were healthy. The disease is thus shown to be spread through the soil.

*Growth of the fungus in culture media.* The fungus grows readily on agar media producing a luxuriant white mycelial growth. After spreading throughout the length of the slant, sclerotial formation begins in about a week's time, varying to some extent with different media. The mycelial growth is mostly aerial and often several hyphae unite into strands. At the top of the slant and sometimes at the bottom more of mycelial accumulations are noticed. The nature of the growth on several media was as follows:

| Medium | Nature of growth | Sclerotial formation |
|---|---|---|
| French bean agar ... | Luxuriant white growth of aerial mycelium, finally turning cream coloured at the top ... ... ... | Large number of sclerotia dark brown in colour formed at the end of 7 days singly or in groups. |
| Oat juice agar ... | A luxuriant white growth ... | " |
| Cornmeal and rice agars | A good growth of whitish mycelium not so luxuriant as on French bean ... | Large number of sclerotia formed. |
| Glucose agar ... | White luxuriant growth with plenty of aerial mycelium ... | Sclerotia rare or few in number. |
| Zinnia leaf-extract agar. | Poor growth with thia aerial mycelium ... ... | Sclerotia few in number smaller in size than in the above media and of a paler colour. |
| Zinnia stem-extract agar ... ... | Growth poor but better than in leaf extract agar ... | " |
| 3 per cent. maltose and sucrose agars ... | Growth poor and more or less in the form of interlacing strands on the surface ... | Sclerotia rare or absent. |
| Potato slants ... | A very luxuriant white growth with plenty of mycelium spreading up the sides of the tubes in a fan like manner... | Numerous dark brown sclerotia formed. |
| Amorphophallus slants.. | " | " |
| Stem of Zinnia ... | A white growth not luxuriant with a number of strands on the stem ... ... | Sclerotia numerous. |

Of the different agar media French bean and Oat juice show the best growth, and are best suited for the rapid cultivation of the fungus. The plant tissues especially those of potato and Amorphophallus give a more luxuriant mycelial growth and a large number of sclerotia.

The effect of different concentrations of sugars such as sucrose, maltose and lactose on the growth of the fungus was investigated. For this purpose agar media containing these sugars in 1%, 2% and 3% concentrations were prepared. The cultures were grown in Petri dishes one sclerotium being planted in the centre of each plate. The diameter of the growth was measured at intervals. Duplicate cultures were grown and the average measurements are given below:

| Date of inoculation | Date of observation | Diameter of the colony in m.m. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Maltose | | Sucrose | | | Lactose | | | |
| | | 1% | 3% | 1% | 2% | 3% | 1% | 2% | 3% | |
| 21— 4—27 | 25— 4—27 | 40 | 50 | 33 | 36 | 42 | 14 | 13 | 13 | |
| | 26— 4—27 | 50 | 60 | 41 | 45 | 52 | 16 | 20 | 22 | |
| | 28— 4—27 | 62 | 68 | 60 | 64 | 67 | 27 | 31 | 33 | |

The dishes with 2% maltose were contaminated and as such no measurements were taken from them. The fungus grew much more quickly in maltose and sucrose than in lactose agar. Of the two former, there was an initial increase in the rate of growth in maltose but later no difference could be made out. In all the 3 kinds of sugars the rate of growth increased with the concentration, 3% showing the greatest growth.

The nature of the growth of fungus on media of different reactions was next studied. Oat juice agar of different Fuller's scale varying from minus 10 to plus 20 was prepared and the rate of growth of the fungus in Petri dishes was observed at intervals. Duplicate cultures were kept and below are shown the average measurements and the number of sclerotia formed.

*Diameter of the growth in mm. Sclerotia planted on August 13, 1928*

| No. | Reaction | 15/8 | 16/8 | 17/8 | 18/8 | 19/8 | Number of Sclerotia on 25/8 |
|---|---|---|---|---|---|---|---|
| 1 | −10 | 25 | 49 | 73 | 88 (full) | ... | 50 |
| 2 | − 5 | 23 | 50 | 75 | 88 ,, | ... | 60 |
| 3 | N | 27 | 55 | 78 | 90 ,, | ... | 42 |
| 4 | + 5 | 31 | 62 | 86 | 90 ,, | ... | 87 |
| 5 | +10 | 27 | 54 | 75 | 90 ,, | ... | 80 |
| 6 | +15 | 26 | 48 | 66 | 82 | 88 (full) | 46 |
| 7 | +20 | 18 | 41 | 56 | 74 | 88 ,, | 43 |

An examination of the results shows that the growth is quickest in +5 with a gradual but slight falling off on either side. +20 shows the lowest growth. By the 18th the growth in the plates from −10 to +10 had completely filled the dishes. In +15 and +20 it was only on the 19th that the growths had extended completely over the dishes. Sclerotial formation had begun by the 20th in all the plates excepting +15 and +20 in which it was delayed by two days more. By the 25th the dishes of +5 and +10 reactions showed the largest number of sclerotia.

*Change in the medium by the growth of fungus.* Alkaline and neutral French bean agar are darker in colour than those of acidic reactions. But when S. rolfsii was allowed to grow over the former it was found that the media became paler by the growth of the fungus. The paler colour was noticed up to 3 mm. in advance of the aerial mycelial growth. This suggested that the fungus might have given rise to some acid during its growth.



The fungus was cultivated on congo-red agar and alkaline litmus agar. In the former the colour of the medium changed with the growth of the fungus from red to violet—an indication that acid is formed. The alkaline litmus agar developed a reddish tinge as the fungus extended over the medium.

To determine definitely the changes brought about in the acidity of the medium during the growth of the fungus it was grown in Richard's solution and the pH value of the medium determined periodically. Four flasks with 100 c.c. of the medium each were sterilised and the pH value adjusted to 5·4. Two of the flasks were inoculated with one sclerotium each on 19–9–27 and the other two were left as controls. On the 22nd the pH value of the medium in the inoculated flasks was 4·6 while in the control it was 5·4. On the 26th the medium in the inoculated flask showed 2·4 while the control had 5·4. On testing the media on the 29th again the inoculated one showed 2·4 and the control 5·4. The readings point out the increase in the acidity of the medium produced by the growth of the fungus. It developed very few sclerotia. Higgins who has worked on this problem describes a similar change in the pH value of the medium produced by the growth of *S. rolfsii*, and attributes the same to the formation of oxalic acid by the fungus.

*Morphology of the fungus.* The mycelium is hyaline much branched and spreads out in strands producing a fan-like appearance. The hyphae are septate and the branches generally arise from below a septum. Clamp connections and H connections are present. Often several hyphae become united to form thick white strands. In 3 to 4 days small whitish masses begin to form at the ends of the strands. These gradually increase in size and become rounded. The colour of these masses changes from white to cream and ultimately they develop into brown sclerotia. These occur singly or sometimes 3 or 4 of them fuse together to form irregular masses. On agar media sclerotia are formed in about 7 days. They are rounded or slightly flattened with one side—generally the side to which the mycelial strand is attached—slightly concave and with a number of minute pits on the surface. When mature they easily get separated from the mycelial strand. The individual sclerotia are usually 1·5 to 2 mm. in diameter but the massive ones formed by the fusion of 3 or 4 sclerotia often reach a length of ·8 cm. When placed in water or inside a moist chamber the sclerotium germinates by the production of long hyphal filaments from all over the surface. No kind of spore formation was observed in any of the cultures.

The size of the sclerotium varies to a certain extent with the medium on which it is formed. On some it is small while on others it is of a larger size. The averages of 50 sclerotia each from the following sources are as follows:

| Source | Diameter of sclerotia in mm. | | |
|---|---|---|---|
| | Maximum | Minimum | Average |
| Sterilised Zinnia stem ... | 3 | 1 | 2·1 |
| Oat agar ... ... ... | 2·5 | 1 | 1·7 |
| Zinnia leaf extract agar ... | 1·25 | ·75 | 1 |
| Zinnia stem extract agar ... | 1·5 | ·7 | 1·36 |

The sclerotia formed on the Zinnia stem are of a bigger size while those from the Zinnia leaf—extract agar are very small. Taubenhas suggests that the acid in certain host tissues might be responsible for the bigger size of the sclerotia on them. In order to find out whether the same holds good on agar media also measurements were made of 50 sclerotia each from oat agar media of different reactions. The measurements were as follows:

| Reaction | Diameter of sclerotia in mm. | | |
|---|---|---|---|
| | Maximum | Minimum | Average |
| −10 ... ... ... | 2·5 | 1 | 1·5 |
| − 5 ... ... ... | 2 | 1 | 1·7 |
| N ... ... ... | 2 | 1 | 1·5 |
| + 5 ... ... ... | 2·25 | ·9 | 1·6 |
| +10 ... ... ... | 2 | 1 | 1·5 |
| +15 ... ... ... | 2 | 1 | 1·8 |
| +20 ... ... ... | 2·25 | 1 | 1·65 |

The acidity of the medium does not seem to exert any marked influence on the size of the sclerotia. The bigger size on some of the host tissues may probably be due to something other than acids contained in them.

Though at first round and big the sclerotium shrinks very much as the medium dries up. But when it is placed in water it again regains its original size.

*Viability.* Sclerotia retain their viability for long periods. But it depends on how they are preserved. A number of them removed from a culture on zinnia stem, 13 months old were alive and germinated readily. But others taken from a dried up French bean agar tube 8 months old did not show any signs of germination. Extreme drying up as that which occurs in old agar tubes (not sealed) is detrimental to the viability of the sclerotia.

*Effect of heat on sclerotia.* Sclerotia are more resistant to temperature variations than the ordinary mycelium and are produced to tide over unfavourable seasons. But above a maximum even the sclerotium is killed. The effect of exposure to dry heat at different temperatures for ½ hour and 1 hour on the germinating capacity of the sclerotia was determined. Mature sclerotia were kept on glass slides inside a hot water oven for the specified time at different temperatures. These were then removed and kept for germination in Petri dishes lined with sterilised and moistened filter papers. The Petri dishes were kept inside moist chambers. 25 sclerotia were kept in each case and the following are the results of germination.



| Temperature | Time of exposure | Number germinated | Remarks |
|---|---|---|---|
| 43°C | 1 hour | 25 | Germinated on the next day, as good as control. |
| 50°C | ,, | 25 | Germinated on the next day, as good as control. |
| 52°C | 30 minutes | 25 | |
| 52°C | 1 hour | 8 | |
| 53°C | 30 minutes | 25 | Germination delayed by two days. |
| 53°C | 1 hour | 7 | |
| 55°C | 30 minutes | 23 | do |
| 55°C | 1 hour | Nil | |
| Control | ... | 25 | |

Sclerotia exposed to 55°C for 1 hour are killed.

*The effect of chemicals on the Sclerotia. Sclerotium rolfsii* is a soil inhabiting fungus. Various chemicals are used for sterilising the soil in gardens. The effect of some of the new fungicides which are being used for soil sterilisation in recent times and formalin and mercuric chloride on the sclerotia was tested. The sclerotia were steeped in the respective solutions for definite lengths of time, then washed in sterilised water and then kept for germination in Petri dishes with moistened filter papers. Twenty sclerotia were used on each occasion with the following results.

| Fungicide | Strength of solution | Time of steeping | Date of steeping | Date of observation | Number germinated | Remarks |
|---|---|---|---|---|---|---|
| Germisan ... | 0·5% | 30 min. | 24-2-26 | 1-3-26 | 4 | |
| | 0·5% | 1 hour | ,, | ,, | ... | |
| | 1·0% | 30 min. | ,, | ,, | ... | |
| Uspulun ... | 0·5% | 30 min. | ,, | ,, | 8 | |
| | 0·5% | 1 hour | ,, | ,, | ... | |
| | 1·0% | 30 min. | ,, | ,, | ... | |
| Control ... | ..... | ..... | ..... | ..... | 20 | |
| Tillantin ... | 0·5% | 30 min. | 25-2-26 | 3-3-26 | 18 | |
| | 0·5% | 1 hour | ,, | ,, | 12 | |
| | 0·5% | 1½ hours | ,, | ,, | 10 | |
| | 1·0% | 30 min. | ,, | ,, | 17 | |
| | 1·0% | 1 hour | ,, | ,, | 12 | |
| | 2·0% | 30 min. | ,, | ,, | 17 | |
| | 2·0% | 1 hour | ,, | ,, | 8 | |
| Control ... | ..... | ..... | ..... | ..... | 20 | |
| Cheshunt compound. | Normal strength | 30 min. | 26-2-26 | 4-3-26 | 18 | |
| | Do. | 1 hour | ,, | ,, | 20 | |
| | 1·0% | 30 min. | ,, | ,, | 20 | |
| | 1·0% | 1 hour | ,, | ,, | 18 | |
| | 1·0% | 2 hours | ,, | ,, | 15 | |
| Control ... | ..... | ..... | ..... | ..... | 20 | |
| Formalin ... | 2·0% | 30 min. | 15-10-27 | 25-10-27 | 6 | Germination on the 4th day only. |
| | 2·0% | 1 hour | ,, | ,, | 6 | |
| | 2·0% | 1½ hours | ,, | ,, | ... | |
| Control ... | ..... | ..... | ..... | ..... | 20 | |
| Mercuric chloride ... | 0·1% | 30 min. | 21-9-27 | 30-9-27 | 14 | |
| | 0·1% | 1 hour | ,, | ,, | 12 | |
| | 0·2% | 30 min. | ,, | ,, | 6 | |
| | 0·2% | 1 hour | ,, | ,, | ... | |
| Control ... | ..... | ..... | ..... | ..... | 20 | |

Of the fungicides 0.5 per cent solutions of germisan and uspulun and 0.2 per cent solution of mercuric chloride kill the sclerotia in one hour. Two per cent formalin kills in 1½ hours while Tillantin and Cheshunt compound are much less effective. Perhaps longer periods of immersion may be more effective. Shaw and Ajrekar mention that 0.1 per cent mercuric chloride kill the sclerotia in 2½ hours. Shorter periods with the same concentration are found to be less effective.

I am indebted to Mr. S. Sundararaman, Government Mycologist, Coimbatore for advice in carrying out this investigation and to Mr. P. D. Karunakar, Government Agricultural Bacteriologist for the determination of OH values of some media.

## Summary

*Sclerotium rolfsii* was observed to cause a wilting of grown up zinnia plants. The fungus was isolated from diseased specimens and infection experiments proved its parasitism on zinnia resulting in the damping off of seedlings and wilting of grown up plants.



It grows luxuriantly on artificial media producing a whitish mucelium spreading out in a fanlike manner and forming in seven days numerous dark brown rounded sclerotia which measure on an average 1·5 to 1·7 m.m. in diameter. During its growth the fungus increases the acidity of the medium. The size of the sclerotium varies to a slight extent with the medium on which it is formed.

Sclerotia have been found to retain their viability for 13 months. They are killed when exposed to dry heat at 55° C for one hour. They die when immersed in ·5 per cent solutions of Germisan and Uspulun and ·2 per cent of mercuric chloride for one hour. In 2 per cent formalin they are killed in 1½ hours.

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## USEFUL RECIPES

### Lime sulphur sprays

Take 2 lbs. of quick lime in a kerosene oil tin and shake it with water. Add 2½ gallons of water, and boil. When the water has begun to boil add 4 lbs. of sulphur little by little, so that water and sulphur get well mixed up. Boil the mixture till the whole liquid gets a dark brown colour (this will be in about 1 hour.)

*Caution.* Never allow the mixture to become green. Remove the liquid, filter through a piece of gunny, and the solution is ready for use. Before spraying make it up to 20 gallons.

If the original mixture is to be preserved, it should be kept air-tight and if this should be effectively done pour some mineral oil (say kerosene) on the surface of the liquid.

(1 kerosene tin = 4 gallons = 24 ordinary bottles.)

# DEVELOPMENT OF 'COTTON SEED SOCIETIES' ON A CO-OPERATIVE BASIS IN COIMBATORE DISTRICT

(By G. K. SUBRAMANIAM)

It is generally possible for cultivators in the case of most crops, to stock part of their harvested crops for seed purposes for the year following; but with regard to cotton, which is one of the most important industrial crops of the district, the ryot always experiences much difficulty in securing good seed, for he sells his crop as kapas (seed cotton) and naturally he cannot reserve his own seed for sowing purposes.

When seed is required for sowing, the ryots go to the next ginning factory, if there be one, or to the nearest dealer in cotton seed, and purchase their requirements for sowings. Often this seed is of inferior quality and costs much. Sometimes this seed might contain mixtures of different varieties of cotton grown in the District. The merchant is anxious to dispose of his stock of seed as quickly as he can and naturally tries his best to obtain as good a seed as possible, but still a trader cannot be expected to take as much interest in cultivation as a Vellala farmer. There is a saying in Tamil "வெட்டிக்கும் பயிருக்கும் ஜன்மபகை" to the effect that 'a trader bears a born hatred for crops.' Therefore, he has no interest in keeping the seed pure and clean and this forms a serious hindrance to the development of good farming.

It is thus a serious handicap to the cotton growing ryot, that although he may grow a good crop of cotton, he is not able to get the best cotton seed for his sowings next season; but has to depend on inferior seed from the bazaar. The ryot is no doubt shrewd enough to select the best quality out of the seed available with the merchant, knowing as he does that 'he will reap only what he soweth.' If the seed is bad, the out-turn is bound to be low, but since only bad seed is available he has to sow bad seed and accept the low yield. The effect of this is that the ryot gradually gets dissatisfied and feels diffident about growing this crop. It is, therefore, no wonder that we hear in some villages ryots saying in Tamil "இந்த பாழும்பொன பருத்தியாலே, வெவசாயமே கெட்டுப் போச்சு," (or literally) 'by raising this cursed cotton crop our farming has been ruined.' Therefore if the crop is to be improved and the growers are to be benefited, it is necessary in the first instance to maintain a supply of pure seed.

Good seed of superior strains of Cambodia cotton was, for a time, obtained from the Agricultural Department and sown by the ryots here and there for a season, but as they sold away their produce as kapas, they could not stock their own seed for the next season and had therefore necessarily to look again, to the Agricultural Department for a supply of seed. But it was obviously impossible for the Agricultural Department to stock sufficient seed to meet the demands from all the ryots.

To meet the demands of the ryots as far as possible and eventually to make the ryots obtain their own seed supply, the Agricultural Department made arrangements to open 'Seed Farms' in a few selected Cambodia cotton growing villages in and around Avanashi-Tirupur. Selected ryots were given



pure strains of Cambodia cotton seed evolved by the cotton specialist in each of those selected villages under the condition that they should grow the crop pure as per methods of farming advocated by the Department and under the supervision of Departmental officers. The kapas was to be picked clean, carted to a ginnery at Tirupur, where after collecting the produce of all the ryots, it was to be ginned under the supervision of the officers of the Department. The lint was to be marketed and sold at a premium, but the seed was to be purchased by the Department to be stocked and sold to the ryots during the next season.

The Department has been following this system for the last five or six years, but it was found that, with the limited staff at its disposal, and with other items of propaganda work on hand, it was not in a position to produce seed for more than about 10,000 acres yearly, from a total of 1,000 acres of seed Farm area. On the other hand, in Coimbatore District alone the area under Cambodia cotton is a little over one lakh of acres. Therefore if the whole area of this cotton in this District alone, not to speak of the surrounding Districts, was to be supplied with pure seed, many more farms will have to be started, and far more seed produced and stocked in different important village centres, to be distributed to the growers in different villages. This would be possible only through co-operative organisations. Although the principle of co-operation is well known in many villages, it has not yet led to the formation of real Agricultural Societies, or even to partnerships for the introduction of agricultural improvements. Each ryot goes his own old way and looks to the Government for further development. Therefore the Department had to go a step further and induce the seed farm ryots to form into a co-operative organisation, as, a 'cotton seed society.' They could, thereby, get the initial supply of seed from the Department, raise the cotton crop pure, obtain under the auspices of these societies financial help they may need for cultivation expenses from the District Urban Bank, pick the kapas clean, gin the produce together, grade the stuff together, and market the same co-operatively, and get back the seed to the societies for distribution to themselves and to their brethren in the neighbourhood for sowings in the next season. They could thus keep up a continuous supply of pure seed and increase the supply by forming more of such societies.

In this way, ten such 'Seed Societies' were organised among the seed farm ryots in the Avanashi-Perumanallur centres and got registered with the aid and assistance of the Co-operative Department. There are now about two hundred members with an area of about 1,200 acres of pure strain of Co2 Cambodia cotton under these ten societies and the seed that may be obtained by these societies in the next season will be about 400,000 lbs. which will suffice for about 16,000 acres in the coming season.

In spite of the slump in the cotton trade, and the consequent low prices obtaining in the Tirupur market for this commodity, the ryot's lint has been always getting a higher price than the local market rate, which fact could be seen from the statement given below. Further, these seed farm ryots have been getting a premium of about Rs 6 on an average, per pothi of kapas (Seed Cotton 260 lbs.) over the prevailing market rates from 1924–25 to 1928–29 five years, and having thus a profit of about Rs 10 per acre on an average every year. This is purely the result of growing the seed pure and co-operative ginning and marketing, and does not take into account the profit or the increased out-turn that the ryot is able to get from these improved

strains and adopting the farming methods advocated by the Department in the cultivation of this crop.

Besides obtaining for themselves higher prices, pure cotton seed, and better out-turn of crop, four of these societies have been able to get each a breeding bull of the Kangeyam type from out of the common good fund saved at Rs 0–4–0 a pothi produced by each ryot, and are maintaining the bulls in good condition. About 150 cows of the locality were served in all by these bulls in 1929 and all of them have received the Government grant of Rs 100 per year per bull, (except in one case where a grant of only Rs 50 was given as the bull had not recorded the prescribed minimum number of services that year). This enables the ryots of the locality to improve their cattle also, which is yet another benefit conferred upon them by the organisation and working of these 'Cotton Seed Societies.'

It is needless, therefore, to dilate further on the advantages that would accrue to the ryots by the formation of such co-operative organisations. If all the cotton growing ryots are willing to be really benefited they could organise themselves into co-operative organisations, raise the crops pure under the auspices of the societies concerned, gin the kapas, and market the produce co-operatively, and arrange to get back all the good seed for distributing the same to all for sowing in their own area. If such an organisation exist in every village, in one or two years the whole of Coimbatore District may hope easily to produce a pure commercial type of Cambodia cotton, which would win for itself a high reputation in the cotton market. They would thereby relieve the Agricultural Department of seed distribution work carried on now by them and leave them free to devote their attention and energy to other items of propaganda such as demonstration of better methods of farming, and tackling new villages and centres. These organisations will really be easy of achievement if only the leaders of the local public of this District who are all known to be enthusiastic co-operators would take an intelligent interest in farming.

**Abstract statement showing comparative year-var transactions of the Seed Farm Cambodia cotton crop under the Co-operative Seed Societies in Avanashi—Tiruppur Area up to June 1929**

| Crop year | No. of Societies (Villages) | No. of ryots | Area of seed farm | Quantity of seed sown | Amount obtained as for cultivation expenses | | | Quantity of kapas produced | | | Quantity of lint obtained | | | Quantity of seed produced | Sale price of lint per candy | | | Market rate for lint on the day per candy | | | Sale price of seed per 1000 lbs. | | | Market price of seed per 1000 lbs. | | | Rate of kapas per pothie | | | Market rate of kapas per pothie | | | Extra price got by ryots per pothie of kapas | | | Extra income per acre | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RS | A | P | P | M | lb | C | lb | lb | RS | A | P | RS | A | P | RS | A | P | RS | A | P | RS | A | P | RS | A | P | RS | A | P | RS | A | P |
| 1924–25 | 4 | 85 | 663 | 16575 | 19410 | 0 | 0 | 987 | 3 | 24 | 173 | 155 | 160910 | 305 | 0 | 0 | 289 | 0 | 0 | 40 | 0 | 0 | 32 | 0 | 0 | 58 | 0 | 0 | 52 | 0 | 0 | 6 | 0 | 0 | 9 | 0 | 0 |
| 1925–26 | 6 | 152 | 1059 | 26475 | 20780 | 0 | 0 | 1781 | 8 | 22 | 276 | 112 | 290133 | 274 | 0 | 0 | 245 | 0 | 0 | 35 | 0 | 0 | 27 | 0 | 0 | 50 | 0 | 0 | 42 | 0 | 0 | 8 | 0 | 0 | 13 | 9 | 7 |
| 1926–27 | 6 | 148 | 1047 | 26175 | 15680 | 0 | 0 | 2278 | 3 | 12 | 394 | 485 | 364373 | 243 | 0 | 0 | 235 | 0 | 0 | 55 | 0 | 0 | 47 | 0 | 0 | 49 | 0 | 0 | 43 | 0 | 0 | 6 | 0 | 0 | 12 | 3 | 0 |
| 1927–28 | 9 | 184 | 1005 | 25125 | 9840 | 0 | 0 | 1821 | 4 | 21 | 310 | 19 | 294437 | 255 | 0 | 0 | 245 | 0 | 0 | 50 | 0 | 0 | 42 | 0 | 0 | 50 | 0 | 0 | 45 | 0 | 0 | 5 | 0 | 0 | 9 | 0 | 9 |
| 1928–29 | 10 | 170 | 1126 | 28150 | 10760 | 0 | 0 | 1831 | 7 | 15 | 309 | 88 | 299034 | 255 | 0 | 0 | 245 | 0 | 0 | 40 | 0 | 0 | 32 | 0 | 0 | 48 | 8 | 0 | 44 | 0 | 0 | 4 | 8 | 0 | 7 | 4 | 8 |

C=One candy of lint: (500 lbs.)
P=One pothie of kapas (seed cotton)—260 lbs.
The seed rate is usually 25 lbs. per acre.
The extra price calculated is the difference between the amount the ryot gets now by ginning and co-operative marketing and the amount they would get by selling their produce as kapas alone.

# CATTLE BREEDING

By R. W. LITTLEWOOD, N.D.A.

*Deputy Director of Agriculture, Livestock*

The Department of Agriculture is trying to build up a dual purpose breed of Ongole Cattle which will produce good work-cattle and milk. It is obvious from results up to the present at Chintaladevi that some Ongole cows are fairly good milkers, three or four cows having reached 5,000 lbs. milk in a single lactation and if they are properly fed and maintained, they breed fairly regularly. The size, constitution and conformation of the bulls have not suffered and so there is every hope of building up a herd of good milkers which will produce good calves and work-cattle. In the Ongole breeding tract very few cows are milked out (except in towns) to find out the milk yield, the calves are allowed to suckle their dams with the result that the cow does not prove economic to keep. Most ryots maintain one or two she-buffaloes to supply milk and *ghee* for domestic use. It is suggested that all ryots should be persuaded to milk out their cows in milk fully one day per week in order to find out the milk yield of the cow. If they discover that their cow gives 16 lbs. milk per day when well fed, they can milk out 3 to 4 lbs. milk in the morning and 3 lbs. in the evening for their domestic use and allow the calf to suckle the remainder, always leaving at least 6 to 8 lbs. milk per day for the calf up to 6 months of age; they could discontinue keeping one or two she-buffaloes and increase the concentrated food and fodder fed to the Ongole cow. Ongole cows are purchased in Madras according to their milk yield, so much (about Rs 10) per lb. of milk yielded, therefore a cow yielding 16 lbs. per day would realise Rs. 160. Ryots should be informed of this, so that they will try to feed their cows in a better manner and also record the yield of milk. This method is followed on all Government Cattle Farms. Ongole Cattle should be encouraged in Vizagapatam, Godavari, Kistna, Guntur and the Ceded Districts.

2. Regarding the Kangayam breed, it is common knowledge that they are poor milkers, the daily average yield per lactation working out at about 5 lbs. milk per cow. This is poor. It is seen that the Kangayam breed is not pure; animals are born from apparently pure stock and yet we get some bulls with short stumpy horns, some with typical Kangayam horns and some reverting to the Alambadi or Mysore breed, the conformation also varying besides the colour. This Department is trying to breed out these defects by selection and at the same time to increase the milk yielding powers of the cows by mating them to a pure bred bull from a good milking dam. The best Kangayam cow for milk yield has produced 4,100 lbs. milk in a lactation and this cow's son is being used as a breeding bull on the farm. Kangayam bulls should be encouraged in Salem, Coimbatore, Chittoor, North and South Arcots, Tanjore, Trichinopoly and Madura Districts where work cattle are required. Local herds can be graded up by the use of pure bred bulls.

3. The Scindhe Herd is one of the best milk breeds in India, the cows do well on scanty rations and maintain fair condition. The bulls of this breed are on the heavy side and are rather slow workers when compared with the Kangayam. The Livestock Section is building up a herd of good milking cows



for urban milk supply and at the same time producing bulls for sturdy work to increase the size and milking capacity of the West Coast animals which are very poor milkers and small. There are several Scindhe cows at Hosur which have yielded over 20 lbs. milk in a day. Scindhe bulls should be encouraged in the South Kanara and Malabar Districts.

4. Until this Department can issue cows and bulls of the Ongole and Scindhe breeds which produce good milking stock, it is essential to have a breed which will produce a good quantity of milk for town milk supply for the present, in order to stop the large drain of the best cows and heifers from the breeding areas. In Madras it is estimated that 600 to 700 first or second calving cows are slaughtered per year when they go dry. This is a severe loss to the breed and to prevent this large loss each year, more crossbred cows should be encouraged as they produce more milk and are more regular calvers. If and when the indigenous breeds of cattle like the Ongole and Scindhe are improved, so that they yield a fair quantity of milk and calve regularly, the use of the crossbred can be discouraged and the use of the country breeds encouraged. The one advantage of the crossbred is that the calf can be sold away one week after birth and the dam will still continue to milk. The disadvantage at present is that there is no demand for crossbred bullocks. In the hill-stations, crossbred cattle do very well and this Department is gradually grading up these crossbred cattle by the continual use of pure bred Ayrshire bulls. Milk is scarce in the hills and there is a great demand for it, and as country cattle of the plains do not thrive well there the crossbred ones have to be used.

5. Regarding buffaloes, these must be encouraged in places and tracts where the country cattle are very poor yielders, such as the West Coast, Coimbatore and Tanjore Districts. They should, however, be discouraged in Guntur and districts adjoining, where Ongole cattle are bred so that the people may pay more attention to the milk yield of the Ongole cow.

6. A herd of Delhi and Murra she-buffaloes are maintained at Guntur in order to produce good breeding bulls for stud work in the districts. Country she-buffaloes have been crossed by these Delhi buffalo bulls and the crossbreds are found to be much better milkers. A herd of crossbreds is being graded up by the use of pure Delhi bulls in each generation and these are proving better milkers. Bulls from these crosses and the pure stock are available for sale for breeding purposes.

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## USEFUL RECIPES

### Alum Bordeaux mixture for spraying against fungoid pests

| Copper sulphate lb. | Alum lb. | Lime lb. | Water Gal. | Casein lb. |
|---|---|---|---|---|
| 4 | 4 | 6 | 50 | 1 |

To prepare 50 gallons of the mixture, dissolve 4 lb. of copper sulphate and 4 lb. of potash alum in 24 gallons of water in a copper, wooden or earthenware vessel. (A) Dissolve 5 lbs. of quick lime in 24 gallons of water (B). Mix A and B stirring the mixture well all the time.

Casein 1 lb. is soaked in water (1 gallon) and dissolved in lime water (1 gallon of water and 1 lb. of lime) and this solution is added to the alum Bordeaux mixture as adhesive.

# MIDRIB FORKING IN SORGHUM

By G. N. RANGASWAMI AYYANGAR, B.A.
*Millets Specialist*
AND P. SUBRAMANYAM, B. Sc. Ag.
*Assistant to the Millets Specialist.*

At the Millets Breeding Station, working on Sorghums, it was noticed in 1926 in family No. A. S. 576 that a few plants had the midrib of some of the leaves forked. The forking varied in intensity, from very slight to quite a pronounced type, depending on the starting point of the forking, as the illustration will show.

On a closer examination of all the lines under study in 1927, it was observed that in 45 families stray cases of forking of degrees were met with. This proved independent of whether the midrib was dull or white in colour.

The forking varied with the number of plants in which it manifested in each line, in the number of leaves in which the forking appeared, and in the intensity of the forking when it did appear. The number of plants showing forking varied from an odd plant to half the population.

To pursue this phenomenon in detail, with a view to exploring the possibility of its constancy proving a distinguishing varietal character, a few selections were taken from four families, A. S. 951, A. S. 376, A. S. 1066, and A. S. 1566.

The following table illustrates the parental character, and progeny behaviour of the selections taken.

TABLE I

| Family No. | Forking percentage in 1927 | 1928 Forked selection number | Forking percentage in progeny |
|---|---|---|---|
| A. S. | | A. S. | |
| 951 | 1·4 | 2103 | 2·6 |
| 376 | 5·9 | 2100 | 32·6 |
| | | 2101 | 22·4 |
| 1066 | 35·1 | 2108 | 30·8 |
| | | 2109 | 26·8 |
| 1566 | 52·9 | 2111 | 58·5 |
| | | 2112 | 49·3 |



This experience was pursued in the year 1929 and the following tables record the counts.

TABLE II

| Family No. | Progeny 1929 | |
|---|---|---|
| | Selection No. | Forking percentage |
| | A.S. | |
| A.S. 2103 (2·6% forking) ... | 2497 | 1·9 |
| | 2498 | 0·0 |
| | 2499 | 0·0 |
| | 2500 | 0·0 |
| | 2501 | 0·0 |
| A.S. 2100 (32·6% forking) ... | 2491 | 5·7 |
| | 2492 | 2·8 |
| | 2493 | 9·3 |
| | 2494 | 3·4 |
| | 2495 | 7·2 |
| | 2496 | 6·6 |
| A.S. 2108 (30·8% forking) .. | 2502 | 2·0 |
| | 2503 | 0·8 |
| | 2504 | 3·5 |
| | 2505 | 4·9 |
| | 2506 | 4·8 |
| | 2507 | 5·3 |
| A.S. 2111 (58·5% forking) ... | 2508 | 39·1 |
| | 2509 | 36·6 |
| | 2510 | 44·4 |
| | 2511 | 34·0 |
| | 2512 | 28·1 |
| | 2513 | 35·5 |

In the 1929 families intensive examination with a view to gauge the nett intensity of the manifestation and the incidence of the details thereof, was made of the plants and the following is the record of the data gathered.

TABLE III

| Clan Number | Number of plants showing forking in the leaf | Number of leaves actually forked |
|---|---|---|
| A.S. | | |
| 2103 | 2 | 2 |
| 2108 | 25 | 26 |
| 2100 | 35 | 43 |
| 2111 | 257 | 299 |

TABLE IV. **Forking intensity per plant**

| No. of forked leaves per plant | No. of plants in Clan No. | | | |
|---|---|---|---|---|
| | A.S. 2100 | A.S. 2111 | A.S. 2108 | A.S. 2103 |
| 1 | 31 | 211 | 24 | 2 |
| 2 | 2 | 30 | 1 | nil |
| 3 | 1 | 6 | nil | nil |
| 4 | 0 | 0 | nil | nil |
| 5 | 1 | 0 | nil | nil |



TABLE V. **Where forking shows most**

| Position of leaf in the plant | | No. of plants manifesting in Clan No. | | | |
|---|---|---|---|---|---|
| | | A. S. 2100 | A. S. 2111 | A. S. 2108 | A. S. 2103 |
| Top leaf (flag) | 1 | 20 | 187 | 24 | 1 |
| " | 2 | 5 | 85 | 2 | 1 |
| " | 3 | 7 | 23 | nil | nil |
| " | 4 | 2 | 4 | nil | nil |
| " | 5 | 2 | nil | nil | nil |
| " | 6 | 3 | nil | nil | nil |
| " | 7 | 3 | nil | nil | nil |
| " | 8 | 1 | nil | nil | nil |

It will be noticed that the forking is fairly constant in the flag, the reproductive end of the leaf series.

TABLE VI. **Extent of forking in the leaf and its incidence**

| Clan No. | Degree of forking | | | | | |
|---|---|---|---|---|---|---|
| | $\frac{1}{4}$ | $\frac{1}{3}$ | $\frac{1}{2}$ | $\frac{2}{3}$ | $\frac{3}{4}$ | full |
| A.S. | | | | | | |
| 2100 | 11 | 14 | 13 | 2 | 2 | 1 |
| 2111 | 15 | 103 | 109 | 26 | 8 | nil |
| 2108 | nil | 3 | 4 | 4 | 11 | 4 |
| 2103 | nil | nil | 1 | 1 | nil | nil |

Half and one-third forking are commonest. Full forking is rare.

When the adult manifestation is weak, the seedlings do not give any clue to this character. But in Family No. A. S. 2111 in which the intensity of forking is greatest, even in the earliest seedling stages forking showed out in stray cases in the end leaf of the thinned out seedlings over a month old.

Similar forking was observed in the midribs of the leaves of *Setaria italica*, especially of some of the broad leaved varieties, mostly showing in the flag and in some of the alternate lower leaves.

Bugnon (2) after an examination of several leaves came to the conclusion that leaf dichotomy is an atavistic tendency. In the light of Bugnon's researches the above phenomenon strikes us as interesting also for the phyletic

tendencies it seems to exhibit. Midrib forking therefore may possibly be a reversion to the 'ancestral and primitive type of branching found in the vascular plants'. And though it is not Bugnon's leaf dichotomy, the midrib dichotomy more closely parallels the dichotomy of the vascular structures in the primitive vascular plants.

We may also perhaps find in this a faint echo of the origin of monocotyledons by the fusion of the two cotyledons of an ancestral pro-Ranalian dicotyledon (1).

If these results of the study of the unaided eye mean anything, it would be distinctly interesting to pursue it and search for similar phenomena elsewhere among the monocotyledons.

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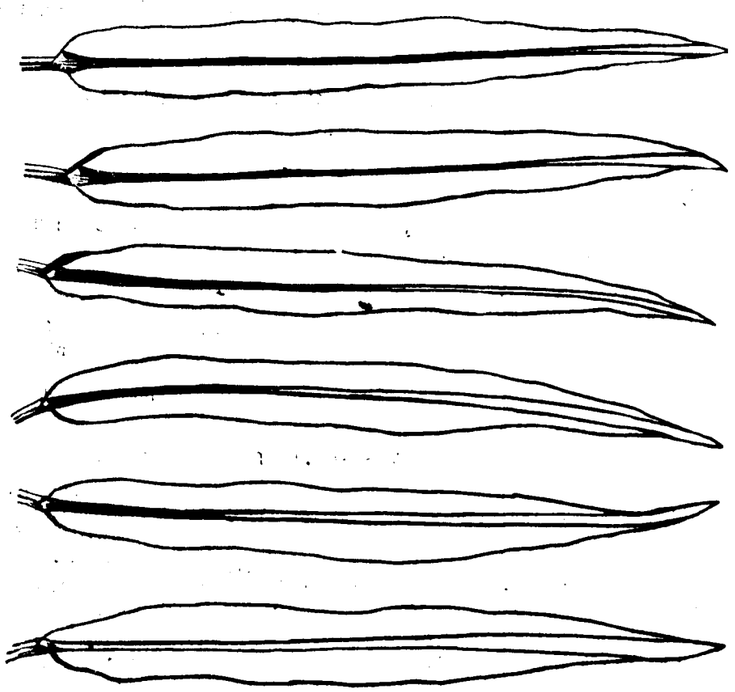

MIDRIB FORKING IN SORGHUM

# THE BIOLOGY OF ACTIVATED SLUDGE [1]

By Dr. GILBERT J. FOWLER, D. Sc., F.I.C.

Biochemistry, and specially the biology of water and sewage purification is not often the realm of the professional biologist, although, it comes under his purview and we have to consult him; it is also a subject difficult to include in a teachable syllabus as it is on a borderland of several sciences. The lecturer hopes, that by this lecture he may stimulate interest and study among the members of this association of Economic Biologists.

The biology of water and sewage purification is in fact intimately connected with the biology of the soil which is rapidly becoming a matter of great importance. The days of pure Chemistry and the ideas of chemical treatment for the soil that flourished in the days of Lawes and Gilbert have now changed in view of the recent work by Russell and Hutchinson on the bacterial activities going on in the soil. Their work has explained the rationale of the practice adopted by English gardeners in cooking their soil. The microbiology of the activated sludge thus presents an interesting picture of what goes on in well cultivated land.

In fact there is nothing essentially different in the two processes. There is the same carbon and nitrogen cycle, and worms if not moulds, play their part in the cycles, although all the organisms found in the soil are not necessarily found in the activated sludge.

The older forms of sewage purifications were by filtering through (1) contact beds or (2) percolating filters, before or after passing through tanks. In the first method, broken bricks or stones are used as the material, and by filling the bed at one end and drawing out at the other—after holding it in contact for some period—even distribution over the entire surface is ensured; the slimy colloidal portion was fixed on to the surface of the medium, during the period the liquid is in contact with the material; when the liquid was discharged oxidation changes which go on, convert the slime into a residue of brown humus, which is removed from time to time by washing the medium.

Filter beds for the town sewage at the Manchester works, main and subsidiary—were studied for their biology and interesting things were found. The subsidiary works for the suburb of Manchester, was the easier to study, as there was no trade refuse and one could easily follow the course without the disturbing factors which upset a natural order of changes going on. The following interesting things were in fact noted.

Some sewage water was collected in sterile conical flasks which were corked with cotton, and left to themselves; later, biological activity developed just as in a fertilised soil. One could find in the fluid, worms, protozoa, bacteria, and most curious of all, leeches—although one could not discover where the last came from. Evidently, the effluent flowing out of these beds was not too well purified (as it is in these days) and presented an intermediate

[1] Abstract of Lecture delivered under the auspices of the Association of Economic Biologists on 14th September, 1930.

stage of study. A remarkable thing was the presence of Carchesium of which single individuals were studied under and drawn with the help of the microscope, and which doubled themselves in the course of just three-quarters of an hour.

The next stage in sewage purification was the use of percolation beds, whereby the liquid trickled through the bed in presence of air—a set of circumstances different to that which obtained in the case of the contact beds—and hence slightly different observations were made by this method; there was a tendency for the slimy material to clog up the top layers, and on account of this, a great many of the sewage works even went out of use for a time.

It was then that a biologist H. D. Bell, seeing enormous number of little black creatures which began to appear at the exit, conceived the wonderful idea of catching them and training them to eat the slime at the top layers; this he succeeded in doing, and later, boxes of this crawling creature—*Achorutes viaticus*—were sent from place to place to open up the closed sewage filter; surely a very good example of the application of pure biology in the cause of humanity.

Other forms of higher life which these filter beds attracted in numbers, were spiders, birds (starlings) and even biting and flying insects, which last came to be a nuisance and which had to be got rid of by the use of chlorine.

It was while Doctor Fowler was asked to suggest a solution for the sewage of New York, that the idea of the activated sludge in its present form was first engendered. A city with one thousand million gallons of sewage, could not be brushed away with the filter bed system, and some other way had to be found out; and it was while watching the flowing of the sullage into the New York harbour, in the company of the Chairman of the Sewerage Commission that the idea came to him, of trying to clot it out, just in the same way as milk is curdled by the use of rennet. Experiments at the Lawrence Experimental Station gave a helpful hint in this direction, but it was in Manchester afterwards, that a culture of an iron bacillus was obtained and the sewage inoculated with this, and air blown through with the addition of a trace of iron salt, and wonderful to relate, the whole thing came down as a clot, leaving a brilliantly clear effluent. Certain iron bacteria—by the way—are rather a source of danger, tending to block up the water pipes, as they induce the formation of hydrated iron oxide which chokes the water pipes. The culture used in Manchester, for the first experiments in Activated Sludge, was discovered in a colliery work near Manchester by E. M. Mumford. Later the first plant was put up in 1913, and this organism which was the first step in the new process was after Mr. Mumford called M. 7. The novel and interesting idea was pushed through, and large carboys filled with dhal broth as the nutrient medium, were inoculated with the bacillus for multiplication and transport.

Clotting over, could one purify the supernatant liquid and if so how? Blowing air continuously through did this, and the sediment, which forms about 15% of the whole sewage, is removed then.

In the earlier years the process was thought by some American workers to be due to worms, the larvae of insects and so on. But now it is recognised and proved that the whole thing is of bacterial activity. Recent advances confirm this view; and the mass of zooglea jelly-like bacterial matter forming in the fluid is the most important phase of this activity and in the functioning



of the activated sludge. It gives enormous absorptive surface, for the proper carrying out of bio-absorption and osmosis, and for bio-chemical and bio-physical action.

The protozoa, however, though not responsible for the changes in the activated sludge, are important, because, their activity or inactivity is a test for the good condition of the sludge. The presence, for example of a good number of paramœcia, is an indication that all is right with the sludge. Again over-aeration of the sludge or as it is called burning, and the seasonal variations produce marked changes in these protozoic organisms, which are easily traceable, and help us to control the working of the sludge. The protozoa thus are passive and not active agents in the medium, important though they are.

Thus, the changes brought about in the sludge process are identical with those taking place in a fertile soil. The clear effluent from the works—rich in nitrates—the last product of bacterial metabolism—is good for irrigating paddy fields, and the sediment—activated sludge as it is called—is an excellent and efficient nitrogenous manure. It contains five to six per cent of nitrogen which is present in the proteid form combined with phosphorous, the form which is of such highly nutritive value for crops.

## ASSOCIATION OF ECONOMIC BIOLOGISTS

*The Secretary of the Association sends us the following for publication :—*

The second meeting of the association was held on 26th August in the Freeman building with the president of the association Dr. T. V. Ramakrishna Ayyar, in the chair. Besides the members and a certain number of visitors, there were present a large number of students at the meeting. There were two papers on the agenda, one by Rao Bahadur T. S. Venkatraman on 'Sugarcane X Sorghum hybrid' and the other by Mr. V. Ramanathan on 'The position of the first fruiting branch in the Madras cottons'. Before starting on the regular business of the meeting, the Secretary of the Association made a brief statement regarding the strength and the financial position of the Association and appealed to such of the members as were in arrears of subscriptions to pay them up at an early date, and to the non-members to become members.

Rao Bahadur T. S. Venkatraman who was next called upon to address the meeting, gave a detailed and highly interesting discourse on the origin, and the economic significance of the sugarcane X sorghum hybrid, which he had succeeded in effecting. Sugarcane he stated, was a long duration crop, and in India occupied the land for a period equivalent to at least two other short duration crops, and there existed a definite need for sugarcanes shorter in duration than the existent kinds. There have been produced at the Coimbatore sugarcane Breeding station, certain seedlings of the types of Co. 214, Co. 281, and Co. 290, whose introduction in N. India, has given a longer working season for the white sugar factories. He considered a further shortening of the growth period might have far-reaching effects on the future development of the sugar industry, and to gain this object he had tried to cross sugarcane with various millets in 1929–30 and luckily, one of these, that between sugarcane and sorghum, the former as the mother and the latter as father, had succeeded. He then dwelt on the various characters of this hybrid, and how they compared with those of the two parents.

He stated that he obtained nearly 8000 seedlings from this cross, but the bulk of them died in the early stages often due to the absence of chlorophyll. The rest of them were planted out and were being studied for various characters. Most of these he found, were lacking in vigour as compared to the sugarcane X sugarcane hybrids. While the seedlings obtained from selfing sugarcane flowers, usually show considerable variation, the variations observed in the seedlings of this hybrid were found to be even greater. Some of the characters for which the hybrid seedlings have been examined were leaf, stem, incidence of insect pests and diseases, and quality of juice. As regards the leaf character, the hybrids were stated to be distinct from those of sugarcane hybrids in shape, surface contour, presence of wax, and behaviour in fading. While a large number of hybrids showed more leaf than stems (i.e. canes) some have been observed to show good tillering and early cane formation, the latter character, earliness, being introduced from sorghum. The stem characters of sorghum which have appeared in these hybrids, were stated to be the single row of root eyes, the presence of pronounced grooves, and the development of buds. As regards insect pests, while none of the sugarcane X sugarcane seedlings have so far been noted to be colonised by *Aphis maidis*, the lecturer found that a certain number of these hybrids showed a heavy colonisation. He found that the hybrids appeared to attract more root aphids and mealy bugs than sugarcane seedlings. Lastly, as regards the juice character, the most important of all, he found that certain of the hybrids had ripened off within the short period of 5 months with juices containing 16 to 18 per cent of sucrose, a quality equal to those of the 12 to 14 months' sugarcanes.

The lecturer showed certain of the pictures—rather half done—which were in course of preparation for a publication on the subject. He had also brought with him a few specimens of the hybrids and the parents to illustrate the characters under study. He regretted, however, that he could not bring in more specimens of the hybrids to show all the characters as they were too valuable to be removed from the soil; and in fact with regard to some of the most important characters every bit of the hybrids was wanted for multiplication and more detailed studies. He, however, cordially invited all the members to pay a visit to the sugarcane station and see for themselves the interesting population of hybrids. He expressed in the course of his lecture his indebtedness to his assistants, Messrs. R. Thomas, and T.S.N. Singh, the former for his enthusiasm and the application with which he carried out the cross when the suggestion was made to him, and the latter, for the anatomical and histological studies of the hybrids. The lecturer thought that crop breeders should not confine their attention to the particular species of plants they were interested in, but should try and effect crosses between different allied species and even allied genera, and that there was a great scope in selecting parents for crosses as widely different as possible. He concluded his lecture by appealing to other members of the association present, for further suggestions in the matter of obtaining vigorous growing sorghums and other crops, as he intended to try hybridising canes with some other cereals particularly of the wild type.

The lecture was followed by an interesting discussion. Mr. S. Sundararaman pointed out that the hybrids having shown a greater susceptibility to *Aphis maidis*, they should be carefully tested for *Mosaic* susceptibility as *Aphis maidis* was understood to be the carrier of this disease. To this the lecturer replied that hybrids which showed special susceptibility to Aphis would be destroyed. Fortunately the ones he had found most useful so far, were not specially liable to the attack of Aphis; he thanked Mr. S. Sundararaman, however, for the suggestion. Mr. S. N. Venkatramanan mentioned that with reference to the lecturer's suggestion, that inter-specific and intergeneric crosses should be attempted in all crops in order to widen the breeding work, the chief difficulty they were up against in the case of cottons, was sterility of the hybrids. He stated that with crops propagated from seed, unlike sugarcane, the suggestion was not likely to be practicable. He also wanted to ascertain from the lecturer whether he had attempted to cross sugarcane with maize. The lecturer in reply admitted the force of the contention about sterility. He himself had experienced this difficulty in the case of sugarcane X sugarcane hybrids, but still by persevering at the problem he had got over the difficulty in canes and the same might be possible in cotton also. He also suggested that an attempt might be made to use the wild cottons as parents in future hybridisation work. As regards crossing cane with maize the lecturer stated that he had attempted it last year without success and that he proposed to try again.



Mr. P. S. Jivanna Rao remarked that sugarcane and sorghum both belonged to the same subgroup, Andropogoneae and what was possible in this case might not be equally so with regard to the other crosses proposed by the lecturer, and suggested that the reciprocal cross with sorghum as the mother might be tried. He wanted to ascertain from the lecturer whether he had studied the chromosomal differences in the hybrid and the two parents. He also wished to know from the lecturer, whether he expected to get any material from this cross which was likely to be useful to the Millets Specialist. The lecturer in replying to the questions raised by Mr. Jeevanna Rao, stated that the sugarcane seedlings were generally found to contain from 106 to 120 chromosomes and he understood the number to be 20 in sorghum. He has had the hybrid material sent to Dr. Bremmer in Java who has found this to contain about 65 chromosomes which puts it down as a definite hybrid between sugarcane and sorghum. As regards the suggestion to try the reciprocal cross the lecturer stated that he intended to do it, and that he would apply for the help of the Millets Specialist as he was not familiar with the technique of emasculation in sorghums. As regards the possibility of some of the hybrids proving useful for the Millets Specialist, he stated that he could not give any definite opinion as none of the hybrids has so far showed any signs of flowering.

Dr. T. V. Ramakrishna Ayyar, the president, thanked the lecturer for his extremely interesting discourse and offered a few remarks on the paper emphasising the advantages and valuable information obtained by the non-botanist members from hearing such a lecture. He pointed out that the taxonomic conception of species and genera was changing. Originally varieties or races that would not cross with each other were put down into different species. Later work had demonstrated a number of interspecific crosses, and a few intergeneric crosses as well, and the case referred to by the lecturer was a rare example of the latter.

To a question from one amongst the audience as to what tonnage of sugar he expected from the hybrid which had ripened off in 5 months, the lecturer stated that he could not make any accurate test at this stage, but expected that the tonnage would not be far short of what was being obtained from the indigenous canes of N. India. To another query from a member, the lecturer explained the meaning of the Dutch word *Pokkah bong* which

meant rolled or injured tops, which was one of the characters observed in the cross.

We cannot possibly visualise the enormous possibilities of this hybrid. If sugarcane could be grown as a garden crop just like *ragi*, or groundnut, which would appear to be reasonably possible from what the lecturer said, any garden land cultivator should be able to cultivate the crop. The area under cane could be increased enormously and it should effectively solve the problem of the country producing its sugar requirement. It is extremely gratifying, that the whole credit of this wonderful piece of work goes to one of the founders of the Association.

The second paper about cottons was then read by Mr. V. Ramanathan. His paper dealt with the position of the first fruiting branch in Madras cottons. This position forms one of the main contributing factors for earliness, a character of great economic importance. Other conditions remaining the same, the lower the node at which the first sympodium arises, the earlier is the production of the boll. The development of the plant is an end result of complex processes brought about by influences both environmental, and hereditary. A plant breeder has to investigate and assess the relative values of the two influences. Mr. Ramanathan studied the position of the first fruiting branch in the cotton plant grown under different environmental conditions. Counts were taken in the various experimental plots at Hagari, Nandyal, Koilpatti, and Coimbatore, and the mean number of nodes from the bottom, at which the sympodium arises was determined. If the means of two plots differentially treated was statistically significant the differential environment was taken to have influenced the character. Such a study had shown that the environmental conditions viz., (1) the nature of the previous crop in the rotation, (2) the manure applied, (3) the cultural operations done during the season, and (4) the time of sowing the seed, all have a significant influence on the expression of the character. That the indications are very similar in three varieties grown in four different tracts adds considerable significance to the results recorded.

The hereditary or genetical influence on the same character was investigated in the case of the progenies of two crosses *Indicum X Cernum*, and *Indicum X Roseum*. Although it has not been possible to determine exactly the number of Mendelian factors involved in the character, the results have been found to conform to a multiple factor hypothesis, as in the case of any other quantitative character.

In the discussion that followed Rao Bahadur T. S. Venkatraman stated that the results put forward by Mr. V. Ramanathan were highly interesting and that they only tended to show how complicated the problem becomes to the breeder when environment can play such an important part in an economic character, the early or late flowering of the crop. One great problem he had come across in his sugarcane work was to induce early or late flowering according as circumstances required. In sugarcane, the only indication they had about flowering was the sudden drop in the total solids of the juice just previous to flowering. Mr. K. Ramiah pointed out that early or late flowering in rice was controlled by Mendelian factors, and was also subject to environmental influences the chief of them being the time of sowing the seed.

Mr. V. Ramanathan finally remarked that the studies described in the paper had made him view the effect of certain agricultural practices from a new angle. The nature of rotations, manures, and agricultural operations



carried out in a field, seemed to disturb the carbon-nitrogen ratios existing in a plant, as indicated by the position of the first fruiting branch in cotton plants.

The President in bringing the meeting to a close thanked Rao Bahadur T. S. Venkatraman and Mr. V. Ramanathan for the interesting papers they had contributed to the second meeting of the Association. He also appealed to all other members to contribute papers for the later meetings and make the association a success.

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## NOTES AND COMMENTS

### The Late Mrs. Howard

The news of the passing away at Geneva, of Mrs. Gabrielle L.C. Howard M.A., formerly Second Imperial Economic Botanist, Pusa, will be received with great regret by all our readers. During a period of twenty years from 1905 to 1924, first as Assistant to the Economic Botanist and later as the Second Economic Botanist, she contributed—in joint authorship with her husband, Mr. Albert Howard, M.A., C.I.E., the Economic Botanist,—over a hundred memorable publications in a number of scientific journals on varied aspects of agricultural research, notable among which are the studies on Indian Tobacco and on Wheat. When Mr. Howard was appointed in 1924, as the Director of the Plant Institute at Indore, she also was deputed, and during the five years of their stay there, was the right hand and helpmate of her husband in the organisation of the New Institute. With her husband, she has been largely responsible for giving impetus to the idea that any researches in plant genetics must be based on a broad outlook and must proceed from the economic the producer's point of view. In recognition of her contributions to the cause of Agriculture and Science, H. M. the King was pleased to confer upon her the honour of the Kaiser-i-Hind Medal, First class. In January 1929, she presided over the Agricultural Section of the Science Congress at Madras, being the first woman to have been so honoured. Her death has removed from the field of research workers in India, an outstanding personality and a scientist of sincerity, enthusiasm, great achievement, and greater possibilities. Her life with Mr. Howard reminds one of the poet Robert Browning and his poetess wife—so harmoniously blended were their ideals and pursuits in life. We offer our most heartfelt condolences to Mr. Howard on his irreparable loss.

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### Soil Nitrates

Adding different amounts of various fertilisers to different kinds of soils, Prof. A.B. Beaumont of Massachusetts Agricultural College, found that lime up to six tons per acre increased the nitrate concentration. Green crops ploughed in, checked nitrification in the beginning, but later, there was an increase in the accumulation of nitrates. Our experience also has been that green manure crops ploughed in, increase the nitrate content of the soil. It is interesting in this connection, to read a bulletin published by the Arkansas Station (Ark. Stn. Bull. 246—1929) on the effect of cultivation on nitrate production and the retention of moisture in soils; therein it is stated that weed growth showed itself wasteful of moisture supply and that in order to conserve the nitrates for the crops, it is necessary to prevent weedgrowth. Here is indeed yet another potent argument for clean cultivation methods!

### The 'Mosaic' Again!

Cruciferous plants are badly infected by a mosaic disease known as *rustabagus* and the degree of susceptibility of the various plants of the order was studied by E. E. Clayton. (Journal of Agri. Research U.S.A. 40—1930–No. 3). He found that while Brussels Sprouts and Cauliflower were subject to infection, Cabbage was highly resistant or even immune.

The Mosaic in cane has been known to be transmitted through the agency of the aphids. Studies on the aphid transmission of plant viruses has revealed that two aphids *Myzus pseudosolani*, Theob. and *Macrosiphum solanifolii*. Ash., while capable of transmitting the specific virus of Tobacco mosaic from tomato to various solanaceous hosts, do not transmit the same from tobacco. Evidently, the aphids are as fastidious in their transmissive pursuits, as the mosaic is in discriminating between plants of cruciferae.

### Honour to a Scientist

We understand from Science of August 1,1930 that Dr. Stephen Moulton Babcock, emeritus Professor of Agricultural Chemistry at the University of Wisconsin, and the inventor in 1890 of the Babcock milk test which revolutionised the dairy industry, is to receive the Capper Award of 5,000 dollars and a gold medal at the annual meeting of the American Country Life Association. The Capper Award has been established by Senator Arthur Capper, of Kansas with the objective of providing 'a concrete expression of gratitude to some of the people who make contributions of national importance to American Agriculture and to assist in stimulating public appreciation of usually fine service to the basic industry.' No time limitation is imposed as to when the service rendered to agriculture was performed. The first award will be presented in 1930 and no person who has once received it, will again be eligible.

### Import of Coffee Beans into India

We understand from the *Planters' Chronicle* of August 2nd that to combat the further spread of the coffee pest Stephandodores, the Government of India have issued a notification under the Destructive Insects and Pests Act of 1914 prohibiting the import into South Indian ports of unroasted coffee beans. The journal understands that a further notification is contemplated prohibiting the carriage of these beans through parcel post, and that the question of total prohibition of imports is under consideration.

### Bombay Cotton Industry

A Reuter's Cable says that the Manchester correspondent of the *Financial Times* announces that a representative of the firm of Airey Entwistle and Company will shortly visit Bombay for valuing several cotton mills in Bombay. The idea behind the visit is said to be to prepare a scheme for amalgamating the principal cotton mills in Bombay on the model of the Lancashire Cotton Corporation.

### Pasteurisation of dried fruits

The pasteurisation of dried fruit is yet another important step in the marketing of fruits. From a note appearing in the *Hindu Illustrated Weekly* it would appear that dried fruits such as raisins, figs, dates, apricots and prunes may be exposed in paper cartons to moist heat at controlled temperatures and humidities. Effective temperatures for a number of micro-organisms are said to be at 70 to 100 per cent humidity, varying from 150 to 180 degrees Farenheit, for from 30 to 70 minutes. Sulphured fruits, as would be expected, harbour very few organisms but as the presence of sulphur dioxide is prohibited by the British Ministry of Public Health Regulations the use of Sulphur or Sulphur dioxide in disinfecting fruit is not desirable.

## Indigo crop of 1929–30

According to a note by the Director of Agriculture, Madras, the average acreage under indigo in the Madras Presidency for the five years ending 1928–29 represents 51·7 per cent of the total area under this crop in British India. The area sown with indigo in the presidency to the end of August 1930, is estimated at 35,600 acres which is 3 per cent in excess of last year's area *viz.* 4,600 acres. Figures showing the actual quantities of the crop converted into dye, or ploughed in the soil as green manure, are not available. It is known, however, that except in parts of Cudappah district where indigo is manufactured, the crop is mostly used as green manure.

## Cambodia cotton strain Co2.

The digest of the operations of the Department of Agriculture, Madras, for the quarter ending 30th June 1930, has a short note on the performance of the Cambodia cotton strain evolved by the Cotton Specialist, Madras, and known as Co2. The quality of this strain last season was above the average. The lot obtained from a seed society recently started at Angeripalayam was the best. A purchasing firm was so pleased with this cotton that it was prepared to pay any price for the first ten candies. When the market price was ranging from Rs. 217 to Rs. 220 per candy, the company was prepared to pay a premium of Rs. 40 per candy of 520 lbs., up to the limit of 100 candies in one lot.

## Cane Ripeness

The following occurs in the *International Sugar Journal* for August 1930, page 426 :—

'Cane ripeness' :—'As an indication of the ripeness of cane, the dry substance as determined rapidly by means of a refractometer is now being much used, especially in selection work. Ordinarily a small piece of cane cut out without destroying the stalk, is crushed between the jaws of an ordinary pair of pliers, and the juice thus obtained placed between the prism surfaces. Mr. A. Garcia of Bais Central, P. I. however, has devised a kind of lancet which is more conveniently manipulated. It is really an awl with a rather deep straight groove running from the point to the hilt. It is simply inserted with steady pressure into the part of the cane to be sampled, usually pointing obliquely upward. Several drops of juice immediately run down the groove, the lancet is withdrawn, and the liquid run between the refractometer prisms by gravity.'

It may not be news to our readers that the Chemical Research laboratory of the Agricultural Research Institute, Coimbatore, developed more than ten years ago a method for extracting minute quantities of juice from the sugarcane with a modified form of an hypodermic syringe, and examining the juice by means of a refractometer. The results were first reported in 1919 to the Indian Science Congress at Bombay. Subsequent work was reported in the Memoirs of the Department of Agriculture in India and at various sessions of the Indian Science Congress.

## Cholera a thing of the past?

What might happen to be the most remarkable discovery of the age according to a short note in *Science*, August 1,1930 is that of bacteriophage or



germ killer by Professor F. d'Herelle of Yale University. A normal inhabitant of the intestines and a parasite on the microorganisms found there, the bacteriophage was accidentally found, after an outbreak of cholera to stop the epidemic when it became diffused through natural means into the drinking water used by the community. This is the basis of a scheme for a wholesale immunisation against cholera and it is suggested that potent strains of bacteriophage be multiplied deliberately and introduced into the wells. The bacteriophage has been found to be a very efficacious remedy, patients escaping death, if it is administered within six hours of the first symptom of an attack of cholera. We understand that the Indian Government have invited Prof. d'Hereile, Major R. H. Malone and Dr. M. K. Lahari to formulate plans based on this discovery, for carrying out complete immunisation against the fell disease.

## A useful tip for the pepper cultivator

Although Malabar pepper is recognised as the best in the market and although there is a great demand for it,—the current market price being as high as Rs. 25 per maund—it is rather curious that cultivators are not taking to the crop with any great zeal. One reason probably is the poor rooting capacity of the cuttings used commonly by the ryots, and the consequent patches in the crop, and the loss of season. The ordinary pepper grower of Malabar and Mysore uses the cuttings from the lower branches, and it is reported that in Mysore, out of two lakhs of cuttings distributed not even a third survived. An intelligent suggestion is made in the *Journal of the Mysore Agricultural Experiment Union* (Vol. XI. No. 1. 1930) that ryots should first raise a nursery with the cuttings obtained and then pick out the healthy and robust ones for later transplantation, on to the field. Mention is also made of an intelligent gardener who got his planting material by encouraging the branches at the crowns to root, by splitting the bark and covering up with loose earth. This method it is claimed, is the practice adopted in the Strait Settlements, where a very high yield of pepper is obtained.

Raising a nursery is certainly a good method for getting vigorous and healthy planting material for any crop, and by adopting the method suggested, the Malabar ryot may improve his pepper crop, and get increased yields. We are in this connection reminded of the practice recently come into vogue, of raising nurseries for sugarcane, whereby rapid propagation and healthy crops have resulted.

## Effects of some oil cakes on milk secretion by cows.

In an experiment conducted by the Post graduate students of the Imperial Institute of Dairying and Animal Husbandry under the direction of Mr. F. J. Warth on the effect of some oil cakes on milk secretion it was found that the value of groundnut cake and linseed cake for milk production was identical for practical purposes. But when linseed cake and cotton seed meal were compared it was found that the former produced more milk, while the latter produced milk richer in fat.

# GLEANINGS

## Mushrooms

Compared with countries of more moist and cooler climate, South Africa as a whole cannot boast of a large mushroom flora, but for those who care to take the trouble to look for them, there are many more varieties than is generally supposed.

*The Common Mushroom.* The mushroom which is most wide-spread and most easily distinguishable from poisonous kinds (often referred to as toad-stools), is the common mushroom, *Psalliota campestris*, or, as it is probably better known, *Agaricus campestris*. This variety grows in lawns, pastures, gardens, cultivated fields, and by roadsides, and is recognised by its smell and the following botanical characters:

*Cap.* Of a buff-creamy or greyish-white colour at first, becoming darker with age.

*Gills* (plate-like structures on the underside of the cap). Flesh pink at first, changing at length to a dark purplish-brown.

*Stalk.* Whitish, about length of diameter of cap, and characterized by the presence of a ring or collar on the upper part, and the absence of a cup formation at the base of the stem. In the early stages, the outer edges of the ring is united to the edge of the cap, forming a veil over the gills; but this ruptures as the plant develops.

*The Horse Mushroom.* Another edible mushroom of the same type, which occurs commonly in the Transvaal, is the Horse Mushroom or *Psalliota arvensis*. This grows in much the same environment as the last-named one, and is distinguished from it in being larger and coarser; in having a browner, scaly cap; a more bulbous stem, and gills that remain a dirty white for a long while before they turn pink and, finally, a purplish-brown. The ring is often thicker and floccose.

*Other kinds.* There are various other kinds of mushrooms which are good eating, but are more difficult for the amateur to recognise from description without an actual demonstration of the living plant. Of these, mention may be made of the Parasol Mushroom (*Lepiota procera*) so-called on account of its shape; *Schulzeria Umkowaan*, the Beefsteak mushroom of Natal, known locally as 'i-Kowe,' and highly esteemed by Europeans and natives alike; *Lactarius deliciosus*, a brick-orange coloured plant which exudes a milky juice and stains green where bruised; and various Bolete forms which have pores instead of gills on the underside of the cap.

*Poisonous Mushrooms.* Poisonous mushrooms, include *Amanita muscaria*, *A. pantherina*, and *A. phalloides*, which are easily eliminated by the observance of the following rules:

Reject all mushrooms that (1) have a cup or sac-like envelope at the base of the stem, also all those which have a scaly or close-fitting layer at the base of the stem and rather loose warts on the cap, especially if the gills are white; (2) in the bottom (very young) stage; (3) with milky juice; (4) with brightly coloured caps, or which change colour when cut or bruised; (5) that have begun to decay, or which are infested with larvae; and look with suspicion on every mushroom which is not positively known to be edible.

The above rules will exclude many good, eating varieties, but it is better to be on the safe side than to risk being poisoned.

In order to make sure of the stem characters, mushrooms should never be pulled, but should be lifted with a knife or other implement.—*Farming in South Africa.* Volume IV, No. 48.



## Biochemical Studies of Spike Disease of Sandal

Mr. M. Sreenivasaya and Mr. B. N. Sastri have continued their very detailed investigations into the spike disease of sandal (*Santalum album, L*), and their latest results are to be found in the *Journal of the Indian Institute of Science*, Vol. 12 A, Part 17, pp. 233 to 252 (1929). Leaf-juice from a sandal tree infected with the spike disease hydrolyses more soluble starch than does the corresponding healthy juice. This is due to a higher concentration of the enzyme and to the presence of activators such as phosphates and amino acids. The pH of spiked leaves is lower than that of healthy leaves, and approaches the optimum for diastatic activity. More potato starch is, however, liquified by the healthy leaf extract than by the diseased extract for equal weights of sugar produced, thus suggesting a qualitative difference between the two diastase extracts. It should be remembered that Dr. L. C. Coleman found that there was lower diastatic activity in spiked leaves than in healthy leaves, and therefore the results here reported might be interpreted as showing that the diastase content of diseased tissue fluctuates within the same limits as does that of healthy tissue.

The chemical composition of leaf and stem tissue fluids has also been investigated. The spike-diseased leaf contains more nitrogen, maltose, and reducing sugars and less ash (particularly calcium) than the healthy leaf. The stem fluids of spike-diseased trees are richer in nitrogen, phosphorus, and calcium than those of healthy plants, and there is a steep gradient of calcium concentration between the stem and leaves.

The seasonal variations in composition of healthy and partially spiked leaves of the sandal tree have been studied by Mr. A. V. Varadaraja Iyengar (*Jour. Ind. Inst. Sci.* Vol. 12 A, Part 20, pp. 295–305). Season was found to affect the chemical composition of the leaves of both healthy and spiked plants in the same manner. The following relative differences were observable in all seasons—the diseased sap had less dissolved matter, less osmotic pressure, a greater electrical conductivity, more moisture, ash, and nitrogen contents, less calcium and was more acid than healthy sap.

These detailed studies of sandal spike from the *Indian Institute of Science* have considerable significance, for it has recently been shown by Mr. M. J. Narasimhan, (*Phytopathology*, 18, pp. 815–817; 1928) that inclusion bodies similar to those which characterise certain virus diseases are present in leaf tissues of spiked plants. This, along with the work of Dr. L. C. Coleman on transmission, suggests that the malady is caused by a virus. We have thus a mine of detailed information on the chemistry of a diseased host which we can use in the elucidation of the problem of the nature of a plant virus.—*Nature*, No. 3163, Vol. 125, June 14, 1930. Page 911.

## Human Chemist Can't Compete with art of Lowly Bug the Lac Insect

The tremendous popularity of rayon as a substitute for natural silk must have created an unemployment problem among the silk worms. While the chemist with his wood pulp has outdone the worm with his diet of mulberry leaves, there is another insect, even humbler, which still retains his supremacy as a chemical factory. His name is *Carteria Lacca* and his product is a resinous material which he produces to enshroud himself but which man converts into the substance known as shellac.

W. H. Zinsser, writing in *Chemical Markets* reveals some of the many industrial applications dependent upon this louse-like inhabitant of India and Siam. Shellac is an organic resin produced through chemical processes taking place in the life of an insect and which, because of resiliency and soluble qualities, stands out in world commerce in contrast to the vegetable resins. It has qualities possessed by no other gum and is soluble in alcohol or in an alkali water solution, but is not soluble in turpentine.

As long ago as 1590 there is a record of shellac having been dissolved and used as a coating or crude varnish, and from that date, uses, to which it is now so universally put, have been developed until to-day it is the 'open sesame' to all phases of the painting and decorating art; the friend of the sculptor, electrician, and metal worker, and the companion of the woodworker and furniture finisher. It is the facile aid of the foundry pattern makers, the base of buttons, phonograph and talking machine records, telephone parts such as receivers and mouthpieces, and imitation ivory products such as billiard balls and poker chips. It is shellac that holds the filament of the electric light bulb in place, and it is the 'size' or stiffening used by the hat maker, which makes possible the many shapes and styles that fashion demands. Shellac is one of the chief ingredients in sealing wax, light drying inks, shoe dressing, and wood cements; it is the 'snap' in playing cards and the artful finish for leather, imitation leather, wall paper, hardwood floors, pencils, broom and brush handles, autos, pianos, and what not. Shellac is the modern finish of the up-to-date rubber rain coat; it is the sealer used to make 'leak-proof' the myriads of gasoline tanks that line the high ways; and is even used as a cement for sealing the seams in the manufacture of cans for foodstuffs and liquids. It is used in the manufacture of brushes as a cement to hold bristles firmly in place. It is an important ingredient in lacquers, giving them body, adhesion, and flexibility.

Chemists have spent years looking for a substitute for shellac for use in industry but have thus far been unable to better the job done by the diminutive *Carteria Lacca.—Scientific American.* Page 483, dated June 1930.

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## Sinus Infection and Vitamins

It has long been known that vitamin-A deficiency produces an inflammation of the eyes. More recently it has been quite definitely shown that vitamin A is related to the resistance of the human body against infection. Following a deficiency of vitamin A in the diet, rats develop inflammation of the eyes, infections of the nasal passages and the sinuses, of the ears, the



tongue, and even of the lungs. Most investigators are now convinced that the value of cod-liver oil in preventing colds, if it has any such value, is due to the vitamin A in the cod-liver oil and not to the vitamin D.

In the research laboratories of the Detroit College of Medicine and Surgery, Drs. B. R. Shurly and R. G. Turner made a special study of the relationship of vitamin A to infections of the breathing tract, and particularly of the sinuses. They made a special study of the bacterial organisms found in animals which had been on vitamin deficient diets. They found certain organisms in such cases which were specially virulent.

In the University of Iowa, in 1926, Drs. Daniels and Armstrong showed that deficiencies in diets encouraged infection of the sinuses as well of the ear. There seems to be no doubt that deprivation of vitamin A permits germs to exercise extraordinarily virulent effects.—*Scientific American*, June 1930, p. 476.

## The Components of an Electric Lamp Bulb

The raw materials required by the Osram Works at Hammersmith come from all parts of the world. In an article in the General Electric Company's Bulletin for February, an interesting account is given of the materials used for Osram lamps. The metal *tungsten* from which the filaments are made is obtained from *scheelite*, a whitish yellow stone of rough texture which is found in north-eastern Australia. In its rough state it is shipped round the Cape of Good Hope to London, where in the Osram works it undergoes the processes of crushing, grinding, washing, acid treatment and heating. The final result is the fine and very heavy powder, which is pure *tungsten*. It is then pressed, hammered, and drawn into the familiar lamp filament. *Shellac*, which is one of the essential ingredients forming the cement which attaches the lamp cap to the glass bulb, comes from India. The insects which form it breed in countless numbers in the valley of the Ganges. They absorb the flowing sap from young shoots of young trees and then exude a resinous secretion over their whole bodies. The twigs bearing the insects are gathered and from them commercial shellac is produced. The *nickel and copper* used in the special leading-in wires which conduct the current in and out the lamp bulb come from Canada. The *tin* for solder comes from Malay. The *sand*, *soda*, and *lime* used for making the glass of the bulbs is got in England, and so also is the minute amount of iron which helps to make the alloy used for the leading-in wires. The *diamonds* used for the dice through which the filaments are drawn come from South Africa. The sources of all the raw materials required for the manufacture of electric lamps lie in British territory.—*Nature*, No. 3159. Vol. 125. May 17, 1930. Page 754.

## The Value of Chinese Tung Oil

The main characteristic that has made Chinese Wood Oil (Tung Oil) so useful as a varnish and paint constituent, is that it has very great drying properties. It not only dries rapidly, but it dries with a very hard and impervious film which is much less pervious to water than a similar film of linseed oil. There is also much less tendency for a dry film of wood oil to hydrolyse on contact with water or caustic, and it is much more resistant to caustic than linseed oil.

*Tung—Aleurites Fordii.*—(Order Euphorbiaceæ), is now being cultivated on a large scale in Florida for the sake of its oil.—*Mechanical World and Engineering Record.* May 30, 1930.

### Sulphur as a fertilizer

Sulphur must take its place on the list of approved fertilizer minerals, at least for certain types of land. Such is the indication of experiments performed by Professor W. L. Powers, of the Oregon Agricultural Experiment Station. Professor Powers has attacked the problem of black alkali, one of the most hopeless types of land ruin in the arid and irrigated West. He found that applications of sulphur, especially when used in combination with a nitrogen-rich organic fertilizer, will reclaim such land and make it yield good crops. Even normal land is often benefited by sulphur application, he found. Sulphur-treated fields produced higher yields of alfalfa (lucerne), which had a richer, greener growth than that of the unsulphured fields.

### No more Insect Pests

A new death ray has been invented for the destruction of insect pests. So exasperated was Mr. H. Neal Turnbridge Wells, electrical engineer by the havoc which grubs, caterpillars and green fly wrought in his garden that he determined to wage scientific war against them. By means of an ordinary accumulator connected with special coils he has been able to produce a ray which wipes out insect marauders by the thousand.

At a demonstration he touched the leaves of plants infested with green fly with a forked copper wand attached to his apparatus. The leaves were unharmed but the insects were killed instantly.—*Tit bits*, London.

### Pepper Cultivation

A general account of the history and cultivation of the pepper plant has been published by M. G. Kidavu and P. A. Venkateswaran (Bull. 98, Agricultural Dept., Madras.) Pepper one of the earliest known spices in the world, is indigenous in India and was first cultivated on the Malabar coast. It was one of the most important articles of trade with Europe during the Middle ages, although it was recorded there much earlier. Being a strictly tropical plant, with the jungle as its natural home, pepper requires a heavy rainfall, and when brought under cultivation thrives best on a well-drained, virgin, red laterite soil containing plenty of humus. It is a perennial climbing plant propagated by cuttings. The standards upon which the vines are trained may either be dead or living, but if the latter, it is important that care should be taken to select suitable plants, those, for example, with a deep rooting habit being essential so as to avoid competition for the surface soil water and nutrients. Regulation of shading, and attention to terracing or other forms of cultivation to minimise soil denudation during the rainy season, are other important factors in pepper growing. The necessity for manuring is only beginning to be considered, but it is already clear that the addition of humus of some kind is very beneficial. In order to avoid disease, attention to drainage and the healthiness of young cuttings, and regular spraying with Bordeaux mixture are recommended. The berries, after being thrashed from the spikes by treading, are dried on mats or in prepared yards, both black and white pepper being obtained from the same plant, but prepared differently. As regards the economic aspect, pepper is a paying proposition, since after the initial outlay the annual expenditure is small. Uniform bearing begins about the fifth or sixth year and the maximum yields are obtained from ten to twenty-five year-old vines, although with careful cultivation still older plants can be profitably grown. (*Nature*.—May 24, 1930.)

## REVIEWS

**The Universites Year Book 1930.** By G. Bell & Sons and edited by Sir H. Frank Heath, G.B.E., K.C.B.

A short compendium giving information in one volume about the present organisations, regulations and recent activities of the Universities of the British Empire of which we understand there are now 70. The information is given in four parts (*a*) General directory, (*b*) General information, (*c*) Reports of events of outstanding interest and (*d*) Appendices.—[M. R. B.]

**Rasa-Jala Nidhi.** Or Ocean of Indian Chemistry and Alchemy. Vols. I to III by B. Mookerji. Price Rs. 6. Foreign Rs. 10.

Compiled in Sanskrit and translated by the author who intends to publish 10 volumes on the subject ; the third volume has just been received in the Library. Chemistry and Alchemy have been studied in great detail and scientifically from the earliest times in India, and the authorship of two of the earliest books on Hindu chemistry has been ascribed to Lord Sri Rama Himself. The present volumes, therefore, will be read with great interest and instruction by those who want to have any idea of India's greatness in the past, in the chemical world. Mainly a manual of Hindu chemistry, the book also deals exhaustively with the relationship of chemistry to medicine and the principles of Ayurvedic practice that are utilised for the preparation of various therapeutic agents. The matter, however, is very technical and some of the statements—as for example the claims by the author of the possibility to transmute baser metals into gold by the use of methods mentioned in the book—are not in agreement with modern accepted ideas of chemistry. Volume I deals chiefly with mercury, Vol. II with mica, arsenic and metals while Volume III treats of iron, gems, and poisons and their antidotes.

[M. R. B.]

**A new method for estimating total carbonates in soils.** By A. N. Puri, M.SC., PH. D., Pusa Bulletin No. 206, 1930. Price As. 3.

A rapid method for estimating the total carbonates in the soil has been outlined, the principle being the titration with standard sulphuric acid, of a known weight of soil held in suspension with $CaSO_4$, using a mixture of brom thymol blue and brom cresol green as indicators. Sixty soils have been analysed by this method, and the results compared with the standard one, *viz.* of treating soil with acid and absorbing the liberated carbon dioxide in potassium hydroxide. The discrepancies between the two methods, considered as percentages of calcium carbonate in the soil are within reasonable limits, and as the author himself remarks the method is quite suitable and sufficiently accurate where a large number of samples has to be done rapidly.—[M. R. B.]

**The Biological control of Insect and Plant Pests.** By W. R. Thomson' PH. D., D. SC., Empire Marketing Board publication No. 29 June 1930—Price 1s. 6d. net. This is a report on the organisation and progress of work of Farnham House Laboratory which was founded by the Imperial Bureau of Entomology in 1927, by means of a grant from the Empire Marketing Board.

Originally the object of the laboratory was the furtherance of the control of insect pests by the biological method, but, later, investigations and practical operations were conducted on insect enemies of weed plants as well. We in South India are familiar with the phenomenal success of the control of the Nephantis caterpillar attacking coconut, by means of parasites, and this publication of the Empire Marketing Board will therefore be read with great interest by those interested in control of pests. With a neat get up and a few interesting illustrations, the booklet gives a clear account of the principles and organisation of work on biological control, and of the practical work done so far under systematic heads such as :—parasites of fruit insects, of forest insects, of cereal insects, of insects attacking man and animals etc. An idea of the work done so far, can be gathered from the fact, that during the short period it has been at work, 73 consignments of beneficial insects containing approximately 2,85,000 living individuals have been sent out by the laboratory.

[M. R. B.]

**Rose culture.** Ontario Department of Agriculture, Bulletin 353 April 1930. This bulletin recently arrived from Ontario, gives useful information about Rose culture. It is mainly a record of the experimental work on Roses done at the Agricultural College, Ontario, and besides giving useful hints about time of planting, suitable soils, fertilisers etc. contains valuable experimental data on the reactions of different rose varieties to weather conditions—a very important factor in rose culture. As a result of such work it has been possible to find out which varieties are suitable for cuttings, which for garden cultivation, which are hardy and which produce the greatest number of blooms. An account of insect pests and diseases is also given and it is interesting to note that a decoction of tobacco is about the best spray to be used against insects attacking the rose.—[M. R. B.]

**Agricultural Zoology of the Malay Archipelago.** By K. W. Dammerman, D. Sc., published by J. H. deBussy Ltd., Amsterdam. In the main, the book is an English edition of a work originally written by the author in Dutch and published in 1919. With its copious illustrations and its voluminous matter, the book suggests an association of Fletcher's 'Some South Indian Insects,' with which, most of us in India are familiar. The book however, deals not merely with insects, but with higher forms of life as well and the arrangement of matter is not the one usually followed giving neither a systematic sequence of the pests nor an arrangement under the various crops. On the other hand the animals that are related from an economic point of view are treated together—thus: Animal pests—soil Fauna, internal plant parasites, stored product pests, beneficial animals, and so on—the method adopted has an advantage that much repetition and cross-references are avoided. A systematic index at the end of the book provides at the same time facilities for the purely systematic zoologist. The climatic conditions of the Malay Archipelago are not very different from those obtaining in the South of India and in going through the Fauna mentioned in the book, one comes across many old friends, among pests and parasites which are familiar to us already. The book can be read with great interest and instruction by students and others interested in Economic Entomology.—[M. R. B.]

**Cattle feeds of Western India.** Bulletin No. 161 of 1930 by Rao Bahadur D. L. Sahasrabuddhe, M. Ag., M. Sc.—Price 1 anna.

A useful compilation of the results of analysis of oil cakes, leguminous seeds, leaves, stems, silage, etc. used as cattle feeds; gives also the principle



of making up suitable rations, dealing with the economic side as well. The digestibility co-efficients, however, are not the results of any recent experiments done in India, probably because this work has only been lately started in Bangalore, the Punjab and Coimbatore, and figures are not yet available.

[M. R. B.]

**Silage and ensilage.** The April number of the Central Bureau of Animal Husbandry and Dairying contains an interesting article on Ensilage reprinted from a compilation by the Military Farms Department, India from a series of articles by Messrs. Amos and Woodman. It refers to the confusion that exists in the use of the terms ensilage and silage and says that the word 'Ensilage' should only be used to describe the process and that the product should be called 'Silage.' Ensilage is the process whereby crops are preserved in a green state by the exclusion or limitation of supply of the oxygen in the air from the silage material.

Five distinct types of silage can be differentiated, depending on (1) the nature of the crop, (2) the maturity of the crop, (3) the facilities obtainable for fermentation and (4) the manner of making silage.

The different types of silage are (1) Sweet dark brown silage, (2) Acid light brown or yellow silage, (3) Green fruity silage, (4) sour silage and (5) musty silage, of which (3) is the best, and (2) the worst.

Almost all kinds of herbaceous crops are capable of being made into good silage with the exception of the Brassicae plants of the Cabbage tribe, which are too succulent and give rise to obnoxious smelling silage.

An ideal crop for ensilage should fulfil the following conditions:

1. It must be easy and cheap to grow so that its cultivation does not interfere with that of other important crops.
2. It should be a reliable crop not given to variations in yield.
3. It should be easy to harvest, easily carted and quickly chaffed for filling the silas.
4. It should quickly reach the necessary degree of maturity for ensiling since immature silage is liable to sour.
5. The silage produced should have a relatively high food value, should be digestible and contain a reasonable amount of albuminoids.
6. Lastly it should allow time for weed destruction before sowing or after harvesting.

Chief crops which are used in India are, coarse grasses such as *Oxytenanthera stockson*, maize, sorghum and oats. A crop suitable for silage is one that is ready at a time when other farm work is at a minimum so that it can be carried out conveniently. The time to cut is when the crop is mature but not too mature (i. e.) in a slightly more advanced stage than haymaking. The best type of silage is obtained if the crop is ensiled immediately after cutting.

Since ensilage is the preservation of green succulent crops by the exclusion or limitation of supply of the oxygen in the air from the silage material, great care should be exercised in preventing the access of the air by making the side walls airtight. In filling air must be excluded by efficient trampling. Detailed descriptions of tower silos and pit silos with instructions to fill them are given, in the bulletin. [C.S.K.]

## CORRESPONDENCE

I

To

The Editor, The Madras Agricultural Journal,

### Tobacco Curing

Sir,

I request you to kindly add this note in your valuable monthly, for obtaining information on the subject.

1. Remedial measures for removing the green colour that persists in the cured tobacco leaf.
2. Methods to impart a leathery consistency in the cured tobacco leaves which in some cases become brittle like old paper.
3. Methods to remove the bitter taste in the cured leaf, which renders the tobacco leaf unfit for chewing.

Yours truly,

S. R. SRINIVASAN.

II

To

The Editor, The Madras Agricultural Journal,

### The Price of Coconuts

Sir,

There is abnormal fall in the price of coconuts from Rs 40 to about Rs 18 a thousand. It has been steadily going down during the last twelve months and it is still on the decline. What is the reason? Though there is depression in trade it cannot account for this unusual fall. We have to go back to some thirty years when coconuts were selling at Rs 20 a thousand. Is there no chance for an upward turn in the near future? I shall be thankful if you will investigate the matter and write a short note on the subject.

Yours truly,

N. SUBBARAO,



(We invite information on the point raised by the correspondent from our readers. The Oil Seeds Specialist, on reference, is of the opinion that the increase in area under groundnuts in recent years might possibly be one of the factors responsible, although that alone could not have brought about such a great slump in the market.—*Editor M.A.J.*)

III

To

The Editor, The Madras Agricultural Journal.

I am sending the following note for publication in the Journal.

### Groundnut dryage

With a view to find out the percentage of dryage in storing groundnuts in different methods, a test was made with local Mauritius and Gudiyattam varieties at the Palakuppam Agricultural Research Station. 10 lbs. of Local Mauritius seeds were stored in a tin with a layer of sand at the top and another 10 lbs. of the same variety were stored in a gunny bag. Gudiyattam bunch variety was also stored in the same way. At the end of three months the seeds were weighed and the results are as under.

| | Local Mauritius | | Gudiyattam bunch | |
|---|---|---|---|---|
| | Tin storage | Gunny storage | Tin storage | Gunny storage |
| 1-4-1930 | 10 lb. | 10 lb. | 10 lb. | 10 lb. |
| 1-7-1930 | 10 lb. | 9¾ lb. | 10 lb. | 9¾ lb. |

M. GOVINDA KIDAVU.

IV

We have received the following from an esteemed correspondent for publication.

To The Editor,

Sir,

### Gardening School at Bangalore

During a recent visit to Bangalore, I was given an opportunity through the courtesy of a friend, to visit the school for gardening run by the Municipality of the Cantonment. It is situated in an unfrequented locality beyond Ulsoor; the authorities need not, perhaps, be particular to have the school widely advertised, as I understand the demand for such training is great and applications are often refused.

The idea of the inception of the school, the first of its kind in South India, was conceived in 1923 by Mr. Yates, the educationist. The object of the school is to provide practical training in intensive gardening in the three branches of horticulture: fruits, vegetables and flowers. The theoretical instruction is given in different vernaculars familiar to the boys, the subjects

taught being simple English, Vernacular Composition, Arithmetic, Space work, Elementary Botany and Elementary Science in relation to gardening. The boys are given a practical course in wood work and drawing and are taught to make simple wooden structures like ladders, arches, and wooden tools needed for gardening. The teaching is done by a staff of three trained teachers.

Boys above 12 years are admitted: the course lasts for 3 years. Most of the boys come from Bangalore and surroundings and make their own arrangements for board and lodging, but the management gives each boy a monthly stipend of Rs 5. For entrance into the school, the boy should have passed the fifth standard in an Elementary School. In practical work a junior is paired with a senior and both conjointly dig, manure, sow and irrigate their allotted plot. I understand that the school is able to obtain jobs for 50 per cent of its pupils; the rest go back to their gardens. The maintenance of the school, including staff costs the Government Rs 4,000 per annum. The orchard is yet young, but from the sale of vegetables and flowers the receipts come to about Rs 500 a year.

The climate of Bangalore readily lends itself to good gardening, and it is not surprising that a demand for trained gardeners exists there. The training given is practical and with a three-years' course, the lads turned out ought to be efficient.

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# College News and Notes

*Students' Corner.*—There was not much athletic activity during September as evidently the students were busy preparing for their terminal examinations. The Michaelmas holidays commenced on the 15th and the boys have gone home, although some students are staying on at the hostel even during the vacation.

With the increase in the number of admissions, hostel accommodation was not sufficient, and four new blocks—each of ten rooms—have sprung up on the southern side of the hostel. Two of these have already been allotted to students, and two more, we believe, will be ready for occupation during the second term.

*Activated sludge.*—Yet one more addition to the existing buildings at the College has been made by the completion of the construction of the sewage works, for the preparation of activated sludge. The works have been located at the eastern entrance to the Farm wetlands near the A Block and drain pipes carrying the sewage from the Estate empty into the tanks built for the purpose. The working of the plant was formally started on the 12th and Dr. G. J. Fowler of Bangalore and Mr. S. Swaminathan of the Guindy Institute had come down here for the purpose.

Advantage was taken of Dr. Fowler's visit by the Association of Economic Biologists to have a lecture by him on 'the Biology of activated sludge' on the 14th of September (an abstract of the lecture appears elsewhere in this issue).

# Weather Review

## FOR SEPTEMBER 1930

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**Rainfall Data**

| Division | Station | Actual | Departure from normal | Total from 1st January |
|---|---|---|---|---|
| Circars | Gopalpore | 10·3 | +2·5 | 38·3 |
| | Vizagapatam | 7·3 | +0·5 | 30·3 |
| | Cocanada | 4·5 | —1·5 | 23·1 |
| | Masulipatam | 5·0 | —1·3 | 27·3 |
| Ceded Dists. | Kurnool | 7·1 | +1·0 | 19·7 |
| | Bellary | 3·8 | +1·2 | 13·5 |
| | Anantapur | 6·1 | +0·1 | 15·9 |
| | Cuddapah | 8·3 | +1·6 | 25·9 |
| Carnatic | Nellore | 1·4 | —2·9 | 17·2 |
| | Madras | 3·9 | —1·0 | 23·5 |
| | Cuddalore | 2·9 | —2·7 | 35·6 |
| Central | Vellore | 5·2 | —1·8 | 26·8 |
| | Salem | 2·1 | —4·5 | 23·3 |
| | Coimbatore Town | 1·6 | +0·1 | 11·9 |
| | Coimbatore Research Institute | 1·6 | —0·3 | 11·9 |
| | Trichinopoly | 2·0 | —2·4 | 19·6 |
| South | Negapatam | 3·4 | —0·3 | 31·4 |
| | Madura | 3·4 | —1·4 | 22·6 |
| | Pamban | ... | —1·7 | 10·5 |
| | Palamcottah | 2·0 | +0·8 | 9·1 |
| West Coast | Trivandrum | 7·3 | +3·2 | 46·5 |
| | Cochin | 18·7 | +9·4 | 86·4 |
| | Calicut | 16·9 | +8·6 | 93·3 |
| | Mangalore | 20·6 | +9·5 | 123·3 |
| Mysore and Coorg Hills | Bangalore | 8·0 | ... | 27·2 |
| | Mercara | 14·0 | +0·2 | 98·0 |
| | Kodaikanal | 11·3 | +4·5 | 36·8 |
| | Coonoor | 3·1 | —2·7 | 26·5 |

**General Summary of weather conditions**

The unusual pressure distribution at the end of August persisted till the 3rd of the month, with an area of high pressure in the centre of the Bay. The distribution then changed over to the normal South-West Monsoon type on the 4th. A depression had formed centred about Lat. 19° N and Long. 89 E by the 7th, and moving towards the Coast crossed the Orissa-Ganjam coast on the 8th and weakening rapidly lay as a trough of low pressure, extending from Upper Sind to the Circars coast on the 11th, and later again intensified into a depression and moved into the United Provinces, and merged

into the seasonal trough of low pressure over the Gangetic plain by the 15th. This depression caused a revival of the monsoon on the West Coast, and Circars, and generally over the peninsula. Rainfall was particularly heavy at Bombay which received 30 inches in the 48 hours ending 8 a.m. on the 11th. Weather was again unsettled off the Orissa coast from the 22nd to the 27th, and a low pressure area appeared over the central parts of the country on the 28th and this caused numerous thunderstorms and general rain in the Ceded districts and Circars till the end of the month.

Rainfall was in slight to moderate excess in the West Coast and the two northern most districts of the Circars, and Deccan, and was in moderate defect elsewhere. The chief falls reported were :—Mangalore 3.9″ (4th); Gopalpore 3.8″ (8th); Vizagapatam 4.0″ (28th); and Calicut 3.7″ (30th).

Temperature was markedly above the normal on the East Coast from the 16th till the 20th and again from the 24th to the 28th.

Skies were for the most part heavily clouded over the northern half of the area associated with the unsettled weather there.

### Weather Report for the Research Institute Observatory

| | |
|---|---|
| Absolute Maximum in Shade | 96·0 |
| Absolute Minimum in Shade | 65·0 |
| Mean Maximum in Shade | 89·7 |
| Mean Minimum in Shade | 71·1 |
| Total Rainfall | 1·66 Inches |
| Mean Rainfall for September | 1·97 ,, |
| Departure from Normal | −0·31 ,, |
| Number of rainy days | 3 |
| Heaviest fall in 24 hours | 0·91 ,, |
| Mean Daily wind velocity | 5·2 M. P. H. |
| Mean 8 a.m. wind velocity | 2·9 ,, |
| Mean Humidity | 73·1 % |
| Total Hours of bright sunshine | 207·2 Hours |
| Mean daily hours of bright sunshine | 6·9 ,, |

### Summary of weather conditions

Pressure was unsteady at the beginning of the month and fell to 28·413″ uncorrected for sea level, on the 11th, during the temporary revival of the monsoon, and thereafter rose and fell again towards the end of the month with the setting in of unsettled weather.

Rainfall was nearly normal being only 0.31″ in defect from normal, and was due to local storms on the 18th and 19th. The heaviest fall in 24 hours being 0.91″ on the 19th.

Temperature was high almost throughout the month, except from the 7th to the 12th when the monsoon was active.

Winds were for the most part from the South and the movement was very vigorous on three days (10th to 12th) there after velocities were very low and numerous calm mornings are on record.

Skies were moderately clouded and the mean hours of bright sunshine were 6·9.

P. V. R.
B. S. N.

# Departmental Notifications

*Appointments, and confirmations*

*Live Stock Section :* D. Shanmugasundaram and R. Anantapadmanabhan are appointed as Upper subordinates V Grade, the former against an existing permanent vacancy and the latter against the temporary post added to the cadre in G.O. No. 724 Misc., Dev., dated 2-4-1930.

*First Circle :* B. P. Bapayya, Assistant Farm Manager, Anakapalli, is confirmed in his appointment.

*Fourth Circle :* N. Krishna Pillai, Upper Subordinate, Agricultural Section, V Grade is confirmed in his appointment.

*Leave etc.*

*First Circle :* R. Vasudeva Rao, Farm Manager, Anakapalli, leave for one month from 29-9-1930 with permission to prefix Sunday the 28th September. D. Panakala Rao, Agricultural Demonstrator, Cocanada, leave on average pay for three months from 25-8-30. T. Paramanantham, Farm Manager, Samalkota, posted as Agricultural Demonstrator, Cocanada, to join forthwith. In modification of the above, D. Panakala Rao, granted L.A.P. on medical certificate from 6-9-1930 for three months.

*Third Circle :* The seventeen months' leave granted to C. Subba Rao *Naidu*, Assistant Agricultural Demonstrator, Allagadda, is extended by three months extraordinary leave on medical certificate, the extension to date from 27-6-1930.

Leave granted on average pay for four weeks to A. Krishnawami Ayyar, Agricultural Demonstrator, is cancelled.

*Fifth Circle :* The lien of A. R. Krishnamurthi Ayyar, Agricultural Instructor, Borstal Institute, Palamcottah on the post of a lower subordinate on probation, will be considered to have ceased from 17-9-30 since he has failed in the A. T. A.

C. S. Namasivayam Pillai, Assistant Agricultural Demonstrator, Srivilliputtur, granted extension of L.A.P. on medical certificate for four months from 16-5-1930. The A. D., Sankarankoil will continue to hold the additional charge of Srivilliputtur Sub-circle until further orders.

M. Kalimuthu, Agricultural Demonstrator, Virudhunagar, is granted L.A P. for fifteen days from 16-9-1930 and the Assistant Agricultural Demonstrator, Sivakasi will hold additional charge of Virudhunagar during Mr. Kalimuthu's absence.

M. Muthayya Nattar, Agricultural Demonstrator, Dindigal, is granted extension of L.A.P. for 10 days from 7-9-1930.

*Live Stock Section :* M. C. Menon, Farm Manager, Buffalo Breeding station, Guntur is granted L.A.P. for 23 days from 30-8-1930.

*Principal's Section :* T. Gopalan Nayar, Farm Manager, is granted L.A.P. for sixteen days from 5-9-1930 with permission to suffix, the holidays on 21st and 22nd September 1930.

*Systematic Botanist's Section :* S. Ramaswami Raju, Sub-Assistant, granted L.A.P. for 2 weeks from 1-9-1930.

*Cottons Specialist's Section :* S. M. Kalyanaraman, Farm Manager, is granted leave on average pay for 11 days from 10-9-1930 and permitted to avail the holidays on 9th and 21st and 22nd September. S. M. Kalyanaraman granted an extension of L.A.P. for one week from 21-9-1930 with permission to avail Sunday the 28th September 1930.

*Government Entomologist's Section :* T. Sekharan Nayar, Fieldman, granted L.A.P. for 11 days from 3-9-1930. C. K. Subramanyan, Sub-Assistant, granted extension of L.A.P. for 18 days from 13-9-1930. A. G. Ramaswamiah, Sub-Assistant, granted L.A.P. for 10 days from 5-9-1930. M. S. Kylasam, Assistant, granted L.A.P. for one month from 23-9-1930.

*Government Agricultural Chemist's Section :* T. Varahalu, Chemical Assistant, Anakapalli, granted 3 months' extension of L.A.P. on medical certificate from 18-9-1930.

*Millets Specialist's Section :* P. Subramanyam, Assistant, granted L.A.P. for one month from 26-9-1930.

APPENDIX

## LIST OF BOOKS BULLETINS AND OTHER PUBLICATIONS RECEIVED IN THE LIBRARY DURING AUGUST 1930

### A. BOOKS

| | | | |
|---|---|---|---|
| 1. | *The Agricultural Zoology of the Malay Archipelago...* ... | By K. W. Dammerman | 1929 |
| 2. | *The Year book of the Universities of the Empire—1930...* .... | ,, H. F. Heath ... | ... |
| 3. | *Ammeisenkunde* ... ... | ,, Antom Kranbe ... | ... |
| 4. | *Rasajalanidhi, Vol. III.* ... | ,, B. Mookerji ... | ... |
| 5. | *Gazetteer of the Ramanad District, Vol II.—Statistical Appendix...* | | 1929 |
| 6. | *Gazetteer of the Guntur District, Vol. II.—Statistical Appendix...* | | 1929 |

### B. REPORTS—PROCEEDINGS Etc.

| | | | |
|---|---|---|---|
| 1. | Year book of the Madras Agri. Dept. 1929. | | |
| 2. | Annual Report of Agri. Dept. | *N.W.F. Province* | 1928–29 |
| 3. | ,, ,, | *United Province* | 1929 |
| 4. | ,, ,, | *Ontario* | 1929 |
| 5. | ,, ,, | *Meteorological Dept.* | 1928–29 |
| 6 & 7. | Proceedings of the third Pan.-Pacific Science Congress—(Tokyo. In 2 Vols.) | | 1926 |

### C. BULLETINS

| | | |
|---|---|---|
| 8. | Silage Investigations at Bangalore. | *Memoirs of the Dept. of Agri. in India. Chemical Series, Vol. X, No. 10.* |
| 9. | Feeding Experiments at Hosur 1926–28. | *Do. Vol. X, No. 3.* |
| 10. | A contribution to our knowledge of South Indian Coccidea. | *Pusa Bull. No. 197.* |
| 11. | A new method of estimating total Carbonates in soils. | *Do. No. 206.* |
| 12. | The Biological control of Insect and Plant pests. | *E.M.B. Pub. No. 29.* |
| 13. | The production of Tung oil in the Empire. | *Do. No. 31.* |
| 14. | Notes on Insects damaging Sugarcane in Queensland. | *Queensland Bureau of Sug. Expt. Sta. Bull. No. 3.* |
| 15. | Crop Bulletin. | *Ontario Agri. Dept. Bull. 183.* |
| 16. | Potatoes. | *Do. 352.* |
| 17. | Rose Culture. | *Do. 353.* |
| 18. | The Pear in Ontario. | *Do. 354.* |
| 19. | The Raspberry and Black Berry in Ontario. | *Do. 355.* |
| 20. | Life history of the Oriental peach moth at Riverton. N. J. in relation to Temperatures. | *U.S.A. Tec. Bull. No. 183.* |
| 21. | Test to determine toxicity of Pyrethrum Vapors to Honey-bees. | *Reprints from J.A.R. Vol. 40, No. 11.* |
| 22. | The Insecticidal Action of some derivatives of Pyridine and Pyrrolidine and of some aliphatic amenes. | *Do.* |
| 23. | Souring of Figs by yeasts and the transmission of the disease by insects. | *Do.* |
| 24. | The home production of Onion seed and sets. | *U.S.A. Far. Bul. 134.* |
| 25. | Sqab Raising. | *Do. 684.* |
| 26. | The city Home Garden. | *Do. 1044.* |
| 27. | Rat control. | *Do. 1533.* |
| 28. | Feeding Hevea Rubber seed meal for milk Production. | *Virginia Agr. Tec. Bull, No. 41.* |
| 29. | The Negro church in rural Virginia. | *Do. No. 273.* |
| 30. | An Economic Investigation of farms in the Maize Districts of the Orange Free State. | *Union of South Atrical Bull. 81.* |

### LEAFLETS AND CIRCULARS

| | | |
|---|---|---|
| 31. | Improved sanitation in milk production. | *U.S.A. Leaflet No. 3.* |
| 32. | Rabbit house construction. | *Do. 15.* |
| 33. | English Sparrow control. | *Do. 61.* |
| 34. | The Asiatic Beetle—a serious pest in lawns | *Do. Cir. 117.* |
| 35. | The Codlin Moth. | *Cyprus Gazette No. 2067.* |

## SAMPSON MEMORIAL FUND

*The Honorary Secretary of the above Fund, sends us the following t*
*publication in the journal*

Subscribers to the Sampson Memorial Fund are informed that
Managing Committee have decided to close the accounts with effect fro
15th October 1930. The accounts were audited on the 24th instar
Mr. J. H. Hensman, and a statement of accounts as it stood on that
herewith appended.

The attention of the committee has been drawn to two proposals reg
the disposal of the funds. One was to open a 'Distress Fund' for h
deserving students at the Agricultural College, Coimbatore, and the other
the institution of a prize for Botany—Vide page 326, 1929 October iss.
the *Madras Agricultural Journal*. The prize will be known as the Sam
Prize, and it may be in the form of a gold medal or in any other suitable
at the discretion of the Director of Agriculture and the Principal of
Agricultural College, Coimbatore, who shall be the trustees of the endowm
It is proposed to award the prize annually to a student of the College
obtains the highest number of marks in the subject of Botany in Part II o
examination for the B. Sc. Ag. Degree of the Madras University and qual
himself for that Degree at first appearance both in Parts I and II. Mar
the subscribers are of opinion that the institution of a prize for Botany is r
desirable and satisfactory. The Committee, therefore, intend to take step
give effect to this proposal, and it will take it that you consent if no contr
view is communicated to the Secretary before the 15th November 1930.

COIMBATORE,
*27th Sept. 1930*

K. GOPALAKRISHNA RAJU
*Hony. Secreta*

SAMPSON MEMORIAL FUND

| Receipts | | Rs | A | P |
|---|---|---|---|---|
| By Subscription | ... | 506 | 0 | 0 |
| Interest | ... | 22 | 5 | 0 |
| Total | ... | 528 | 5 | 0 |

| Expenditure | Rs | A | P |
|---|---|---|---|
| Paid to Mr. C. Ranganatha Mudaliar Charges for the portrait ... | 30 | 0 | |
| „ St. Joseph's Industrials School for the frame ... | 15 | 12 | |
| „ Mr. C. Ranganatha Mudaliar for fixing the portrait to frame ... | 1 | 8 | |
| „ M.A.S.U. for Block ... | 6 | 0 | |
| „ for Printing Charges ... | 2 | 4 | 0 |
| „ Postage ... | 7 | 4 | 6 |
| „ for purchase of Stationery. | 0 | 7 | 6 |
| Total ... | 63 | 4 | 0 |
| Deposited with the Dist. Urban Bank, Coimbatore | 465 | 1 | 0 |
| Grand Total .. | 528 | 5 | 0 |



COIMBATORE,
*24th Sept. 1930*

Audited and found correct,
(Sd) J. H. HENSMAN.