

RESEARCH ITEMS

The Genitalia of Hymenoptera

THE morphology of the external genitalia of male insects has received a good deal of attention in recent years, and one of the most active workers in this field is R. E. Snodgrass, of the U.S. Department of Agriculture. His most recent contribution to this subject deals with the male genitalia of the order Hymenoptera (*Smithsonian Misc. Coll.*, 99, No. 14, Washington, 1941, 86 pp., 33 plates). The author concludes, in regard to insects in general, that the primary genital ducts in the male must have opened on the tenth segment of the abdomen. Paired penes, giving individual exit to these ducts in Ephemeroptera and certain Dermaptera, appear to belong to this segment. The median genital organ of other insects is termed by Dr. Snodgrass the phallus, which is formed by the union of a pair of genital lobes arising, in most cases, on the ninth abdominal segment. The nature of the so-called claspers is fully discussed, and while it is conceded that these structures are derived from the phallus in some orders of insects, in others, including Heteroptera, Mecoptera, Trichoptera, Lepidoptera, and Diptera, he says that there is no conclusive evidence as to the nature of the movable claspers borne on the 'coxal plates' in the orders named. In the Hymenoptera the development of the phallus is from a pair of rudiments on the ninth abdominal segment. Characteristic genital features of the order are the lateral parameral lobes or 'valvæ externæ', a median oedeagus, a pair of volsellæ or 'valvæ internæ' and, in bees, the sagittæ or 'penis valves' in addition. All these components are derived from an original phallus, and include no counterparts of the claspers found in those orders listed above.

Incidence of Lice

AN investigation has recently been carried out by K. Mellanby at the request of the Board of Education and the Minister of Health with the object of discovering the incidence of the head-lice in England. In a memorandum enclosed with Circular 2306 (Ministry of Health) and Circular 1544 (Board of Education), it is stated that infestation of the body is rare in children. As the result of an examination based on approximately 60,000 cases in hospitals, it is found that a very high degree of infestation with head-lice exists in industrial cities, and that girls are more frequently infested than boys. In industrial cities infestation in girls reaches a peak at three years old (51.6 per cent), and similarly in boys, but at the rate of 40 per cent. In the rural areas the percentage of children infested is very low. There is, it appears, no evidence that louse infestation, though widespread, is increasing. All the evidence points to the fact that education and improved social conditions have resulted in it being less common and less severe than in the past. The conclusion is reached that education of the public is the only method likely to yield permanent success. While local authorities have powers to take appropriate action, it must be premised that the desired improvement of conditions will be secured by a continuous use of administrative measures for treating cases which have arisen and by educational efforts rather than by resorting to powers of compulsion.

Frost Resistance in Plants

IN the now voluminous literature on this subject it is evident that two physical factors in the organization of protoplasm are of importance in determining hardiness: the percentage of bound water and the permeability to water. Increase in either of these properties, or of both, is involved in increase in hardiness. Some light is thrown on the relation of these properties to hardiness by Siminovitch and Levitt (*Canadian J. Res.*, 19, 9; 1941) in an investigation of the physical properties of the protoplasm in several hardy and non-hardy species. The surface membrane of non-hardy cells stiffens when dehydrated osmotically and therefore ruptures readily when subjected to tension on deplasmolysis. This stiffening either fails to occur in hardy cells or arises as a result of much greater dehydration. The volume enclosed by the membrane can be reduced in these latter tissues to less than one third of its initial value without any sign of deplasmolysis injury, whereas in non-hardy cells a reduction to only two thirds causes death on deplasmolysis of more than 50 per cent of the cells. A further difference brought to light by these plasmolytic experiments is the clumping of plastids and granules (systrophy) in non-hardy but not in hardy species consequent upon prolonged immersion in a plasmolyticum. With regard to other physical properties, the refractive index of the protoplasmic surface increases more on dehydration in non-hardy than in hardy cells, and oil drops injected into plasmolysed cells readily become crescent shaped in non-hardy cells on deplasmolysis, but not so readily, if at all, in hardy cells. All these facts indicate a greater hydrophily in hardy than in non-hardy species both of the surface membrane of the protoplasm and, possibly to a lesser extent, of the protoplasm as a whole. This is obviously in harmony with the above-mentioned views concerning bound water and permeability.

Lily Mosaic

THE ninth volume of the Royal Horticultural Society's Lily Year Book (from the Society's office, Vincent Square, Westminster, S.W.1; 1940, 5s. paper, 6s. cloth) contains a useful review by D. E. Green and M. A. H. Tincker of the damage caused to lily plants by the mosaic virus. Many species of the genus *Lilium* frequently show the characteristic leaf mottling symptoms of the disease, which usually destroys a stock within three or four years. Malformation and dwarfing of the flowers is also found, with diminution in size of the bulbs. The malady is distributed by the insect vector *Aphis gossypii*, which can be largely controlled by frequent application of nicotine dust. Infection by the virus often occurs in the seedling stage, though the disease is not truly seed-borne. *Lilium speciosum* and *L. auratum* were the host species particularly studied, and stocks of the former survived for a longer period at Wisley than did the latter, which is very susceptible.

Rust-Resistant Antirrhinums

D. E. GREEN reports progress on the selection of strains of Antirrhinum resistant to the rust fungus *Puccinia Antirrhini*, in a recent short paper (*J. Roy. Hort. Soc.*, 66, Pt. 3; 1941). Resistant forms were

obtained from the United States, but were not florally desirable; the problem was first to select a series of parent forms with flower colours suitable for decorative combination. This has now been accomplished, and five rust-resistant strains of varying flower colour have been established. It is not yet known if they are resistant to a second physiological race of the parasite which has appeared in the United States.

Trisomics in *Nicotiana*

T. H. Goodspeed and P. Avery (*Proc. U.S. Nat. Acad. Sci.*, **27**, 13-14; 1941) have found the twelfth primary trisomic in *Nicotiana sylvestris* ($n = 12$). This trisomic, Stiff, has extremely long flowers and stiff leaves which easily distinguish it from the diploid and the other eleven known primary trisomics. Stiff arose from the cross $3n - 1 \times 2n$ as a double trisomic with Puckered. This in turn gave 24 diploid, 12 Puckered, 14 Stiff and 3 double trisomics. Stiff has also arisen from the progeny of an asynaptic form of the trisomic Inflated.

Determination of Arsenic

At a meeting of the Society of Public Analysts and other Analytical Chemists held on February 5 H. J. G. Challis described the interference of selenium and tellurium with the determination of arsenic by the hypophosphorous acid method. In the method of B. S. Evans for the determination of arsenic by separation with hypophosphorous acid and subsequent iodimetric titration, if selenium or tellurium is present errors are caused inasmuch as these elements also are precipitated by hypophosphorous acid and are oxidizable by iodine. To avoid these errors a modification of the method is described in which the hypophosphorous treatment is carried out first at 50°C. for half an hour. This precipitates selenium and tellurium but not arsenic, and after filtration the arsenic is precipitated from the filtrate at boiling temperature as described by Evans.

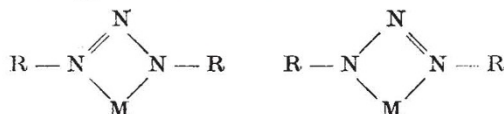
Underground Water Supply of Calcutta

AN inquiry from the Corporation of Calcutta as to the nature of the strata below the Gangetic delta, arising from a proposal to install deep tube-wells, led to the preparation by A. L. Coulson of Water Supply Paper No. 1 (*Mem. Geol. Surv. India*, **76**, 150; 1940) which contains a systematic account of all the relevant information. After a general description of the Indo-Gangetic plains and the Ganges delta, the question of the maximum thickness of the alluvium and the discrepancy between the geological evidence and that afforded by geodetic observations is discussed. Theories are given for the origin of the 'swatch of no ground' off the Ganges delta. Detailed information gained from the sinking of tube-wells in Calcutta and its vicinity during the last 135 years is compiled. It is pointed out that the rate of flow of the underground water is slow and that considerable mutual interference must be expected between wells sunk too close together. As to the sources of the water, it is concluded that while there is a south-easterly flow from the Damodar river, the bulk of the underground supplies is replenished by slow southward percolation from the Brahmaputra and Ganges. It is pointed out that there is some danger of exhausting the supplies if numerous wells are sunk to tap the aquifers. It is recommended, however,

that an experimental tube-well boring should be sunk to a depth of 5,000 feet or less, according to whether or not the basement rocks underlying the Gangetic alluvium are encountered before that depth is reached. A gradual coarsening of the beds with depth is expected, until the Tertiary marine strata or the Supra-Panchet rocks are struck. It is the gravel beds—if these are proved to exist—immediately overlying the basement rocks that will most likely furnish water under artesian conditions.

Metallic Triazine Complexes

THE preparation of a number of metallic salts of diazoamino compounds and the determination of their molecular weights, by F. P. Dwyer (*J. Amer. Chem. Soc.*, **63**, 78; 1941) show that they should be formulated as inner complex salts in which the triazine group functions as a chelate (2-co-ordinating) group, and with the possibility of resonance (leading to stability) between the two structures:



Two compounds prepared appear to be the first examples of hexacovalent palladous compounds described, the triazine groups being probably octahedral about the metallic atom in *cis* positions. F. P. Dwyer and D. P. Mellor (*J. Amer. Chem. Soc.*, **63**, 81; 1941) by magnetic susceptibility measurements show that nickel complexes of diazoaminobenzene and 4,4'-dimethyldiazoaminobenzene are diamagnetic and hence in them the nickel atoms have a square co-ordination configuration. In that case the triazine group appears to function as a chelate group. Molecular weight determinations show that two deep red diamagnetic complexes are dimeric in benzene; on boiling, this structure gradually breaks down into the monomeric form, the change being reversed on cooling. The dimeric forms involve an 8-membered ring of nitrogen atoms bridging the nickel atoms which is very unusual, although there is evidence for its occurrence with *bis*-ethylenediamine cobalt complexes with sulphonyl diacetic acid and with homophthalic acid.

Crystal Structure of Iodic Acid

AN X-ray examination of the structure of the α -modification of crystalline iodic acid by M. T. Rogers and L. Helmholz (*J. Amer. Chem. Soc.*, **63**, 278; 1941) shows the presence of discrete pyramidal IO_3 groups in the crystal with the observed I-O distances 1.80 Å., 1.81 Å., and the O-I-O angles 96°, 98° and 101°. Three oxygen atoms in positions approximately opposed to the three-bonded IO_3 oxygens and at distances 2.45, 2.70 and 2.95 Å. complete a distorted IO_6 octahedron with three strong bonds and three weaker ones. The hydroxyl oxygen atom of each iodate group has two nearest oxygens at 2.78 Å. There are thus two hydrogen bonds for each iodate group forming a moderately strong bifurcated bond. The oxygen atoms are in a somewhat distorted closest packed arrangement and the structure somewhat resembles that of perovskite. Crystalline iodic acid is an aggregate of HIO_3 molecules held together by hydrogen bonds, and secondary I-O bonds of the type observed for arsenic and oxygen in arsenolite.

Stability of Crystal Lattices

IN the fifth of a series of papers, R. Fürth (*Proc. Camb. Phil. Soc.*, **37**, 34; 1941) deals with the relation of some experimental results and recent theories of the equation of state and the melting of solids. After a short survey of Born's theory of the thermodynamics and melting of crystals it is shown that Lindemann's and Grüneisen's law for the normal melting temperature can be deduced. Values in good agreement with experiment are got for the dependence of the melting temperature on pressure and for the dependence of the compressibility and elastic constants on pressure and temperature. Several connexions between breaking and melting, suggested by the fundamental ideas on melting and stability of crystals, are discussed and verified. A relation between heats of melting and of sublimation gives values of the correct order of magnitude (see also *NATURE*, **145**, 741; 1940).

Reagent of Aldehydes

A 1 per cent solution of *N,N*-dibenzyl-*m*-phenylenediamine in 95 per cent alcohol is proposed as a reagent for aldehydes by F. G. Singleton and C. B. Pollard (*J. Amer. Chem. Soc.*, **63**, 240; 1941). The test is carried out by placing two drops of the substance in a test-tube and adding 5 ml. of the reagent. Saturated aliphatic aldehydes give a red initial colour followed within ten minutes by a bright green fluorescence which becomes stronger on standing; formaldehyde is exceptional in giving a yellow initial colour and no fluorescence. Unsaturated aliphatic aldehydes give a darker red initial colour than saturated, and a dull brownish-green fluorescence appears within ten minutes; hexadiene-2,4-al and cinnamaldehyde show unusually dark red initial colours but no fluorescence. Aromatic aldehydes give initial colours which vary from bright yellow to dark red, and a bright green fluorescence appears only after two or three hours.

Long-Chain Polar Compounds in Lubrication

THE effect of long-chain polar compounds on the coefficient of kinetic friction under boundary conditions has been studied by O. Beeck, J. W. Givens and A. E. Smith (*Proc. Roy. Soc., A*, **177**, 90; 1940). The Boerlage four-ball friction apparatus in various modifications was used, and the structure of thin films of lubricants rubbed on polished mild steel surfaces was examined by electron diffraction. For oils which showed high surface orientation imparted by addition of long-chain polar compounds, a sudden decrease of the coefficient of friction was observed at various velocities of the sliding surfaces, depending upon the compound used. Those compounds in which the effect occurred at the lowest velocities were found to be most highly oriented with their carbon chains most nearly perpendicular to the surface. At the regions of sudden decrease of the coefficient of friction the electrical resistance between the sliding surfaces changes from a low value, corresponding to metallic contact, to an extremely high value. The effect is explained as a 'wedging' of oil under the surface.

The Ellipticities of the Earth and Moon

JEFFREYS has recently combined six data relevant to the ellipticities of the earth and moon and found the agreement satisfactory (*Mon. Not. Roy. Astro. Soc.*, **101**, No. 1; 1941). These are the secular motions of the node and perigee, the monthly term in the moon's latitude, the inclination of the moon's

axis, the annual libration in longitude and a new determination of the ellipticity term in gravity recently made by Jeffreys himself. Following work by Brown and Spencer Jones, and using Belkovich's solution concerning f in preference to that of Franz and Stratton, Jeffreys obtains:

$$J = 0.0016377 \pm 0.0000042 \text{ (0.0000062 s.e.)}$$

giving $\frac{1}{\epsilon} = 297.05 \pm 0.38$ (0.56 s.e.). This value has about the same apparent accuracy as Heiskanen's and the international gravity formula (Potsdam standard) is modified to

$$g = 978.049(1 + 0.0052895 \sin^2\varphi - 0.0000059 \sin^2 2\varphi).$$

It has been suggested by Browne and Bullard that the first factor should be 978.032 but that the change should not be made until the connexions between Potsdam, Cambridge and the National Physical Laboratory have been strengthened. According to Jeffreys the constants for the moon are now:

$$J + \frac{1}{2}K' = 0.0003733 \pm 0.0000011 \text{ (0.0000016 s.e.)}$$

$$K' = 0.000073 \pm 0.000023 \text{ (0.000034 s.e.)}$$

$$f = 0.804 \pm 0.062 \text{ (0.092 s.e.)}$$

An outstanding difficulty is still the disagreement between the moon's dynamical and visual parallaxes, which Jeffreys suggests may be due to an abnormal deflection of the vertical at Cape Town.

The Ellipticity Term in Gravity

JEFFREYS has recently made a new estimate of the main ellipticity term in gravity (*Mon. Not. Roy. Astro. Soc.*, Geophys. Supp., **5**, No. 1; 1941). Taking the existing observations of gravity over the surface of the earth, forming summaries of the free air anomalies over 10° squares and reducing to the mean height of the square so as to eliminate the correlation of the free air anomaly with height, it was hoped to determine the harmonics of low order other than the main ellipticity term. It was found that the observations were unsuitably distributed for such a determination owing chiefly to lack of data for the South Pacific and high southern latitudes, but they did yield a new estimate of the main ellipticity term in gravity. This ellipticity turned out to be the reciprocal of 296.80 ± 0.71 .

Diffuse Radiation in the Galaxy

THE so-called interstellar 'absorption' of light which gives rise to the dark nebulae is likely to be (at least in part) scattering rather than absorption. This being so, those regions of the Milky Way rendered least luminous to the naked eye because the light of distant stars is absorbed should show a faint background of diffuse light due to scattering by the interstellar particles. This has been recently verified by Henyey and Greenstein (*Astrophys. J.*, **93**, 70; 1941), who used for the purpose a Fabry photometer attached to the 40-in. refractor of the Yerkes Observatory. Surface brightnesses of the sky were measured photographically across the Milky Way at several points, choosing fields free from stars brighter than mag. 16 so as to reduce the correction for unresolved starlight. After correcting for the light of faint stars, for direct and scattered auroral light, and for zodiacal light, these observations indicate a diffuse radiation concentrated closely to the galactic equator and reaching there a value equivalent to some 60 tenth-magnitude stars per square degree; more in the dark regions, less in the transparent areas. This diffuse light can be explained as scattered stellar radiation if the phase function governing the scattering is strongly forward-throwing.