not appear that mere isolation suffices to produce even distinct varieties of Calochortus. For instance, *C. catalinae*, Watson, is found on Catalina and other islands, and also on the mainland; but instead of running into numerous insular races, it "is one of the least variable" of all, and no variety has been distinguished by name. On p. 141, Mr. Purdy admits that his *Calochortus venustus*, var. *eldorado*, "var. nov.," is the same as *C. venustus purpurascens*, Watson; while he applies the name *purpurascens* (Purdy, 1895) to a quite different variety of the coast range. This surely cannot be permitted; the former must stand as *purpurascens*, while the latter may be called var. *Caroli*.

T. D. A. COCKERELL.

EARTHQUAKE OBSERVATIONS IN GALICIA.

THE ninth number in the new series of the publications of the Austrian Academy of Sciences relates to earthquakes observed during the year 1901 in Lemberg. The first feature which one observes in this publication, the author of which is Dr. W. Laska, is that he describes each earthquake according to the phases it exhibits, the various phases being distinguished from each other by differences in their periods. Twenty years ago, earthquakes were described as consisting of preliminary tremors, shocks and concluding vibrations, each of which had distinguishing periodic motions. Now we find first preliminary tremors of types p_1' and p_1'', second preliminary tremors of types p_2', p_2'', p_2''' and p_2'''', and on they go, commencing with p_1', with periods between 2·1 and 6·9 seconds, and ending with types where the periods have exceeded one minute. Inasmuch as these groups overlap, so that it is frequently difficult to assign a set of waves to their proper group, for our own part we are for the present content to divide the seismic spectrum into four parts—first and second preliminary tremors, large waves and concluding vibrations. In addition to these entries, Dr. Láska gives tables of tri-daily readings of two levels and of a thermometer. The most interesting portion of the work is, however, found in its introduction, where, amongst other matters, reference is made to the natural period of a pendulum as influencing the magnitude of its records and to rules which enable an observer to determine the distance of an origin from the inspection of a seismogram.

One simple rule is to diminish the duration of the first preliminary tremors reckoned in minutes by unity and multiply the same by 1000. The result is an approximation to the distance of the origin expressed in kilometres. For example, if a seismogram shows that the preliminary tremors had a duration of 7·6 minutes, then the earthquake it represents originated at some place about 6600 kilometres distant. The mnemonic is certainly simple, but its application is confined to those records where preliminary tremors are well defined. These are comparatively few in number and the accuracy of the determination is dependent upon the measurement of intervals of time which are small. These objections apply to a second rule suggested by Dr. Láska, the value of which is apparently still further impaired by the introduction of two assumed constants determined by Dr. F. Ōmori. These constants are the velocities of the first and second preliminary tremors as determined from observations of ten earthquakes which originated near Japan and were recorded at Tokio and in Italy.[1] To obtain these velocities, the arcual distance between the Tokio isoseist and Italy is divided by the difference between the times of observation in Tokio and Italy. Had the distance between the origins and Italy been divided by the difference of times between the times of origin (which are easily calculable) and the times of arrival in Italy, then the constants given by Dr. Ōmori would have been reduced. A further reduction would be made on the assumption that the wave paths of the motion considered had approximated to chords. If the speed of the preliminary tremors between their origin to the Tokio isoseist had been the same as it was from that isoseist to Italy, then the above objections might be withdrawn, but this, according to Dr. Ōmori's own showing, appears hardly to be the case.[2]

Although it is interesting to find the relationship between the duration of preliminary tremors and the distance they have travelled again brought to our notice, the well-known method of determining origins by the interval of time between the first motion of an earthquake and the subsequent arrival of the large waves is apparently one of more frequent and certain application.[1]

J. MILNE.

[1] "Publications of the Earthquake Investigation Committee in Foreign Languages," No. 5, pp. 71-80. (Tokio, 1901.)
[2] *Jour.* Sc. Coll., Tokio, vol. xi, p. 158.

PILOT CHARTS OF THE METEOROLOGICAL OFFICE.

IN addition to the usual information, the Meteorological Office pilot chart of the North Atlantic and Mediterranean for the month of January deals with some new features, necessitating the use of the back of the chart as well as the front. There is an account of the destructive cyclone which visited our coasts on October 15–16 last, and also of the slow-moving disturbance and its accompanying gales which wandered about the Tyrrhenian Sea from October 22–29. A summary is given of the characteristics of the surface temperature of the Atlantic for each of the ten months from January to October last, the most striking feature being the evidence of a distinct tendency for the water in the immediate vicinity of western Europe to remain cooler than the normal during the first nine months, a fact which may be associated with the persistent low air temperature over the adjacent land during the spring and summer. On the Newfoundland banks, there was a marked excess of warmth through the first six months, little or no ice being found in the locality. In October, an excess was shown on the eastern side of the ocean for the first time, and simultaneously the air temperature over the British Isles passed above the average in all districts. With the object of discovering what connection, if any, there is between the movements of weather systems and the distribution of the temperature of the surface water, observations are being collected for obtaining the mean barometric pressure month by month over the region from 30° to 60° N., 0° to 70° W., and the tracks of the centres of storm areas. For October, the mean isobars are superimposed on the sea temperature results, while the storm tracks are given on a separate chart.

To arrive at any definite conclusion as to cause and effect, it will require a long series of such charts—probably, too, for shorter periods than a calendar month, periods determined by the prevailing type of conditions, depending mainly on the positions and stability of the controlling anticyclones. Summaries are given of the ice reports from the whaling steamer *Balaena*, up Davis Strait, and the barque *Lady Head*, in Hudson Bay, last summer. Neither vessel passed any ice in the lower part of Davis Strait when heading for home in October. On July 1 last, the New Zealand Shipping Company's s.s. *Waikato* was disabled in 33° S., 6° E., and for twenty-six days she drifted helplessly about the south Atlantic, being finally taken in tow on July 27 in 28° S., 13° E., having in the interval travelled 812 miles, or at an average rate of more than thirty-one miles per day. The track of her wanderings day by day, together with the direction and force of the wind, supplied by Captain Kiddle, is reproduced, with the addition of the normal current circulation of the region, which shows that the *Waikato* followed closely the drift indicated by the Admiralty chart.

STARVING A PARASITE.

IN a recent paper read before the Royal Society,[2] Prof. Marshall Ward described the results of three series of experimental cultures of Brome-seedlings in sand, to which had been added various nutritive salts, or manurial mixtures, which were then infected with the parasite to see how the latter behaved on starved seedlings. Some of the seedlings received all the salts necessary for successful development, others none of such salts other than the root-hairs could extract from the sand itself and from the reserves in the endosperm, and others all necessary minerals except phosphorus, or potassium, or magnesium, or calcium, or nitrogen respectively.

So far as the seedlings themselves are concerned, the effects of the mineral starvation were most evident in the small stature,

[1] "Brit. Assoc. Reports," 1900, p. 79; and "Seismological Investigation Report," 1902.
[2] "Experiments on the Effect of Mineral Starvation on the Parasitism of the Uredine Fungus, *Puccinia dispersa*, on Species of Bromus." By Prof. H. Marshall Ward, F.R.S. Read before the Royal Society on November 27.

reduced root-system, narrow leaves, pale colour, &c., the nitrogen-starved and phosphorus-starved specimens, and in those lacking all salts.

In no case, however treated were the starved or manured seedlings rendered immune. All were successfully infected by normal uredospores adapted to the normal species, though in the phosphorus-free and in the nitrogen-free seedlings, and in those deprived of all salts, there were signs of retardation of the infection, and the resulting patches and pustules of fungus spores (uredospores) were fewer and smaller.

As regards the fungus, apart from the reduced size of the mycelium, as expressed in the small pustules and retardation of development above referred to, even the reduced number of spores borne on the smallest pustules—*e.g.* on phosphorus-starved plants– showed no signs of morphological degeneration, or of diminished germinating capacity or virulence—*i.e.* capacity for infection.

The positive results, therefore, are purely *quantitative*. A starved plant develops smaller pustules and fewer spores, simply because it can offer smaller quantities of food materials to the mycelium in its tissues; these food-materials, however, are as good in *quality* as they are in the case of a normal or highly manured plant. Not only so: the experiments also show that spores developed on starved seedlings can also infect seedlings which have been *similarly starved*—for instance, the few spores obtained from the very minute pustules of a phosphorus-starved seedling *can infect another phosphorus-starved seedling* just as readily as they can a normal plant, and so on through the series.

Consequently, we must infer that predisposition and immunity on the part of the Brome, and impotence and virulence on the part of the Fungus, are alike independent of mere nutrition; and since the author has shown in previous papers[1] that these properties are also independent of the anatomical structure of the host-plant, it must be concluded that the phenomena of adaptive parasitism depend on deep-seated peculiarities of the living protoplasm of the cells—possibly their capacity for forming enzymes, toxins and antitoxins, chemotactic bodies and the like, although such bodies have as yet resisted all efforts at extraction.

The full paper is illustrated with photographs and tables.

THE NORTH OF ENGLAND SCIENCE CONFERENCE.

THE first annual conference of persons in the north of England concerned in primary, secondary, technical and other forms of higher education, was held at Manchester on January 2 and 3, and proved highly successful. The conference may be regarded as a natural outcome of similar meetings which have for some years past been held annually in London under the auspices of the London Technical Education Board. Many teachers and other educationists from the north of England have, year by year, attended the conferences in London and have become familiar with the benefits to be derived from a discussion of educational methods. Believing that many teachers and others in the northern counties, anxious to reap the advantages springing from such meetings, were debarred from attendance by the expense of travelling, a number of prominent educationists in Lancashire and Yorkshire arranged this series of meetings in Manchester, and the phenomenally large attendance at all the discussions has fully justified their enterprise. More than three thousand persons accepted invitations to be present, and every meeting was characterised by the greatest enthusiasm. It had been intended to hold all the meetings at the Manchester Municipal School of Technology, but the number of visitors to be accommodated necessitated the duplication of meetings, and a few days before the commencement of the conference arrangements were made for additional papers to be read in other places at the same time as those originally provided.

In addition to the papers and discussions, the executive committee provided exhibitions to illustrate methods of nature-study, the teaching of experimental science, school furniture and other forms of school equipment. Demonstrations on the teaching of light and magnetism were respectively given by Messrs. Adamson and Moore, of the Manchester Technical School; and, in addition, the numerous excellent educational institutions in different parts of the city were thrown open for the inspection of visitors. A conversazione, held at the School of Technology on the evening of the first day of the conference, provided a good opportunity for teachers in different districts to become acquainted.

The method of conducting the meetings deserves to be more widely imitated in educational conferences. Immediately after the reading of a paper, the discussion of the subject was opened by one or two speakers of wide experience, who had been previously selected for the purpose and had prepared their remarks, with the result that the discussion was much more helpful to teachers than is usually the case on similar occasions. Moreover, as printed copies of the papers for discussion could be obtained immediately before the commencement of the meetings, subsequent speakers were able to contribute something of value to the debate, and general remarks having little relation to the subject in hand were reduced to a minimum. Messrs. J. H. Reynolds and H. Lloyd Snape, the honorary secretaries, are to be congratulated upon the complete success of the conference.

Half an hour before the commencement of the serious business of the conference, the visitors were welcomed by the Lord Mayor of Manchester, and his remarks were warmly endorsed by Dr. Maclure, Dean of Manchester, by Prof. Hopkinson, principal of Owens College, and by other prominent educational authorities of the district.

School Curricula.

Mr. M. E. Sadler presided at the first meeting of the conference, and in his introductory speech dealt with the aims of education. The purpose of all practical inquiry and experiment was, he said, to find the kind of training which would best equip the rising generation for their life as home-makers or wealth-makers, under the actual conditions of the modern world. The reform of the curricula of our schools would, he thought, involve certain practical changes in the conditions under which many English teachers at present worked. Little boys ought not to be prematurely specialised in classical erudition in order to win scholarships at the public schools. In no school should any pupil fail to gain insight into the meaning of scientific method and into the operation of physical laws. In any type of curriculum, drawing and other forms of expression by means of the hand should be given a permanent place and should be worked in, as far as possible, in connection with the other subjects of study. There was a need that scientific and experimental study of education should be actively carried on at the universities, with encouragement of similar investigation among teachers already at work in the schools.

Miss Burstall, head mistress of the Manchester High School for Girls, then read a paper on the curriculum in different types of schools, in which she endeavoured to find general principles by which school curricula may be tested and, if necessary, amended. Three principles were deduced; first, the gradual adjustment of the child to the spiritual possessions of the race; second, that of training; and third, the theorem that the order of subjects in school life is conditioned by the laws of development of the child. These principles, Miss Burstall contended, lead to a broad rather than a narrow curriculum. The compulsory subjects of the curriculum for all children could be divided into three groups—English, including literature, history and geography, the humanities; science, *i.e.* arithmetic and nature-study for young children, mathematics and science later; physical and manual training. Technical education should be reserved for the last year of school life, when the specialised study of mathematics and science required for engineering, or housewifery and the domestic arts for girls, might be taken up. The subsequent discussion was very animated, and many teachers took part in it. Mr. King, high master of the Manchester Grammar School, contended that the subjects of education did not so much matter as the method in which they were taught. Prof. Armstrong, F.R.S., deprecated a statement of Miss Burstall's that a child's reasoning powers developed late.

A paper by Mr. W. E. Hoyle, of the Manchester Museum, on the value of natural history collections for teaching purposes, was also read at Owens College during the first morning of the conference.

[1] *Proc.* Cambridge Philos. Soc., vol. xi. 1902, pp. 307-328; and *Annals of Botany*, vol. xvi. 1902, pp. 233-315.