SOME FACTS ABOUT ARUMS.

We are all familiar with the fact that plants absorb and decompose carbonic acid, and that while keeping the carbon to build up their tissues, they restore nearly the whole of the oxygen to the air for the benefit of the animal world.

All this is true, but it is not the whole truth. Some plants—the whole race of fungi for instance—breathe as animals do, and exhale carbonic acid; and the tiny yeast plant, as it multiplies in the wort, produces carbonic acid in such quantities that the gas may be seen flowing over the sides of the beer-vat. Nor is even this all. *All* plants take up oxygen and give off carbonic acid, and that at all hours of the day and night, but especially at night; though the quantity given off is so small compared with that which is absorbed that it is apt to escape notice. Whether performed on a large or small scale, however, this giving off of carbonic acid is true breathing; it means that carbon has been oxidised or burnt, and therefore that more or less heat must have been produced. Yet plants, like frogs, are, with certain exceptions, always cooler than the surrounding air, owing to the constant evaporation or perspiration going on through the myriads of minute pores with which their leaves are studded. There are 120,000 pores in a square inch of lilac leaf; some leaves have 800 to the square inch, others 170,000; and through these water is constantly being perspired as invisible vapour. A single sunflower plant has been known to perspire as much as twenty-two ounces of water in the course of twenty-four hours; and thus, although some small amount of carbon is always being oxidised, the leaves are kept cool. Plants are especially active in giving off carbonic acid at certain times—namely, when they first begin to sprout from seed and when they blossom; and when a number of seeds are all sprouting together, as in the preparation of malt, the heat is quite sufficient to be noticeable.

If the bud of some large flower, such as a thistle or cucumber, be isolated under a bell-glass, when just on the point of expanding, it will be found that its temperature rises from a half to a whole degree centigrade ($1\frac{4}{5}$° F.) In many blossoms the heat is much greater than this, and is like that from a stove or a feverish hand. It is especially noticeable in plants of the arum tribe. We all know the common white arum, or "arum lily" as some people call it, with its large glossy leaves and snow-white sheath or "spathe" surrounding the golden sceptre-like column, which botanists call the "spadix."

The true flowers are set round the base of this central column, what we call the blossom being in fact an assemblage of many blossoms, some of which are barren and some fertile. The fertile flowers bear pistils, and the barren stamens; and it is from the former, which are usually set lowest on the spadix, that the clusters of fruit are formed.

If the green sheath of the wild spotted arum or cuckoo-pint be wrapped in and filled with wadding to prevent the escape of the heat, the mercury in a thermometer placed close to the brown column will be found to rise several degrees.

The sudden increase of heat is more remarkable still in the heart-leaved arum of the Isle of Bourbon, whose temperature at blossoming time rises from twenty to twenty-four degrees centigrade above that of the surrounding air; and even this is outdone by the common Italian arum, which grows in the olive-yards, and is a familiar object to all who have enjoyed a Roman spring or spent a winter in the Riviera. This plant much resembles the cuckoo-pint, but its glossy dark leaves are larger and veined with yellow. The pale yellow sheath, which is stalkless, grows close to the ground, unfolds in March and April between 4 and 6 p.m., and emits a fragrant odour like that of wine, the temperature of the club-like column at the same time rising until it feels quite hot to the touch.

Professor Kraus found four of these arums near Rome one 28th of March, the temperature of whose blossoms varied from 40°C. to 43·7°C., that of the surrounding air being at the time 16°C.; 20°C. (68°F.) is a good summer heat, and 35°C. is blood heat, but these arum blossoms were hotter than a hot bath. This state of things did not last long, however, and by the following morning the sheaths had grown pale and wrinkled, the blossoms had passed their prime, and the heat had quite disappeared.

Interesting as these facts are in themselves, they become still more so when we consider them a little further, and ask what they mean. The older botanists, Humboldt included, had noticed the extraordinary degree of heat generated by some of the arum family, but there they stopped short, and the Italian, Delpino, seems to have been the first to suggest a reason for the phenomenon.

It is well known that in order to produce perfect seeds, most plants require to be fertilised by pollen brought from other plants of the same species. For this they are dependent upon wind, rain, birds, insects, &c., the two last mentioned being attracted to them by their bright colours or sweet scents.

Now the arum family are not deficient in these customary attractions, but they seem to try and outbid their neighbours by adding warmth to the list. Most arums, in the temperate zones at least, blossom early in the year, when the nights are still so chilly that a comfortable well-warmed bed is by no means to be despised; and accordingly the common Italian arum is visited by all sorts of small flies, gnats, and midges, bringing with them in payment for their night's lodging a tribute of pollen from their last quarters.

Many South European and foreign arums are flesh-coloured or reddish brown, and emit such a carrion-like odour that the flesh-flies are attracted and so far deceived as to lay their eggs on them. In these species the lower part of the sheath, which is enlarged like a bulb, is shut off from the upper part by a ring of longish hairs which slope downwards, and thus, while affording easy entrance to the warm chamber below, make the leaving of it again an impossibility.

In return for bringing pollen to the pistil-flowers, the flies are caught and kept prisoners; but not for long—only, in fact, until the anthers or pouches of the stamen-flowers above have burst and scattered their pollen, part of which naturally falls upon the captives, while part is brushed off by them when they are let out. For as soon as they have fulfilled their object, the hairs at once wither away and the insects come out to carry the pollen to other blossoms, quite undeterred by the fact of their imprisonment, for the prison is in truth a most luxurious one, well warmed and scented; besides, they have been fed with nectar from the faded pistil-flowers. The hairy arum of the South is, however, said to express her gratitude to her pollen-bringing visitors by keeping and devouring the greater number, which are sucked and digested by the acid juice exuding from the hairs with which her sheath is lined.

But there are other guests for which a number of the aröids seem especially to prepare their warm lodgings; these are the little marsh snails, which climb up the stalk and find entrance into the enlarged part of the sheath by a narrow aperture at its base, which closes later on. Aröids all like a damp situation, and growing as they do in shady woods, on river banks, and in marshes, no creatures could be better adapted for rendering them the services they need than snails, whose tastes in this respect are so very similar to their own. Most of those observed by Delpino were visited by small snails, and we may reasonably suppose that the foreign varieties are equally attractive to the race in their own lands.

One of the greenhouse aröids, *Philodendrum bipinnatifidum*, is a plant with handsome foliage, the leaves being deeply and doubly cut. Its sheath, which is greenish without and white within, swells into a cauldron-shape at the bottom, and in this cauldron is contained the ring of female or pistilliferous flowers, which, as in other species, are the first to open. In a specimen carefully watched by Dr. F. Ludwig, these flowers began to expand at noon, and at the same time the temperature of the air within the sheath began to rise and continued to do so until seven p.m. When the thermometer marked 38°C., and the heat was so great that it could be distinctly felt by the hand even at some distance, the temperature of the surrounding air was at this time only 15°C. As the flowers burst open a strong, fragrant scent, something between musk and cinnamon, filled the whole house; and this, in the plant's own country, would no doubt be well understood by the snails as a signal that their bed-chamber was comfortably heated and ready for their reception. By noon the following day both heat and fragrance were much diminished, and the aperture at the base of the sheath was entirely closed. When this closed, and not till then, the anthers of the upper ring of blossoms burst open and discharged their pollen, which hung about the spadix in tassel-like threads an inch long, instead of separating into dust in the more usual manner.

Now insects could not possibly carry these tassels, but they would adhere readily to the moist bodies of snails, and in contact with them would be broken up into single grains and thus easily carried away. And the snails must crawl up the sheath and come in contact with the pollen, because the door by which they entered at the bottom is now closed. Go they must, moreover, for their hostess has burnt carbon so liberally through the night that the cauldron is filled with carbonic acid, and they would be suffocated just as surely as the glowing match which Dr. Ludwig introduced was extinguished, if they stayed.

The plant has her own good reasons, moreover, for wishing to get rid of her visitors. Not only are their services required in carrying away the pollen, but if they stayed longer they might be dangerous, for snails are greedy creatures, and if not dismissed would begin to devour the young fruit-germs and other fleshy parts of the plant. Many aröids, indeed, allow their hungry guests to feed upon the sheaths, which soon cease to be required for the protection of the fruit; but in the great majority of species all the green portions are so virulently poisonous that not the smallest bite can be taken with impunity. Were it otherwise, indeed, the snail would naturally begin to devour the first leaf which came in its way without taking the trouble to climb the long stalk—an arduous journey for a small snail, which is only tempted upwards, like the boy who climbs a greasy pole, by the prospect of something very nice at the top. Having been regaled, however, with a delicious drop of nectar and made comfortable for the night, the snail at once departs, crawls up the sheath, brushing off pollen as it goes, then down the stalk, and without delay begins to mount another, just as other blossoms are announcing by their fragrance that they are in want of its services.

"And thus," as Carns Sterne, to whom we are indebted for most of the above facts, remarks, "the flowers receive the needful pollen by the fastest snail express."

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BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

SOCIOLOGICAL SECTION.

At the opening meeting of the Sociological Section for the current session, held at the Mason College, on Thursday, 15th October, 1885, Mr. W. R. Hughes, F.L.S., the President, delivered a brief address, in which he alluded to the satisfactory progress of the Section, and to the number of accomplished masters and students of the respective sciences embraced in the "Synthetic Philosophy" who had kindly rendered assistance to the Section. The Section had systematically gone through Mr. Herbert Spencer's "Essays on Education," and it was now engaged in a critical examination of "The Principles of Biology" and "The Study of Sociology." Mr. Hughes also alluded to the gratifying fact that within the last few days Mr. Herbert Spencer had completed and published a third edition of the first volume of "The Principles of Sociology." The volume was specially interesting to the Section, as it contained a subject-index which had been prepared —as a labour of love—by Mr. F. Howard Collins, F.L.S., one of the members, and which could not fail to be most valuable to students. The volume had also a new appendix C, and it contained about 2,500 references to 455 works quoted therein. Mr. Hughes also announced that Part VI. of "The Principles of Sociology—Ecclesiastical Institutions" was in the press and would be published immediately,