Breeding of Trochus and Preservation of the Beds in the Andamans.

By C. Amrithalingam.

TOP or Pagoda shell (*Trochus niloticus* Linn.) occurs in abundance, within the five fathom limit, in the Andaman and Nicobar waters and has been fished for some time by various Japanese firms for the manufacture of paint, tooth paste, mother-of-pearl buttons, etc. It was only in recent years that the Andaman Administration was made aware of the economic importance of this fishery and so proceeded to take steps to establish it on a permanent basis. As the various stages of the life-history of this mollusc had not been investigated, it was found necessary to determine the breeding season, etc., before the *Trochus* fishing could be controlled properly. My work on the boinomics of this shell-fish revealed that it starts spawning in April and continues spawning till the commencement of the south-west monsoon.

From the inception of legalized shelling industry in the Andaman and Nicobar waters, the accepted season has been from 1st. October to 30th. April, *i.e.*, seven months. This year, according to my suggestion, while I was a Research Officer, Andaman Fisheries, the shelling season is expected to start on the 1st. September; I did not suggest a closing date as I had not then discovered the breeding season of *Trochus niloticus*. Now that it is known that this mollusc starts spawning in April, it is but evident that the fishing season should be closed on the 31st. of March.

By changing the fishing season from 1st. October–30th. April to 1st. September—31st. March, the breeding individuals will not be fished, and thus the beds will be saved from depletion; this suggestion, if accepted, will ensure the restocking of beds without any loss of the current revenue from this source, as shelling-season will last for the same length of time as in previous years.

On the Bombay coast too, Mr. Hardit Singh Rai* finds the necessity of observing a close season in the fishing of marine economic animals during the breeding period. It is evident, therefore, that in legislating for the control of marine industries in the Indian waters, special attention should be paid to the breeding period of the species concerned in much the same way as laws regulating Game Birds.

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"The Rôle of Organic Matter in the Soil."

INAUGURATING the symposium on "The Rôle of Organic Matter in Soils," held under the auspices of the Society of Biological Chemists (India) on the 30th. July, Dr. Fowler, who presided, outlined the present position of the problem. The foundation of agriculture is soil fertility which is considerably influenced by the organic matter present in the soil. The extensive work of Howard in India definitely showed the vital importance of root aeration in relation to crops. Organic matter, by affecting the texture of the soil, effectively helps the aeration and moisture conservation in soil, thus providing optimum conditions for the micro-organisms to flourish; it affects the reaction of the soil, and the viability of the microflora especially the nitrifying and denitrifying organisms. The importance of the products of oxidation of organic matter in the soil is not to be ignored. There is again the famous auximone theory of plant stimulation put forward by Bottomley. The carbon/nitrogen ratio is a very acute question which has a bearing on the chemical aspects of the problem. Finally, the organic matter in the soil affects the vitamin value of the crop produced. He hoped that the several speakers would deal with these subjects and would materially contribute to our knowledge of the problem.

Dr. V. Subrahmanyan, discussing the microbiology of the decomposition of organic matter in the soil, outlined the essential factors concerning this aspect of the subject. The nature of the organisms, which are selected from the natural flora of the soil, are determined by the chemical composition of the organic material, soil conditions and climate. The mechanism of the slow conversion of dead microbial cells into plant nutrients, of which definite evidence exists, is obscure. Physical texture, aeration, light, moisture, reaction, treatment with minerals and system of cropping are factors that determine the nature and activity of the organisms occurring in the soil. There is yet no satisfactory method available for the study of the nature or activity of the microflora concerned in the decomposition of organic matter in the soil. Excessive quantities of organic substances are accompanied by marked change in the associated fauna and flora; bacteria are suppressed and a variety of pathogens develop. Either fallowing or partial sterilization by heat or antiseptics restores the soil to normal biological equilibrium. Among the many fundamental problems on the decomposition of organic matter in soil awaiting solution are, the standardization of conditions leading to economy of carbon and conservation of nitrogen, study of conditions leading to loss of nitrogen and those favouring fixation, the physiological transformations undergone by various putrefactive and pathogenic organisms associated with different organic materials applied to the soil, and steps to be taken to avoid sudden outbreaks of various plant and animal diseases.

Dealing with the chemical aspects of the problem, Dr. Mirchandani showed that there were still many gaps in our knowledge of the decomposition of organic matter in the soil. Of the several factors determining the decomposition, he considered C : N ratio of the organic matter as the most important. From the decomposition studies of many substances, individual as well as mixtures, of varying C : N ratio, he concluded that a ratio

of 16 was the most desirable one if benefit was to be derived from the added organic matter; and the further the ratio was removed from the optimum, the further was the period of nitrogen deficiency in the soil. The effects of narrow C : N were also described and stress was laid on the need for the proper regulation of the decomposition of organic matter by adjusting its C : N ratio.

Mr. G. S. Siddappa, in presenting a paper on "Organic matter as direct source of plant nutrition", traced the history of the subject from 1837 to date. It had been recognized from the early days of agricultural science that organic manures were very beneficial to crops. There is a school of opinion which holds that the effect of decomposing organic matter is to provide additional carbon dioxide for plant growth. This is not entirely unchallenged. The exact history of the rôle of organic matter as direct source for plant nutrition or stimulant dates from the announcement of the "auximone theory" by Bottomley and Mockeridge in 1912. The recent work on the necessity of "bios" for the growth of yeast adds one more proof to the subject. This subject has been the centre of keen controversy and numerous are the experiments done to uphold or reject the theory. The evidence at present points very strongly towards the truth of the theory. Recent experiments at the Indian Institute of Science on the effect of injection of extracts of yeast and farmyard manure on the growth of *Helianthus annus* has strikingly confirmed the presence of plant stimulants in organic matter that influence the growth of plants quite out of proportion to their quantity. Further work on the subject is being carried out.

Rao Bahadur B. Viswanath spoke on the relative advantages of the use of organic and mineral fertilizers. In India, the soil is remarkably poor in carbon and nitrogen as compared with European and American soils. The importance of manuring soil is, therefore, much greater here than elsewhere. Graphs were shown, and experiments conducted at Coimbatore were outlined to illustrate that organic manures have very much greater effect on plant growth than inorganic mineral fertilizers. The effect of the organic manure is more lasting and better. Although the mineral fertilizer may show an advantage in the earlier stages, these fall off slowly and steadily so that finally the organic manure triumphs. The seeds obtained from plants grown on organic manure have a decidedly better nutritive value as shown by Col. McCarrison in his dietetic experiments on rats. The straw was also found by experiments in Coimbatore to be of greater food value to domestic animals. The seeds, moreover, inherited the qualities of the parent crop in their quality and quantity of growth. It is, therefore, very essential that we should conserve our organic manures very carefully and utilize them to the best advantage.

Mr. P. V. Ramiah contributed a paper on the bearing of organic manures on animal nutrition. Cereals grown on cattle manure always possessed higher nutritive values. This could not be ascribed to higher protein content. In fact there was less nitrogen in the grains grown on cattle manure plots. Vitamin assays of these grains were conducted both at Coimbatore and at Coonoor and showed that they always possessed higher values. Plimmer has shown that the vitamin B content of a diet greatly influenced the nucleo-protein metabolism. This may be extended to other constituents of the diet and may be mainly responsible for the difference observed in these nutritive values. Thus, there is a close relationship existing between soil, plant and animal. By manuring the pasture lands with ammonium sulphate the amount of sulphur metabolized by the sheep grazing on them can be greatly enhanced thus leading to an increased output of wool. One could thus manure either for milk, wool or meat as is required.

Mr. Viswanath opening the discussion on the subject, took up the problem of plant stimulation. The experiments conducted at Coimbatore showed that minute quantities of substances like yeast extract stimulated plant growth to enormous extent. Although Russell in his latest edition of the book on "Soil conditions and plant growth" still wrote that the influence of organic matter lies in its effect on the texture of the soil, the matter is not so simple as that. The work of Bottomley and later by Ashby and others point to the existence of certain plant stimulants which catalyse plant-growth and which function in the presence of micro-organisms. The relative results obtained with the use of yeasts, yeast and mineral fertilizer, mineral fertilizer alone and ordinary farmyard manure, showed that the best effect was obtained with yeast and mineral fertilizer and that yeast alone is much superior to other treatments. The grains from the stimulated ones, when sown, take up greater nutrition from the soil than the untreated ones. The yield of straw and grain is greater. The nutritive value of plant and seeds obtained by yeast stimulation was better than unstimulated ones. The evidence points to a clear relation between vitamins and auximones, thus establishing a sort of cycle between animal, plant and bacteria.

Dr. B. Sanjiva Rao raised the point of the rôle of inorganic catalysts in the decomposition of organic matter in soil. Indian soils are notorious for the rapidity with which the organic matter is depleted from them and this is more so in the case of laterite soils, where ferric oxide is present, than in other soils. He suggested the possible rôle of ferric oxide as a catalyst in the decomposition of organic matter in soil.

Dr. Fowler drew attention to the experiments carried out at Rothamsted where it was definitely shown that small traces of boron have great effects on plant growth.

Mr. M. Sreenivasaya suggested the possibility of applying tissue culture methods in place of the usual pot culture ones for the study of these problems. He pointed out the economic importance of the necessity of finding out whether the qualities of seeds grown on organic manure persist for a few generations. He suggested that experiments on the activation of enzymes by yeast extracts like diastases in starch elaborating plants and proteases in legumes could be advantageously tried to study the problem of plant nutrition.

Mr. A. V. Varadaraja Iyengar suggested the use of plants reared on a 'basal diet' on an analogy with animal nutrition experiments. The importance of the quantity of mineral fertilizers on the decomposition of organic matter should be considered.

Mr. B. N. Sastri pointed out the inadequacy of controls used in some of the experiments conducted and suggested the injection of ash constituents for the control plants. He drew attention to the fact that traces of inorganic constituents were known to stimulate the growth of plants, much in the same way as the auximones whose existence has been postulated.

A detailed report of the symposium will shortly be issued by the Society of Biological Chemists (India).

K. S. VARADACHAR.

Investigation of the Solar Corona without an Eclipse.

By Dr. K. R. Ramanathan, D.Sc.

THE study of the solar corona has been, till recently, confined to short intervals during total solar eclipses, when the overpowering light of the sun is shielded from the earth by the moon's disc. In a paper read before the French Physical Society by M. Bernard Lyot of the Meudon Observatory near Paris an experimental technique worked out by him was described which provides a new method for investigating the light of the corona at all times when the sky is sufficiently clear and thus gathering more knowledge regarding this outer extensive tenuous envelope of the sun.

The most important obstacles to the observation of the comparatively feeble light of the corona under normal conditions are: firstly, the scattering of light by the solid and liquid particles suspended in the atmosphere and secondly, the scattering of light by imperfections in the optical system of the instrument used in the observation. The scattering by the gaseous constituents of the atmosphere are of comparatively little importance.

The only way of getting over the first difficulty is to make the observations from a high-level station which lies well above the low-lying dust layers and at times which are comparatively free from atmospheric disturbances. Mons. Lyot made his observations from Pic der Midi in S. France with an elevation of 2,800 meters above sea-level. Using a faultless telescopic objective and stopping it down to about 4″ diameter, he formed an image of the sun on a blackened disc whose diameter exceeded that of the sun's image by a few seconds. Another lens placed behind the disc produced an image of the first lens on a diaphragm whose centre was occupied by a small opaque screen. The edge of the diaphragm cut off the light diffracted by the edges of the first lens and the small screen stopped the light of the sun's image formed by internal reflection from the faces of the first lens. A well corrected objective placed behind the diaphragm and screen formed an image of the corona.

Examining the image with an eyepiece the prominences could be seen round the edge of the sun with a rosy red colour. When the atmospheric conditions are particularly good, the corona also could be photographed using a red filter.

Placing the slit of a spectrograph tangential to the image of the disc, the red and green rays of the corona (6375 A and 5503 A) could be photographed.

It is hoped that by installing one of these instruments in a selected high level station, it would be possible to follow day-to-day changes of solar corona and investigate its relationship to prominences and sunspots and perhaps also to related terrestrial phenomena such as magnetic storms and the reflection of electric waves from the upper atmosphere.