temperature distribution in the atmosphere over England, with some remarks on the general and local circulation (this being an abstract of a paper appearing in the Philosophical Transactions of the Royal Society), and with total and partial correlation coefficients between sundry variables of the upper air. The main conclusions, as we gather from Dr. Shaw's preface to this memoir, are that the upper regions of cyclonic areas are colder than those of anti-cyclonic areas, and that the temperature up to the stratosphere varies in the same direction as the pressure at the surface, and that a close relation exists between the five quantities—pressure at ground level, mean temperature up to nine kilometres, pressure at nine-kilometre level, height of troposphere, and temperature of stratosphere. Illustrations are given of progessive changes in cloud formation.

In No. 3, Mr. G. W. Walker, superintendent of Eskdalemuir Observatory, which has become answerable to the Meteorological Office, gives a graphical construction for the epicentre of an earthquake; and in No. 4 Mr. R. Corless, who, as Dr. Shaw's scientific secretary, is following in the footsteps of such men as Dr. G. C. Simpson and Mr. Ernest Gold, deals with the radiation records obtained in 1911 at South Kensington, together with a comparison between them and the corresponding absolute observations of radiation made at Kew Observatory. We need only remark that it would be more satisfactory for some purposes if a more direct comparison could be made than one between a vertical instrument at one station and a total radiation instrument at another station, operated for only part of the time. Mr. Corless himself emphasises this difficulty, but apart from the comparison with Kew, the actual observations are of great interest, and show among other results the inadequacy of the sunshine instrument as a radiation recorder.

W. W. B.

THE BIOLOGY OF THE FIG-TREE AND ITS INSECT GUEST.[1]

WE take advantage of a recent treatise on fig-culture to enlarge and correct what has hitherto been taught about the biology of the fig-tree and its insect guest, Blastophaga. Our new information is drawn from Dr. Ruggero Ravasini's "Die Feigenbäume Italiens" (Bern, 1911), which gives the results of a prolonged study made in Italy. The research has been directed by Prof. A. Tschirch, of Bern; for the detailed observations and experiments we have to thank Dr. Ravasini, who, in addition to his scientific attainments, enjoys the advantage of being an Italian, and thereby better able to win the confidence of Italian fig-growers. Fig-cultivators and all biologists who make a special study of the fig-tree will, of course, betake themselves to the original treatise, which is clear, interesting, well-illustrated, and not too lengthy. We shall here address ourselves to those biologists for whom a less complete exposition will suffice, at least for the moment.

The structure and life-history of the fig-tree have been modified by long-continued cultivation; and in order to simplify the presentation of the facts, we shall first describe the reproductive process in the wild fig-tree, which still maintains itself in Italy, probably also in all fig-growing countries where the ground is not too closely occupied by cultivation.

The wild fig-tree is monœcious, its unisexual flowers being collected into mixed inflorescences. In remote ancestors of the figs the head may have taken the usual flattish or convex form. Dorstenia, an allied plant, which is now and then seen in hothouses, bears a crowd of small greenish flowers on a flattened disc about an inch wide. In a fig the edges of the disc close in upon the flowers, and we get a hollow, pear-shaped receptacle lined with minute, crowded, unisexual flowers. The opening is not only narrowed, but further obstructed by outward-pointing scales. During ripening the wall of the receptacle becomes thickened, and the central cavity almost disappears. In Dorstenia the small fruits are shot out by the turgidity of the wall; in the figs the wall may become eatable, and promote the dispersal of the seeds in another fashion.

The wild fig-tree bears three different kinds of inflorescence, according to the season of the year. There is a *spring inflorescence,* bearing male and sterile female flowers; a *summer inflorescence,* which bears only fertile females; and a *wintering inflorescence,* which bears only sterile females. Sterility here results from the adaptation of female flowers to the nutrition of fig-wasps (Blastophaga); the sterile flowers are hence called *gall-flowers.* In the cultivated fruiting fig-tree sterile pistillate flowers of another kind occur.

The process of pollination of the fig by Blastophaga is comparatively familiar, but it may be briefly described here to save the necessity of reference to books. Blastophaga is a small Chalcidid hymenopterous insect. The male is wingless, and the female (which alone passes from one inflorescence to another) winged. In spring, impregnated females issue from the wintering inflorescence and fly to the spring inflorescence. Here they lay eggs in the gall-flowers, one egg to each flower, and from these eggs both male and female flies proceed. When full grown, the male crawls sluggishly about until he becomes aware of the presence of a female still enclosed within the ovary of a gall-flower. Then he bites a hole in the ovary, passes in the tapering, pointed end of his abdomen, and effects his purpose. Since the male rarely quits the inflorescence, he has no need of wings or eyes; accordingly there are no wings, and the eyes are poorly developed; even the antennæ are small and few-jointed; the mandibles, however, and two of the three pairs of legs, are powerful.

The winged female after impregnation bites off the top of the ovary, and makes her way into

[1] "Die Feigenbäume Italiens und ihre Beziehungen zu einander." By Dr. Ruggero Ravasini. Pp. 174+6. (Bern: Max Drechsel, 1911.) Price 11 marks.

the central cavity of the spring inflorescence. The staminate flowers, set in a ring round the outlet, are now ripe, and the issuing female gets dusted by their pollen. Then she flies to the immature figs of the summer generation (we are still speaking of the wild fig-tree), which contain only female flowers. In her fruitless search for gall-flowers in which to lay her eggs, she pollinates the female flowers. So many Blastophagas are deceived by appearances that whenever a wild fig-tree is shaken in July or August, swarms of the flies come out of the summer figs. Is it possible that they procure food for themselves there?

Ravasini shows that in the wild fig-tree there are only two sets of gall-flowers, one in the wintering, another in the spring inflorescences. He believes that there are also only two sets of Blastophagas, answering to the two sets of gall-flowers. One female Blastophaga may suffice for an entire inflorescence, so that there is a great superfluity of insects.

In October the wintering inflorescences are ready, and the later-hatched Blastophagas of the spring generation enter them to lay their eggs in the gall-flowers. The life-cycle of the insect is thus completed.

We must now add a few words about cultivated fig-trees.

When men began to plant wild fig-trees in their gardens, they would, of course, propagate them by cuttings. Now cuttings of the wild fig-tree are found to reproduce the characters of the *branches* from which they were taken. By taking cuttings from branches destined to bear spring inflorescences, trees have been produced in which only the spring inflorescences regularly attain complete maturity; these trees are Caprifigs (goat-figs), which are practically male. In the same way, by using as the parent stock branches which bear summer inflorescences, trees have been produced which are entirely female. Of these two the caprifig alone is capable of harbouring the insect guest during its growth period.

Two fig-trees, very different in appearance and function, have thus been developed by the action of man out of the single primitive stock; they are often called *varieties*, but Tschirch and Ravasini show that they are really *artificially produced sexual forms* of one and the same natural species, viz. of the wild fig-tree. One proof is that seeds of the cultivated fig-tree produce either caprifigs or inferior fruiting figs. A further proof is yielded by the fact that the female Blastophaga, when laden with eggs, can only fly a very short distance. Hence we infer that she is adapted to a monœcious fig-tree, in which all the forms of inflorescence are to be found on one tree. The cultivated fig-tree is practically dicœcious, and without artificial pollination ripens no seed. Only one monœcious tree is known, which can be regarded as a possible common ancestor of the two interfertile forms, caprifig and fruiting cultivated fig; this common ancestor is the wild fig-tree.

Fig-cultivators must have become early acquainted with the Blastophaga and the effects of its visits, for the female flowers of the fig remain unfertilised if no Blastophaga enters them, and unfertilised female inflorescences (in unimproved fig-trees) fall off prematurely. To prevent such failures, the expedient was successfully tried (ages ago) of fastening to the female trees ripe staminate inflorescences of the wild fig-trees. Blastophagas and pollen were thus supplied together, and the female inflorescences duly ripened. In course of time the inflorescences of the wild fig-tree were replaced by those of the caprifig, which answer the same purpose, and are easily raised on the spot. Thus arose the practice of "caprification," which is essential to the production of the best keeping or drying figs.

The dried figs of commerce, which are all seed-bearing, absolutely require fertilisation by the Blastophaga, and this is most easily secured by caprification. But if only *fresh* edible fruits are desired, caprification may be dispensed with. By long-continued selection it has been found possible to create varieties in which the unfertilised figs do not fall off prematurely, but develop into a valuable fruit. The large, non-seeding, sweet and juicy table-figs of north and mid-Italy require no pollination at all. Ravasini calls this the greatest triumph of fig-culture.

We have not explained all that we should like to explain, but enough, we hope, to send some of our readers to "Die Feigenbäume Italiens," and to make them look out for the further experiments which Dr. Ravasini promises.

L. C. M.

NOTES.

THE next meeting of the International Union for Solar Research will be held at Bonn on Friday, August 1, 1913, and succeeding days.

A REUTER message from Stockholm announces that the Swedish Royal Academy of Sciences has awarded the Nobel prize for physics for 1912 to M. Gustaf Dalen, a Swiss engineer, the head of the Stockholm Gas Company, and the prize for chemistry has been divided between Prof. Grignard, of Nancy University, and Prof. Sabatier, of Toulouse University.

THE council of the Royal Scottish Geographical Society has resolved to award the Livingstone gold medal to Captain Roald Amundsen and the society's silver medal to Captain Egnar Mikkelsen, the leader of the Danish expedition to north-eastern Greenland, in recognition of their services to geographical science.

WE are glad to learn that the Chilean Government has sent instructions to the Chilean authorities at Easter Island to afford every assistance in their power to the expedition organised and led by Mr. and Mrs. W. Scoresby Routledge. The main object of this carefully planned and well-equipped expedition is to make a topographical and archæological survey of Easter Island, the most remote of Polynesian islands, which is famous for its megalithic monuments, of which visitors to the British Museum have seen examples in the portico. There are many problems of extreme interest concerning the culture of the natives,