

## RESEARCH ITEMS

## Secondary Sexual Characters in Beetles

THE great development of horn-like outgrowths in male Dynastid beetles is a conspicuous secondary sexual character. What these horns are used for has long attracted attention and excited speculation. William Beebe (*Zoologica*, 29, Aug. 1944) records observations made in the New York Zoological Society's Laboratory at Caripito, Venezuela, on the elephant beetles *Megasoma elephas* and *Strategus aloeus*. In both these species he finds that the males use their cephalic and thoracic horns for fighting with each other. The initial stimulus appears to be the advent of the rainy season. The technique of fighting seems to be the same for both species: first an effort to unbalance the opponent by tripping, and then by ventral attack with the anterior horn so as to throw him on his back. It is interesting to note that Charles Darwin, in the first edition of "The Descent of Man", claimed that the most obvious conjecture is that these horns are used by the males for fighting together. But since they had never been observed to fight, he came to the conclusion that they were acquired as ornaments. Eight years afterwards, A. R. Wallace, in "Tropical Nature", expressed the view that these horns may be protective. Their presence, he says, would render it very difficult for the large-mouthed goatsuckers and other nocturnal birds to swallow the beetles. It is therefore noteworthy that Mr. Beebe's observations appear to settle this disputed point, and are supported by a very convincing series of successive photographs taken of actual combats.

## Intracellular Symbiosis and Vitamin Requirements of Insects

MANY insects contain symbiotic micro-organisms, usually bacteria or yeasts. The organisms are intracellular and are housed in special organs called mycetoms. One function of such organisms seems to be the synthesis of certain vitamins normally required for the nutrition of the insect. M. Blewett and G. Fraenkel (*Proc. Roy. Soc.*, B, 132, 212; 1944) have studied this question in the case of the larvae of two beetles, *Lasioderma serricornis* and *Sitodrepa panicea*. It is possible to sterilize the eggs before hatching and so obtain larvae free from symbionts (sterile larvae). Such sterile larvae fail to grow if the diet is deficient in any one of the following components of the vitamin B complex: thiamin, riboflavin, nicotinic acid, pyridoxin, pantothenic acid. On a diet rich in vitamin B (wholemeal flour and yeast) both sterile and normal larvae grew equally well; while on a diet deficient in vitamin B (white flour) the sterile larvae did not grow so well as the normal ones. It was concluded that, in the case of these two larvae, the normal symbionts could synthesize the various components of the vitamin B complex in amounts sufficient to meet the normal growth requirements of the larva (see also *Nature*, 152, 506; 1943).

## Nervous Control of Intestinal Function in the Earthworm

N. MILLOTT (*Proc. Roy. Soc.*, B, 131, 271; 1943) has shown that the intestine of *Lumbricus*, while possessing an intrinsic nervous system of its own, is also supplied by nerves from the central nervous system. There are two such extrinsic systems of nerves, one inhibitory and one excitatory to the intestinal muscle, and the condition is thus parallel to that obtaining in the vertebrates. Further (*Proc.*

*Roy. Soc.*, B, 132, 200; 1944), Millott has shown that stimulation of the extrinsic nerve supply causes the secretion of protease by the glandular cells of the intestinal epithelium. The glandular cells showed the usual histological changes associated with secretion, and an increase of protease was demonstrated in the intestinal fluid. The probable course of the nerve fibres was mapped out by the usual methods of electrical exploration.

## Rubidium in Algæ and Freshwater Plants

THE presence of rubidium as a 'trace element' in certain plants has been recognized since 1862, when Grandeau identified it in the ash of beet and succeeded in extracting no less than 400 gm. of pure rubidium chloride from that source. Rubidium has also been reported in various other plants and plant organs (for example, tobacco leaves) and is usually derived by the plant from traces present in the soil. T. F. Borovick-Romanova, in a paper on the content of rubidium in plants (*C.R. Acad. Sci. U.S.S.R.*, 43, 163; 1944), gives an account of the quantitative spectroscopic examination of the ash from fifteen different seaweeds (*Laminariales*, *Fucales*, *Rhodymeniales* and *Charales*) and from fourteen higher water-plants. The results, which are tabulated to show the percentage of metal in the ash and in the live plant, and also the rubidium-potassium ratio, were checked by comparison with lines produced by addition of definite quantities of barium salts. The rubidium content of the seaweeds is more than ten times that of the sea water in which they grew ( $2 \times 10^{-5}$  per cent), while in the freshwater plants it is almost a thousand times that of the medium in which they were found. The rubidium-potassium ratio is higher in the *Laminariales* than in the *Fucales*, the average rubidium content being about 1 per cent of the ash, or 0.065 per cent of the live weight. Among the freshwater plants examined, the water-lilies showed the highest rubidium content, with 6.7 per cent of the total ash from the roots of *Nuphar luteum* (or 0.0052 per cent of the fresh weight). The plants had been collected between 1933 and 1938 from such widely separated parts as the Barents Sea, the Pacific Ocean, the Caspian Sea and the Staroselje reserve of the Ukrainian Academy. Their examination occupied the intervening years and follows a study of the distribution of rubidium in sea waters. It is a part of a survey of the occurrence of rubidium in the biosphere.

## Boron in Horticulture

SINCE the first demonstration that boron is an essential element in plant nutrition, boron deficiency in a great variety of crop plants growing in the field has been recorded. Correction of boron deficiency by the use of dressings of borax is not always a straightforward matter, as in many cases the limits of boron tolerance are narrow, and A. S. Heinicke, W. Reuther and S. C. Cain (*Proc. Amer. Soc. Hort. Sci.*, 40, 31; 1942) suggest that the application of borax even to a boron-deficient soil may induce separation of apple fruits from the trees, although this may be the result of an acceleration of fruit development as found by L. P. Batjer and M. H. Haller (*ibid.*, 40, 29; 1942). Usual dressings of borax are of the order of 10 lb. per acre; this amount is sufficient to control boron deficiency in the field in cauliflower, radish, beet and swede (R. H. White-Stevens, *ibid.*, 39, 367; 1941), while half this amount will increase the yield of potatoes and peas on

soils deficient in boron, but where the deficiency is not sufficiently acute for characteristic boron deficiency symptoms to develop. Twenty pounds of borax per acre may be harmful to spinach and carrots; and it is therefore surprising to find that indications of borax injury to eighteen-year-old apple trees did not develop until the applications of borax to the soil had reached the level of 10 lb. per tree (L. P. Latimer and A. P. Percival, *ibid.*, 43, 21; 1943), and these damaged trees showed complete recovery in the following year.

#### Spraying of Fruit Trees with Growth Substances

A. E. Hitchcock and P. W. Zimmerman (*Proc. Amer. Soc. Hort. Sci.*, 42, 141; 1943) describe the effects of spraying different fruit trees during the summer with growth substance (potassium  $\alpha$ -naphthyl acetate). Peach and plum especially and apple, pear and cherry, to a lesser extent, responded to the treatment by delaying the opening of fruit and flower buds in the following spring. In the same journal, P. C. Marth (pp. 620-628) describes how exposure of rose bushes during the winter to the vapour of naphthyl methyl acetate retards their shoot development. The magnitude of the response depends partly on the physiological condition of the bushes—'high starch' plants showing a greater retardation of shoot growth than 'low starch' ones. Of theoretical interest, these experiments have a practical bearing also as they offer with rose and fruit bushes a possible method of prolonging shoot dormancy and so escaping some of the damaging effects of spring frosts, and of extending the planting season.

#### Verticillium Wilt of the Tomato

WILT diseases of the tomato crop are widespread, and though a useful control can be effected by maintaining the temperature between 70° and 74° F., this is not always feasible. Soil factors which affect the pathogenicity of the fungus *Verticillium albo-atrum* have been investigated by F. M. Roberts (*Ann. Appl. Biol.*, 30, 4, 327; 1943). Attack by the fungus appears to depend to some extent upon lack of competition from other soil organisms. Inoculation of the ground immediately after steam sterilization gave nearly 90 per cent infection, as against 55 per cent in unsterilized soil. Sterilization thirty-two days before inoculation resulted in only 28 per cent infection. Nitrogenous manures favoured infection; phosphate had little effect, but a deficiency of potash also encouraged the parasite.

#### Thermodynamic Diagrams of the Atmosphere

CARMELO DI CORLETO has discussed, under the title "Comparación Entre Los Diagramas Termodinámicos De La Atmosfera, Mas Usados En Meteorología" (*Pub. Fac. Cien. Fisicomat.*, 3, No. 1; Univ. Nac. De La Plata), the work of various investigators on the subject of variations in mass of moist air, due to ascending and descending movements. Diagrams based on the work of Hertz (1884), of Neuhoff (1900), and in more recent times of Kreitmeyer, Bjerknes, Stüve, Shaw, Refsdal and Låijtman are supplied, and the basic assumptions regarding the various conditions, and the formulæ derived from these, are briefly discussed. There is a certain amount of discrepancy in the views of different meteorologists on the results of their investigations, to which the author directs attention at the end of the paper. Criticisms

of some of the diagrams are referred to, and the views of Brunt, Rothé and Refsdal on the diagrams devised by Neuhoff, Bjerknes and Shaw are quoted. Comparison of the different diagrams, made in the paper, leads to the view that the preference for any thermodynamic diagram over another is based solely on questions of convenience. Any one of them provides the reader with the conditions of the air so far as atmospheric stability is concerned.

#### A New Representation of the Types of Nuclear Forces

IN *Revista de la Facultad de Ciencias Fisicomáticas*, 3, No. 29 (Institute de Física, La Plata, Argentina), Mario Bunge has a paper with the title, "Una Nueva Representación De Los Tipos De Fuerzas Nucleares". In Section 1 he deals with the fundamental characteristics of the usual representations of nuclear forces and gives a brief outline of the theories of Gamow, Gurney and Condon, Heisenberg and others. Operators are then introduced which are formally identical with those employed in Dirac's theory of the relativistic electron, and these are able to supply an explanation of the four quantum states of the nucleon in non-relativistic approximation. By the employment of this new notation, explicit use of the isotopic spin is excluded, and it is synthesized with the ordinary spin in a single four-valent variable. The various scalar and non-relativistic potentials theoretically possible are formed by means of these new operators, and they are then applied to the problem of the deuteron. At the end of the paper there is a discussion on the advantages and the limits of the representation.

#### Hydrogen Bond and Diamagnetism

A CRITICAL analysis of the available data by S. V. Anantakrishnan and P. S. Varadachari (*Proc. Indian Acad. Sci.*, 20 A, 128; 1944) shows that the contribution to diamagnetic property by the methylene group  $\text{CH}_2$  is constant,  $\chi_m = 11.69$ . On this assumption, it is shown that hydrogen bonding leads to increased diamagnetism, with a susceptibility change of one unit per mol whenever structures of the type  $\text{O}-\text{H} \dots \text{O}=\text{A}$  are involved. A bifurcated hydrogen bond, as in iodic acid, apparently leads to an even larger value. The decrease of diamagnetism in water and alcohols on association is interpreted as due to an increase of the paramagnetic term associated with distortion. The interpretation of structures is considered in the paper.

#### Fatty Substances in Starch

CONSIDERABLE importance has been attached to the fatty constituents of starch, which interfere with the fractionation of starch and many properties of cereal starch pastes. Since the fat is not removed by a typical fat solvent such as ether or carbon tetrachloride, it has been supposed to be present in the form of esters with starch; but the adsorption of palmitic acid by starch is typical and throws doubt on this chemical theory. R. L. Whistler and G. E. Hilbert (*J. Amer. Chem. Soc.*, 66, 1721; 1944) find that the fat is easily removed from disintegrated corn starch granules by methanol, although it is difficult to extract from the intact granules. At the same time the phosphorus content of the starch is appreciably reduced, and the nitrogen content is affected to a lesser degree. All the fatty matter in corn starch (about 1 per cent) is apparently bound by associative forces rather than by primary valency bonds.