

Research Items

Crystalline Preparations of Viruses

Two papers which describe the preparation and properties of liquid crystalline substances from virus-infected cucumber and tobacco plants have recently been published by Messrs. F. C. Bawden and N. W. Pirie. The first (*Proc. Roy. Soc., B*, 123, No. 832, 274-320; Aug. 1937) shows that such substances cannot be isolated from healthy plants and that crystalline preparations of tobacco mosaic are infective at a dilution of 1 in 10^{10} . Many physical properties of virus mixtures are discussed, and it is interesting to note that filters which pass an infectious filtrate from plant juice will not allow the passage of purified preparations, thus suggesting that the purified aggregates are larger than those which occur naturally in the plant. The other paper (*Brit. J. Exp. Path.*, 18, 275; 1937) considers the relationships between crystalline preparations of cucumber viruses 3 and 4, and strains of tobacco mosaic virus. All such preparations have similar chemical composition, and have many physical properties in common. Precipitation tests and X-ray measurements, however, can distinguish between the cucumber viruses and tobacco mosaic preparations. A reasonable similarity between the chemical and physical properties of a crystalline virus preparation and its pathological behaviour is noticeable.

Invertebrates of Dybø Fjörd

DR. KNUD LARSEN'S paper "The Distribution of the Invertebrates of the Dybø Fjörd, their Biology and their Importance as Fish Food" (Report of the Danish Biological Station 41; 1937) is an attempt to link up the number of animals found on the sea bottom with the numbers eaten by the fishes on the same grounds. The *Macoma balthica* community is specially studied for this purpose. The work is in three sections, dealing with (1) the composition of the animal community; (2) the biology of the individual species, and (3) the importance of the species in the diet of the fishes in the fjord. By means of the first and second sections, the author can calculate the proportion between the percentage quantities of the individual species on the sea bottom and in the fish stomachs. *Idothea viridis*, the commonest isopod of the fjord, comes first in numbers as fish food, being eaten by all the fishes investigated (7), except the roach. Next comes *Gammarus locusta* and the third *Leander adspersus*. The roach is entirely a mollusc-feeder and its extremely rapid growth is attributed to its diet, for molluscs are of high nutritive value. *Mytilus edulis*, *Cardium exiguum*, *Hydrobia* sp. (called here *ulvæ*), *Littorina rudis*, *Neritina fluviatilis* and *Limnaea ovata* are all eaten. There is a great preponderance of molluscs in the community which make up about 88 per cent of the average weight per square metre, the remaining 12 per cent consisting of crustaceans, worms and insects. It is interesting to find that the *Hydrobia* of the fjord, still unnamed, although placed under the heading of *H. ulvæ*, has no pelagic larval stage, "the whole development taking place in the egg from which the animal enters the bottom stage directly". This suggests that it is another species and not the true *H. ulvæ*.

Fossil Insects from the Permian Rocks of Kansas

THE *American Journal of Science*, 33, 81-110 (1937), contains a paper by the late Dr. R. J. Tillyard which forms Part 17 of that author's series on Kansas Permian insects. Under the name of *Elmoa trisecta*, there is described what is claimed to be the first known Megasecopteran from these rocks, the author not accepting the view that the contemporaneous Protihymenoptera are specialized members of the same order. The new genus *Kansasia* is erected for the third known Palædictyopteron from the same beds. An apical fragment 8 mm. long of an early dragonfly wing is named *Camptotaxivineura* and made the type of a new family of Protanisoptera. In the new family Permibiidae there is brought to light what is described as an early group of Psocid affinities. The remainder of the paper deals with Neuropterous fossils and adds considerably to knowledge of that order in Lower Permian times. Most of these appear to be allied to the recent family Berothidae, of which archaic living types still remain in Australia. The basal half of a wing of Sialoid affinities is named *Promartynovia* as the type of a new family of ancient alderflies. It is pointed out that the relationships of these early Sialioidea are obscure, and better material is needed before they will be understood.

Embryology of the Crustacean *Anaspides*

IN *Papers and Proceedings of the Royal Society of Tasmania* for 1936 (1937; pp. 1-35, pls. i-xiii), Mr. V. V. Hickman contributes an important article on the embryological development of *Anaspides tasmanica*. It forms the first account yet published of the development of any of the Syncarida. *Anaspides*, it appears, shows, in its development, a close resemblance to the Leptostraca as exemplified by *Nebalia*. The early stages, however, bear some resemblance to those of certain of the Entomostraca. Thus the holoblastic segmentation, followed by the formation of an evident blastocoel and the development of an invagination-gastrula giving rise directly to the mesenteron, are cases in point. In certain other respects, *Anaspides* also resembles the Branchiopoda. These are evidenced in the mode of origin of the maxillary gland, the long persistence of yolk granules, the prolonged dormancy of the embryo in the winter egg and in the mode of hatching. A further resemblance is seen in the habit of movement in an inverted position (when young) on the underside of the surface film in calm water. The author states that it is hoped to supplement this paper by further examination of the post-embryonic development.

Herbage and Forage Seeds

THE last three bulletins of the series of six on the production of seed of herbage and forage crops have now been published by the Imperial Bureau of Plant Genetics (Herbage Plants), Aberystwyth. Bulletin 22 (price 5s.), by Gwilym Evans, describe the technique which has been evolved at the Welsh Plant Breeding Station for producing seed from their various strains of hay and pasture grasses, special consideration being given to the time and rate of sowing, isolation, manures and fertilizers,

harvesting, seed conditioning and storing. Bulletin 23 (price 5s.), edited by R. O. Whyte, is concerned with the methods used in the production of legume seed (lucerne, various clovers, etc.) in different parts of the world, and is a companion volume to Bulletin 19, already published, which deals with the production of grass seed from a similar point of view. Bulletin 24 (price 2s.), by F. J. Crider and M. M. Hoover, gives an account of the collection of native grass seed in the Great Plains, United States, and will be of particular interest to those in the more arid grassland countries where erosion is a problem, as it contains illustrations of typical grasses which are being produced in connexion with the soil conservation programme of the Great Plains district.

Arctic and Antarctic Diatom Floras

THE report on the diatoms collected during the Australasian Antarctic Expedition, 1911-14 (Scientific Reports, Series C. Vol. 1, part 1. Pp. 82+6 plates. Washington: U.S. National Museum. 9s.) emphasizes the wealth of the diatom flora of the arctic and antarctic areas. Dr. Mann suggests that the high percentage of carbonic acid held in solution owing to the low temperature and the long-continued light during the summer season may be significant in this connexion. In contrasting the two areas, the striking difference is that the arctic species are small and relatively simple in construction, whilst the antarctic forms are large and elegant in form and ornamentation and include many forms common to temperate and subtropical seas. Dr. Mann points out that owing to the distribution of the land masses, wide open seas run down to the antarctic and include various southerly currents, whilst the arctic seas are more enclosed by land masses and even in the Atlantic, the only northward current is that running along Scandinavia towards Spitsbergen. The species recorded are listed and described.

Incompatibility and Sterility in Sweet Cherries

THE results of an exhaustive survey of cherry varieties in respect to the above properties have recently been presented by M. B. Crane and A. G. Brown (*J. Pom. and Hort. Sci.*, 15, 2, 86; 1937). Conclusions drawn from more than 236,000 pollinations are discussed and the results presented in tables which should prove of great value to the cherry grower. Incompatibility in the sweet cherry is due to the failure of the pollen tubes to complete their growth down the tissue of the style, with the result that fertilization cannot take place and the young 'fruit' ceases growth and falls from the tree at an early stage. This is distinguished from sterility, which is expressed by non-viable pollen or imperfectly developed ovules, being more apparent on the female than the male side. Incompatibility is determined by genetic factors which control pollen-tube growth, and it seems that under normal conditions pollen cannot function in the style of a plant carrying the same factors as the pollen. All the varieties examined exhibited self-incompatibility without exception, whilst cross-incompatibility was common and always reciprocally expressed. The yields from compatible crosses showed considerable variation, which though largely due to indirect factors such as age of tree and previous cropping, was undoubtedly due in certain cases to the effect of generational sterility on the proportion of fruits which set and reached maturity. The genetical aspects of the results are discussed and

the practical applications indicated. Though many factors such as disease, nutrition, climate, etc., affect the initial setting of the fruit and the ultimate yield, it is clear that effective pollination and fertilization are essential. In view of the general occurrence of self-incompatibility and the frequency of cross-incompatibility, no variety of sweet cherry should be planted in complete isolation either as single trees in private gardens or as large blocks in commercial plantations. Care should be taken to inter-plant varieties which are known to be compatible and which flower at the same time.

A New Fungus Gall

THE fungus *Cyttaria septentrionalis* causes the appearance of a gall upon *Fagus Moorei* in southern Australia. It is rather infrequent to find that an operculate member of the Pezizales has such an action upon a living tree, and the structure of galls formed by this fungus has been investigated by Miss Janet M. Wilson (*Proc. Linn. Soc. N.S. Wales*, 62, Pts. 1-2; 1937). Wedge-shaped areas of infection appear on the small branches, and although the galls may grow to a considerable size, they do not appear to restrict the growth of that part of the tree upon which they occur. Secondary xylem and phloem, cambium and cortex are all invaded by mycelium of the fungus, and each region is enlarged by the abnormal multiplication of cells. Haustoria of the fungus approach the nucleus of a living cell in the host, and coil around it, but do not cause death. Initial infection appears to be associated with the cambium, and the fungus often lies dormant for a season, before it initiates the formation of a gall.

Ecology of Tomato 'Spotted Wilt' Virus

A VERY extensive study of the incidence of 'spotted wilt' disease in field plots of tomatoes in southern Australia has been made by Dr. J. G. Bald (*Bull. Council for Sci. and Ind. Research*, No. 106, Melbourne, 1937). Records of infection were made for nine years, and yielded a number of interesting results. The degree of infection rose through the growing period in a series of successive maxima which apparently represented the emergence of successive broods of the transmitting insects *Thrips tabaci* and *Frankliniella insularis*. High temperatures usually increased the rate of infection, and within a range of about 15 yards from a source of infection every plant had an equal chance of contracting the disease. It required isolation by distances of 200-300 yards before the spread of infection was seriously reduced. Migration of thrips from overcrowded populations upon plants of *Solanum nigrum* and *Lycium ferrocissum* also accounted for considerable infection in spring, and it was possible in all cases to find a positive correlation between the degree of infection and the relative number of transmitting insects.

Structural Geology of Maryland

VOL. 13 of the reports of the Maryland Geological Survey is of general interest to geologists because it contains a detailed account of the methods used in investigating the structures of crystalline rocks and a fine series of examples of the application of these methods. Hitherto, much of the more recent relevant literature has been in German. The Piedmont Province of Maryland includes complexes of igneous rocks which were intruded as molten masses into

rocks already metamorphosed. Both were then again subjected to forces which further transformed them. Ernst Cloos shows how the various types of rock behave under stress and summarizes the methods by means of which the available evidence can be pieced together to yield a picture of the former conditions and history of the region. H. G. Hershey gives an account of the structure and age of the Port Deposit Granodiorite complex. The ovoidal gneiss-domes near Baltimore are shown by C. H. Broedel to have originated as a result of earth movements which began in Pre-Cambrian time. A volcanic complex in Cecil County has been studied by J. Marshall. The history is one of isoclinal folding, fracture cleavage, intrusion of gabbro, injection of granodiorite followed by dykes and veins, and finally development of cataclastic structures along shear zones. The statement in the preface that "The volcanic activity is the oldest geological incident in the history of this region since the lavas include fragments of all subsequent rocks formed prior to the close of igneous activity after the invasion of the gabbros and granites which now form the rocks of the Susquehanna Gorge" is not very helpful. The Baltimore Gabbro consolidated as a saucer-like body between adjoining domes of Baltimore Gneiss. Made classic by the well-known work of Williams half a century ago, it has now been thoroughly re-studied by C. J. Cohen. Primary flow-lines are distinguished from superposed structures due to subsequent deformations. The volume also contains an account of the Upper Cretaceous stratigraphy of the coastal plain of Cecil County by C. W. Carter.

Sanriku Earthquake Seawaves of 1936

IN 1896 and 1933, and to a less extent in 1897, the north-east coast of Japan suffered from the seawaves resulting from great earthquakes. On November 3, 1936, an earthquake, strong enough, like the others, to cause slight damage on the adjoining coast, occurred in the same region of the Pacific. Mr. N. Miyabe (*Bull. Earthq. Res. Inst.*, 15, 837-844; 1937) has described the small seawaves, about one foot in range, that were recorded at seven stations on the Japanese coast. The interval between the time of occurrence at the origin of the earthquake and the first disturbance on the mareogram, ranging from 28 min. to little more than an hour, enabled him to estimate the distances of the origin from six of the stations, and thus to obtain the position of the epicentre in lat. $38^{\circ}0'$ N., long. $143^{\circ}0'$ E. It is interesting to notice that all four epicentres lie on a curve roughly parallel to the coast, about 90 miles in length and the same distance from the coast and coinciding nearly with the isobath of 3000 metres, the epicentre of the latest earthquake occupying the most southerly position.

Crystalline Vitamin A

ALTHOUGH the existence of vitamin A was proved so early as 1913, its isolation is only very recent, and a provisional standard based on the extinction coefficient of a concentrate has been in use. H. N. Holmes and R. E. Corbet (*J. Amer. Chem. Soc.*, 59, 2042; 1937) now describe the preparation of a substance crystallizing in pale yellow needles, melting at $7.5-8.0^{\circ}$, and having the very high extinction coefficient of 2100, as compared with the highest previous value of 1700 and the provisional standard of 1600. The substance is regarded as pure vitamin A. It was obtained from the liver oils of three different

species of fish by a process of fractional freezing and cold filtration, and the addition of water to a solution in methyl alcohol. The biological assays give about 3 million international units per gram. The molecular weight by freezing point lowering was found to be 294, whilst Karrer's formula, $C_{20}H_{30}O$, for vitamin A requires 286. It was found that extinction measurements with the spectrophotometer should be made instantly after dilution with ethyl alcohol, since the extinction coefficient changes rapidly on standing and indications of a new absorption band appear, perhaps as a result of chemical change. The combustion analyses of the substance gave C = 83.28, H = 10.44, whilst Karrer's formula requires C = 83.84 and H = 10.56 per cent.

Liquid Parahydrogen

THE molecular volumes at saturation of liquid normal hydrogen and parahydrogen have been determined by R. B. Scott and F. G. Brickwedde (*J. Research Nat. Bur. of Standards*, 19, 237; 1937), who find that parahydrogen has a higher molecular volume, the expansivity being only slightly greater than that of normal hydrogen. The change in molecular volume in passing from orthohydrogen (molecules rotating) to parahydrogen (molecules not rotating) is opposite in direction to the change observed with other substances in passing from rotating to non-rotating states. An explanation is given based on the small moment of inertia of the hydrogen molecule so that the orientation of the axes of the molecules of parahydrogen can have a random distribution in the liquid and solid phases, and hence the state of non-rotating parahydrogen is like that at high temperatures in other substances whose molecules are rotating. The discussion involves a detailed consideration of the intermolecular forces for the two kinds of hydrogen molecule, the repulsive forces arising from regions of high electron density in neighbouring molecules being different. It may be mentioned that E. A. Long and O. L. I. Brown (*J. Amer. Chem. Soc.*, 59, 1922; 1937) find no essential difference in the p, v, t relations of normal and parahydrogen gases at low pressures from the boiling point to 55° K.

Conductance of Mixtures of Strong Electrolytes

ALTHOUGH the simple theory of Kohlrausch indicates that the electrical conductance of a mixture of strong electrolytes is additively composed of the separate ionic mobilities, calculations by Onsager and Fuoss based on the modern theory of electrolytes indicate that the decrease in velocity of an ion due to the field effect is a function of the properties of all the ions in solution, and a deviation from the additive law is to be expected. Experimental results found by Bray and Hunt in 1911 showed good agreement between observed and calculated values at low concentrations, but at higher concentrations the observed mixture effect appeared to be about half that calculated. In these experiments, mixtures of hydrochloric acid and sodium chloride were used. K. A. Krieger and M. Kilpatrick (*J. Amer. Chem. Soc.*, 59, 1878; 1937) have now investigated mixtures of lithium and potassium chlorides. The same result is found, namely, that the observed change is about half that calculated by Onsager and Fuoss at higher concentrations and tends to agree with it at lower concentrations. No explanation of the discrepancy is offered.