

bach, of Basle, showed some photographs of cirrus clouds taken by reflection from the surface of the Lake of Sarnen. In this case the surface of the water acts like a polarizing mirror, and extinguishes the skylight. Photographs of clouds were also exhibited by Mr. Clayden, Dr. Drewitt, Dr. Green, Mr. Gwilliam, Mr. Harrison, Mr. McKean, Messrs. Norman May and Co., Mr. H. C. Russell, and Mr. Symons. Mr. H. P. Curtis, of Boston, U.S.A., sent a valuable and highly interesting collection of photographs, showing the devastation caused by the tornadoes at Rochester, Minnesota, on August 21, 1883, and at Grinnell, Iowa, on June 17, 1884. After seeing these photographs, some idea can be formed of the immense destruction wrought by these terrible scourges, which so frequently visit various parts of the United States. Mr. Curtis also exhibited three photographs of the tornado cloud; two of these were taken at Jamestown, Dakota, on June 6, 1887, when the cloud funnel was 12 miles to the north; the third, which was taken in New Hampshire, during the storm on June 22, 1888, shows the spiral-shaped funnel trailing at a considerable altitude in the air.

Many interesting photographs illustrating meteorological phenomena were exhibited. These included floods, snow-drifts, hoar-frost, frozen waterfalls, &c. A large number of photographs of flashes of lightning taken during the last twelve months were also shown, as well as some photographs of electric sparks, taken by Mr. Clayden and Mr. Bidwell, which explain the formation of dark images of lightning-flashes.

Mr. Clayden exhibited a very interesting and instructive working model, showing the connection between the monsoons and the currents of the Arabian Sea and the Bay of Bengal.

Mr. Dines showed a model of the whirling machine used by him at Hershams for testing anemometers and for experiments on wind-pressure; he also exhibited a remarkable curve showing the normal component of the wind-pressure upon a sloping surface 1 foot square, the normal pressure being taken as 100, and the pressure at various angles of inclination being expressed proportionately. Mr. Munro sent two instruments which he has recently constructed in conjunction with Mr. Dines. The first is for showing the velocity of the wind. The shaft of an anemometer is connected with the shaft of the instrument, and in turning works a small centrifugal pump, thus raising the level of the mercury in the long cistern. The deflection of the pendulum from the vertical position is proportional to the rate of turning, and thus gives a uniform scale. The second instrument is for showing the pressure of the wind from a velocity anemometer. The arrangement is the same as in the preceding instrument, but the fall of the float in the small circular cistern is proportional to the square of the velocity and therefore to the wind-pressure, thus giving a scale of pressure with the divisions at uniform distances.

Mr. Hicks exhibited Draper's self-recording metallic thermometer; a mercurial minimum thermometer with lens front; and a radial scale thermometer. Mr. Long showed Trotter's compensating thermometer for taking temperatures at any distance; and Mr. Denton exhibited his clinical thermometer case with new spring-catch.

WILLIAM MARRIOTT.

#### THE ORIGIN AND COMPOSITION OF THE FLORA OF THE KEELING ISLANDS.

AT intervals I have contributed to NATURE the results of the more recent investigations of insular floras, more especially in relation to the dispersal of plants by ocean currents, birds, and winds; and now, through the courtesy of the author and Captain Petrie, Honorary Secretary of the Victoria Institute, I am able to furnish

a commentative summary of a lecture<sup>1</sup> by Dr. H. B. Guppy, on the flora of the Keeling Islands.

It is hardly necessary to mention that Darwin visited these islands in 1836, except in connection with the fact that Dr. Guppy's visit was in a measure an outcome of that event. In 1878, Mr. H. O. Forbes spent some time there, and extended our knowledge of the flora. Primarily, no doubt, the coral-reef question took Dr. Guppy to the scene of Darwin's early labours, though he was probably not less interested in the flora, having been stimulated by practical botanizing in the Solomon Islands a few years previously; and a stay of nearly ten weeks enabled him to elucidate many points that were either obscure or conjectural.

Mr. John Murray, of the *Challenger* Expedition, found funds for Dr. Guppy's mission, and he presented to the Kew Herbarium the collections made of dried plants and drifted seeds and fruits; and there, such of them as were not already familiar to Dr. Guppy, and of which the material was sufficient, were named, and a set incorporated.

For the sake of brevity it will be better to describe what Dr. Guppy has accomplished, rather than follow him through his account of it.

Specimens were taken of all the different species of plants found in a wild state in the islands; notes made of the conditions under which they occurred, of their relative frequency, of their chances of propagation, and of their natural enemies, besides other particulars. In addition to seeds, or fruits containing the seeds, of the plants actually established on the islands, many others were picked up on the beach, where they had been deposited by the waves. Whilst most of these were in various stages of decay, others were actually germinating, and the question arose, Why had they not succeeded in obtaining a footing? As we shall presently learn, this question was easily answered.

Another point on which we had little trustworthy information was the length of time various seeds of essentially littoral and insular plants would bear immersion, or, rather, flotation, in sea-water without losing their vitality. With the exception of a few isolated instances of seeds having germinated after having been carried across the Atlantic to the western coast of Europe, very little was known, because the majority of the seeds experimented with by botanists at home did not belong to this class of widely-spread plants. Dr. Guppy instituted experiments on the spot, and although his time was too short to determine the extreme limits of endurance of the various seeds, he was able to prove that certain kinds germinated freely after being thirty, forty, or fifty days in sea-water. Again, he observed that some seeds that do not readily float, or only for quite short periods, are conveyed hither and thither in a variety of ways—such as in the cavities of pumice-stone, and in the crevices of drift-wood.

From all available evidence, it is almost absolutely certain that there were no permanent inhabitants of the Keeling Islands till about the end of the first quarter of the present century; and from the most trustworthy accounts the islands were covered with vegetation, the coco-nut largely preponderating in the arboreal element. Indeed, as the outer part was almost entirely coco-nut, it seemed, as Darwin says, at first glance to compose the whole wood. But there is evidence that there were large "forests" in the interior of the islands, consisting mainly of the iron-wood, *Cordia subcordata*. The largest island is said to be only about five miles long; and the group is between 600 and 700 miles from the nearest land, excluding the small Christmas Island.

Already at the time of Darwin's visit in 1836, the islands were in the possession of Captain Ross, the

<sup>1</sup> "The Dispersal of Plants, as illustrated by the Flora of the Keeling or Cocos Islands." A Paper read at a meeting of the Victoria Institute on Monday, February 3, 1890, by Dr. H. B. Guppy.

grandfather of the present proprietor, and coco-nut planting was progressing. Since then most of the available ground has been cleared of other vegetation and planted with coco-nut trees, so that the wild vegetation is nearly limited to an external fringe, and this often broken. In North Keeling, about fourteen miles distant from the main group, which was not visited either by Darwin or Forbes, there was still sufficient of the original vegetation left for Dr. Guppy to form an idea of what it was generally before it was cleared away for cultivation. Darwin's investigations had the effect of arousing the interest of Captain Ross in the natural history of the group, and this interest has been inherited by his descendants, who have greatly aided subsequent travellers by their hospitality and by their knowledge of local phenomena. Darwin collected or noted about a score of different species of wild plants, and this number has now been doubled by Forbes and Guppy.

This brings us to the results of Guppy's own investigations, the most interesting and important being those relating to the capabilities of certain plants, notably the coco-nut, to establish themselves on coral islands, as some writers of repute have strongly contested the possibility of it, and there can be little doubt that the coco-nut and other plants having large seeds obtain a footing only under exceptional circumstances, such as being buried by the sands washed over them in heavy gales.

Foreign coco-nuts are frequently cast ashore on the Keeling Islands, where they sometimes germinate, but the crabs invariably destroy the sprouting nut. Suppose, however, a period when crabs were less numerous, and the chances are not so very remote of some of the growing nuts escaping them. Again, Mr. Forbes cites an instance in which the crabs may even facilitate the establishment of the coco-nut, for he observed that the crabs sometimes burrow so near the surface that the nuts occasionally break through and find favourable conditions for growth. Should they escape the crabs in their earliest infancy, they are safe. Many other plants are now prevented by the crabs from establishing themselves on the Keeling Islands. Dr. Guppy says:—

"I have been informed by the proprietor that sometimes when a large amount of vegetable drift has been stranded on the beach, a line of sprouting plants may be shortly observed just above the usual high-tide mark; but the tender shoots are soon eaten by the crabs, and in a little time every plant is gone. Many of the seeds that germinate on the beach are beans, varying in size from those of *Entada scandens* downward. They form one-third of the vegetable drift."

Indeed, the crabs are so numerous that Mr. Ross has failed in many attempts to raise plants of some of these things in his garden. One flourishing *Entada scandens* and a sickly *Calophyllum Inophyllum* were all the reward of much trouble in this direction. The huge square fruits of *Barringtonia speciosa* are often thrown up, and the seed germinates, but very few escape the crabs. This tree had not established itself in North Keeling, though in August 1888, Dr. Guppy observed two seedlings about eighteen inches high, and they owed their preservation, it was supposed, to the circumstance of the fruits having been concealed when the seeds germinated by the bed of fine drift pumice that had been deposited on the shores of the lagoon after the Krakatã eruption.

Particulars are given of the incipient germination and early destruction of *Carapa*, *Nipa*, *Cycas*, and other seeds. Of course, the clearing of the original vegetation and subsequent cultivation, and the incidental or intentional introduction of various birds and animals, and the migration of the myriads of sea-birds that formerly inhabited the islands must all be taken into consideration. Yet no species of plant ever known to grow wild there has become quite extinct, an evidence of their tenacity of life under unfavourable conditions.

Dr. Guppy's additions to the Keeling flora include the following plants, which he regards as having formed part of the original vegetation, judging from the conditions under which he found them: *Calophyllum Inophyllum*, *Thespesia populnea*, *Triumfetta subpalmata*, *Suriana maritima*, *Canavalia obtusifolia*, *Terminalia Catappa*, *Barringtonia speciosa*, *Sesuvium Portulacastrum*, *Ipomæa grandiflora*, *I. biloba* (*I. pes-capræ*), *Premna obtusifolia*, and *Hernandia peltata*. Their general distribution fully justifies this deduction.

The experiments on the vitality of seeds after forty to fifty days in sea-water were necessarily of a limited character, but they established the fact that the following germinated: *Cordia subcordata*, *Hernandia peltata*, *Guet-tarda speciosa*, *Thespesia populnea*, *Scaevola Kænigii*, *Morinda citrifolia*, and *Tournefortia argentea*. Every seed of the last named germinated after forty days', and half of the seeds of *Morinda* after fifty-three days' immersion. Dr. Guppy calculates that a surface current of only one knot an hour would convey drift a distance of 1000 to 1200 miles during these periods. From the fact that almost all the drift is thrown up on the eastern and southern coasts, it is assumed that the bulk of it comes from the Malay Archipelago, and perhaps some from the north-west coast of Australia. This is borne out by the general distribution of the established Keeling plants, as well as by the other seeds and fruits that are stranded there.

Among the latter may be mentioned *Pangium edule*, *Heritiera littoralis*, *Erythrina indica*, *Mucuna* spp., *Dioscorea reflexa*, *Casalpinia Bonducella*, *Cerbera Odollam*, *Quercus* spp., and *Caryota*.

Carpophagous pigeons have played no recognizable part in the flora of the Keeling Islands.

In his forthcoming book Dr. Guppy will doubtless give all the details of his observations in a more connected and systematic form.

W. BOTTING HEMSLEY.

#### NOTES.

TO-DAY the honorary freedom and livery of the Turners Company are to be conferred on Sir John Fowler, K.C.M.G., and Sir Benjamin Baker, K.C.M.G., "in recognition of their distinction and eminence as engineers, earned by many great works at home and abroad, especially the design and construction of the Forth Bridge, one of the greatest triumphs of British engineering in the Victorian age."

SIR JOHN KIRK, F.R.S., AND SIR WILLIAM TURNER, F.R.S., Professor of Anatomy in the University of Edinburgh, have been elected members of the Athenæum Club, under the rule which provides for the annual election of a certain number of persons of distinguished eminence in science, literature, or the arts, or for public services.

MR. T. KIRKE ROSE, Associate of the Royal School of Mines, has obtained the appointment of Assistant Assayer at the Royal Mint, by competition among selected candidates. It is a post of some importance, and the salary rises from £350 to £450, with an official residence in the Mint. After an unusually brilliant career at the Royal School of Mines, Mr. Rose was engaged as metallurgist and assayer to the Colorado Gold and Silver Extraction Company in Denver. It is to be hoped that he will afford valuable assistance to Prof. Roberts-Austen in preserving the standard fineness of our coinage with the remarkable degree of accuracy that generations of assay masters have attained.

SIR HENRY ROSCOE has introduced into the House of Commons a Technical Education Bill, which is intended to clear up any doubt as to the legality of the provision of technical