A Paper on the INSECTIVOROUS PLANTS OF THE WILMINGTON REGION,

READ BY

DR. THOS. F. WOOD,

CHAIRMAN OF THE SECTION ON BOTANY OF THE HISTORICAL AND SCIENTIFIC SOCIETY OF WILMINGTON, N. C.

The history of our section may be a sealed book to the outside world; it may never be known that there was a settlement by Raleigh, or a Tuscarora Insurrection, or that the sturdy old patriots resisted the Stamp Master, or of the brilliant though unsuccessful defense of our harbor at Fort Fisher; but wherever there is a botanical student or a wonder-monger, —in every land where a book is printed our section is already famous as the home of the *Dionea muscipula* or Venus Fly-trap. This section abounds in many wonders of the plant-world, and especially so many of the so-called insectivorous plants, that I have selected it as the subject of my paper, from among many others which I hope soon to bring to the attention of this Society.

Of the insectivorous plants, there are at least six species which grow within an half-hour's walk of the market, and at least 14 species attainable by closer examination, viz *Dionea muscipula*, or Venus Fly-trap, *Drosera rotundifolia*, *D. Brevifolia*, *D. filiformis*, all sun-dews, *Pinguicula lutea* and *P. Elatior*, the Butterworts; no less than five *Utricularias* or Bladder-worts, *Sarracenia purpurea* and *S. flava* and *S. variolaris*, the Pitcher, and Trumpet plants.

In order to gain a comprehensive idea of our subject we must take a rapid glance at the history of the discovery of the Venus fly-trap.

About the year the famous band of Reguistors were forming in North Carolina, that is in 1768, Ellis a well known English botanist sent a drawing of the Dionea to Linnæus. "The plant" he wrote "shows that Nature may have some views towards its nourishment in forming the upper lobes of the leaf like a machine to catch food," and follows with a description singularly accurate considering it was a new discovery. He thought the little red glands that cover its surface secreted the bait which decoyed insects to the fatal trap. So wonderful was this story that Linnæus could not be brought to believe that Nature intended that a plant could thus get nourishment, and concluded that they were entrapped and then let loose; this view more nearly corresponded to the theories then held of the relation between the animal and vegetable kingdoms. Some time after this, or perhaps in 1758, John Bartram made a tour through this region and the adjoining States, and according to the account of the son, specimens of the Dionea were first communicated to the curious of the old world by John Bartram, the American botanist and traveller. It may be that the plants from which Ellis made the drawings and the observations for Linnæus were the very ones mentioned by Bartram.

Hear how the enthusiastic Bartram discourses of the wonders of the Fly-trap: "But admirable are the properties of the *Dionea muscipula!* A great extent is occupied by those sportive vegetables—let us advance to the spot in which nature has seated them. Astonishing production! see the incarnate lobes expanding, how gay and sportive they appear! ready on the spring to entrap incautious deluded insects! what artifice! There behold one of the leaves just closed upon a struggling fly; another has gotten a worm; its hold is sure; its prey can never escape—carnivorous vegetable."

We are indebted to a North Carolina botanist for an account of the Fly-trap, which has been pronounced "a model of scientific observation." In 1804, the Rev. Dr. Moses A. Curtis, an amateur botanist whose fame has since extended far beyond the Atlantic for his researches in Botany, especially that of Mycology, sent an account of the Dionea to the Boston *Journal of Natural History*.

"Each half of the leaf is a little concave on the inner side, where there are placed three delicate hair-like organs, in such order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse, and inclose the prey, with a force surpassing an insects effort to escape. The fringes of hair on the opposite sides of a leaf interlace like the fingers of two hands clasped together. The sensitiveness re-

no man now living in the State who has the technical knowledge sufficient to make such a collection, to say nothing of the forty or fifty years of laborious investigation necessary. But, to return to our Dionea: It was Dr. Curtis who made out the practical details of the functions of the fly-trap, correcting and adding to the little known of it when he undertook its study. In 1868 Mr. Canby, of Wilmington, Del., studied its habits and reported a most entertaining and interesting number of experiments, made upon the spot. It was to this account, more than to any other, that the attention of the scientific world was drawn to these wonders, and about the same time Mr. Darwin was investigating the functions of a member of the same family, the round-leaf Sundew—(*Drosera rotundifolia.*)

The home of the fly-trap is within a radius of thirty or forty miles, Wilmington being the centre. Its favorite soil is that of our sandy bogs or savannahs. Its roots are simply small, bulbous expansions, which serve to absorb water, and perhaps very little nourishment from the soil. Their leaves bear strong resemblance to a pair of upper eye-lids with their lashes, being so arranged that when the leaves close the spines or lashes inosculate and make a complete cell, through whose walls there is no escape except for the smallest insects. The sensitive filaments which stand guard are naturally on the inner side of the leaf, arranged in a triangle. They are exquisitely sensitive, and when struck with a human hair or fine blade of grass, they rapidly close. The exterior of the leaf is studded with minute purplish processes, which appear very beautiful under the microscope, and are the absorbent glands; while on the inner side are numerous reddish or purplish glands, from which comes the solvent secretion.

Flourishing in low or wet places, where flies and other insects abound, the Dionea, if it had power of locomotion, as well as prehension, would be enabled to derive its entire subsistence by its prey. But the naturalists, as well as the wonder-mongers, have greatly overrated the importance of animal food to the sustenance of the plant, for, according to my observation, by far the greater number of them never succeed in getting an insect, and yet seem to flourish as well.

Mr. Darwin learns that the Dionea is on the high-road to extinction; although it is well adapted to sustain existence. How he got his information I don't know; but I do know that whatever agency has been at work to lessen the crops of these plants, it has been extrinsic. Amateur collectors notice year by year that they have to go further away from town for the specimens, and this is due to two causes. In the early spring farmers have the custom of burning off the dead grass, which destroys large numbers, and the second cause is the extensive ditching of the bog-lands. So there is in this instance more solid theory than the "survival of the fittest." The theory which underlies all of Mr. Darwin's investigations makes it necessary to determine how these plants acquired their peculiar powers, and to solve the problem of their struggle for existence. Therefore he sees Fly-trap, (Dioncæ) and Sun-dews, one the promordial form of the other, on its way in the scale of ascending development. Half a century ago an animal was "an organized body, sensible, capable of voluntary motion, provided with a central organ of digestion. In the light of today "the rhizocephalous crustaceans feed by absorbing through root-like processes; that is, that while some plants have stomachs, some animals have roots." If all this was merely a novelty, it would only serve to please the rich owner of a hot-house, but it has served to teach lessons to some of the greatest histologists and physiologists of the day.

Let us look into the *modus operandi* of Fly-trap digestion: Here is a healthy plant which has entrapped a fly or soft-bodied insect. His struggles only make him more secure by stimulating the sensorium, and causing the leaf to squeeze more firmly. His prison has now become a stomach, and the solvent juice is trickling slowly from the excited glands, until its whole body is covered. If the plant has not seized an indigestible substance and paralyzed its power, in from two to three weeks all the juices of the insect are absorbed, and nothing remains but the light skeleton, which is blown away by the wind, and the plant is ready for more. As I said before, if its powers have not been overtasked, it responds more readily now than ever to excitement

locality of this exudation, I dissected carefully the interior membrane, and found it there also. I thought previously that I had detected it by the sense of taste, but this delicate test makes it sure.

Pinguiculas, or Butterworts.

Two natives of our bogs of which I present specimens, belong to a genus made famous by Mr. Darwin, viz: the *Pinguicula lutea* and the *P. elatior*, the yellow and blue butterwort. They can be readily recognized by the amateur by their greasy looking leaves rising only two or three inches from the ground, the edges incurved. The flowers to outward appearance resemble the violets of our meadows.

Mr. Darwin's experiments show that slight continued pressure and the absorption of nitrogenous substances, (of which the leaves are capable) cause complete incurvation of the leaves. I have not seen one of these plants with an entrapped insect, but would suggest it as a new field for investigation for some of our amateurs

Droseras or *Sundews.*

The earliest mention of the habits of the Drosera I have seen is found in Bartram's travels in North and South Carolina, Georgia and Florida, begun in 1773. He there speaks of it, as though its habits were already well known, and that was probably in 1778. Of the Droseras we have five species in the South, only one of them the *D. Rotundifolia*, whose functions have been studied minutely. They are low glandular-hairy plants, with circinate tufted radical leaves (Chapman). The borders of the leaves have hairy tentacles, each one surmounted by a drop of sticky, transparent fluid. In addition to this the upper surface is studded with glands also surrounded with the same sticky secretion. Examined with a low power glass these leaves are beautiful. The minute reddish semi-transparent glands and brilliant dew drops of the tentacles glittering in the sun, gave rise to the common name.

The *modus operandi* of the functions of the Sun-dew bear a striking analogy to the Fly-trap. If a substance is placed upon the glands of the centre of the leaf, motion is slowly communicated to the tentacles; first those tentacles nearest the object, and finally the whole of them are incurved—covering the object. This takes place in from one to five hours. The difference in the activity of the leaves will depend upon the size and nature of the object, upon its age and vigor, and the surrounding temperature. A living insect hastens the process of incurvation, by its efforts to escape; a soft-bodied insect yielding up its juice to the plant, as in the case of the Dionea, serves to stimulate to lively action, showing that nitrogenous matter is made use of by the plant. If the nature of the substance coming in contact with the glands is such as to cause no more than temporary excitement, like a drop of gum, the tentacles soon resume their condition.

That the phenomena observed deserves the name of *digestion* is readily proved by a simple experiment. Take a cube of boiled albumen, about two grains weight, and place it carefully upon the glands. If the piece of albumen be not too large it will be either completely digested, or far enough advanced in indigestion to appear translucent in 48 hours. Now is this digestion? Test the fluid which bathes the albumen; it is acid. Does this acid play any part as a solvent? Take a few drops of a weak solution of soda or potash, strong enough to neutralize the stomach juice, and digestion is retarded. Now carefully add after several hours of this retarded digestion a very dilute solution of hydrochloric acid, only strong enough to neutralize the alkali, and digestion recommences. After following this and like experiments through many varying circumstances, Mr. Darwin is enabled to say that "the glands of the Drosera secrete some ferment analagous to pepsin, which in the presence of the acid gives the secretion its power of dissolving albuminous compounds."

Sarracenias, or *Trumpet and Pitcher Plants.*

The Sarracenias are remarkable alike for the form of their leaves as well as their flowers. In April and May their flowers appear in advance of their foliage, all the species so much alike at first sight as to mislead a careless observer. Of the (S. purpurea) purple pitcher we will speak first, as it has a general distribution from Canada to Florida. The leaves are pitcher-shaped, with purple reticulati; on springing in a cluster from the ground, semi-erect and generally containing water

a *chevaux de freize* to prevent their e cape. The winged insects fly towar the sky-light of their prison, are repell and finally drowned in the fluid contai in the tube.

The *Sarracenia flava*, or yellow trum is the one which abounds so extensiv in our savannahs. The flowers are on ding stems with their fine yellow pe hanging down like dogs' ears. The o of it, however attractive it may be to sects, is rather repulsive to human o tories. The pistil rises from the mids stamens and broadens into an umbre shaped style. The style is five-an and bears minute hooked stigmas bene By examining the flower you will see t the bee or other insect entering it in se of honey must come in contact with stigma, and accomplish cross-fertiliza with the greatest facility, indeed al with unerring certainty.

Let us hear what our loquacious friend, Wm. Bartram, says about plant: "Shall we analyze these beau plants, since they seem cheerfully to i us? How greatly the flowers of th low Sarracenia represent a silken ca The yellow pendant petals are the tain, and the hollow leaves are not o the cornucopia or Almathea's horn quantity of water a leaf is capable o taining; about a pint! Taste of it cool and animating—limpid as the ing dews; nature seems to have fur them with cordate appendages which turns over, to prevent too and copious supply of water from showers of rain. See the short stiff-hairs; they all downwards and prevent the varie insects which are caught, from ret being invited down to sip the mel exudation from the interior surfac tube, where they inevitably perish

The mass of decomposing insec in a leaf when it is divided vert exceedingly offensive, a fact which me to believe that there is either vent juice at all, or else it is not a to the juices secreted by the Fly Sun-dew. These last named pla a principle in them analagous to which acts as an antiseptic. property resided in the Sarrace we would find digestion instead o faction. By the putrefaction of trapped insects, ammonia is furn rectly to the plants, although the are amply sufficient to sustain th independent of the insect supply.

Utricularias or Bladder-Wo

I am enabled to show you seve specimens of this plant, the *U.* Its habits were studied first by M Treat, of New Jersey, a lady to w are indebted for many well-condu convincing experiments of the h the insectivorous plants. This found in many parts of the wo may be distinguished at this seaso small yellow flowers. The plant still water by means of a celular and of a cluster of bladders attache roots, as some of the botanists t but Mr. Darwin says that branche bore no bladders, and others fro they had been removed, floated well. Wonders never cease t themselves to inquirers into physiology, and the sharp-eyed of Mrs. Treat first and Darwi demonstrated the wonderful facts real use of these bladders is be small aquatic animals. Crustac most always found in these plant will see by examining these sp Mr. Darwin tells that Prof. Gol that a plant placed one evening swarming with crustaceans the ing the bladders contained the animals. Why the animals are to these bladders is not known, are found enclosed swimming arou consuming all the oxygen they physiated. Insects have been c the very act of entering, with th securely engaged. That these animals serve to nourish the plan to be demonstrated; it is quite though, it has some significance nected with the nourishment of t

I have thus given a sketch of t of plants which are now classed tivorous. I am aware the sketch too brief to enlighten those already studied the subject. I succeeded in arousing attention t that we are living in the midst ders of the plant creation, and beauties which lie hidden there captivating than many which are at more pains and expense, I will spoken in vain of these too much of God's creatures.

Nearly every mail carries away

© Reproduced with the permission of Cambridge University Library

the Atlantic for his researches in Botany, especially that of Mycology, sent an account of the Dionea to the Boston *Journal of Natural History*.

"Each half of the leaf is a little concave on the inner side, where there are placed three delicate hair-like organs, in such order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse, and inclose the prey, with a force surpassing an insects effort to escape. The fringes of hair on the opposite sides of a leaf interlace like the fingers of two hands clasped together. The sensitiveness resides only in these hair-like processes on the inside, as the leaf may be touched or pressed in another part without sensible effects. The little prisoner is not crushed and suddenly destroyed, for I have often liberated captive flies and spiders which sped away as fast as fear or joy could carry them. At other times, I have found them enveloped in a fluid of mucilaginous consistence, which seems to act as a solvent, the insects being more or less consumed in it. This circumstance has suggested the possibility of their being made subservient to the nourishment of the plant through an apparatus of absorbent vessels in the leaves."

And right here let me pay a passing tribute to the great achievements Dr. Curtis made in the science of Botany. He cultivated it *con amore*, until what was undertaken as a pastime in the leisure hours of a school teacher and afterwards of a minister, made him the best botanist in the South. The Doctor published no systematic work on Botany, but besides contributions now and again sent to scientific journals, he gave us "The Woody Plants of North Carolina," "Plants within the rains of Wilmington," "Natural History Survey of North Carolina, giving a catalogue of Indigenous and Naturalized Plants." The Commission appointed by Congress to investigate the American Cattle Plague, in their researches into the fungi found Dr. Curtis' the largest collection in this country, according him this credit in their report. It is highly proper now that our State should honor the memory of her illustrious scientist, and at the same time honor herself and one of her institutions of learning, by securing the extensive herbarium prepared by his own hands. Such an opportunity may never recur, for it is certain there is

Part two Plants

him more secure by stimulating the sensorium, and causing the leaf to squeeze more firmly. His prison has now become a stomach, and the solvent juice is trickling slowly from the excited glands, until its whole body is covered. If the plant has not seized an indigestible substance and paralyzed its power, in from two to three weeks all the juices of the insect are absorbed, and nothing remains but the light skeleton, which is blown away by the wind, and the plant is ready for more. As I said before, if its powers have not been overtasked, it responds more readily now than ever to excitement of its sensory filaments. It is very different with the leaf if touched by some light accidental substance like waving grass, for it soon reopens.

The character of the fluid secreted when the leaf is excited by the proper stimulus, bears great analogy to the gastric juice of animals: it has an acid and an ingredient resembling pepsin, the acid secreted at this time being quite different from the acid of the plant when not thus actively engaged. The range of articles which can be digested is quite limited--soft-bodied insects and some of the smaller beetles; and artificial feeding substances containing albumen, such as white of egg and beef.

The Dionea, though wonderfully possessed of motion, has no nervous system, which is demonstrated by the fact that motor impulses cannot be directed towards specific points. The rate of impulse is transmitted much slower than in most animals.

Dr. Burdon Sanderson demonstrated in his experiments upon the leaves of the Fly-trap that the movements are entirely due to electrical circumstances. He attached an electrometer sometimes to the limb and sometimes to the foot-stalk of a living leaf, and found that there were two permanent currents acting in different directions. Dr. Sanderson also demonstrated that the same structural changes ensue in the contraction of a muscle and of a leaf.

Since I commenced writing this paper I have demonstrated what I did not formerly believe, that there is a sweet exudation on the interior of the leaf which serves as a bait to insects. I boiled a leaf in water and tested the solution for sugar by Trommer's test, finding it in considerable quantities. In order to determine the precise solving albuminous compounds."

Sarracenias, or *Trumpet and Pitcher Plants.*

The Sarracenias are remarkable alike for the form of their leaves as well as their flowers. In April and May their flowers appear in advance of their foliage, all the species so much alike at first sight as to mislead a careless observer. Of the (S.purpurea) purple pitcher we will speak first, as it has a general distribution from Canada to Florida. The leaves are pitcher-shaped, with purple reticulati; on springing in a cluster from the ground, semi-erect and generally containing water and the remains of insects and sometimes dead leaves or other accidental substances. At the mouth of the pitcher is a dense shining growth of hairs, pointing inwards. The flowers of this plant are not as large as in the yellow-trumpet, but purple in color. That this plant has any power of digestion is not certain, but, however this question may be decided in the future, we know that the skeletons of many insects are found in them. Some of these insects take up their dwelling and live on the leaf, and one beetle which I found, kindly named for me by our entomologist, Mr. W. F. Wenzell, the *Passimachus Marginatus*—after remaining over a season bore no signs of having been acted on by a solvent juice. The statement by Mrs. Harreck in *Scribner* for March, that the purple Sarracenia catches only small insects is not strictly true, as I have time and again observed. It is evident that the insects entrapped serve to fertilize the plants by the nitrogenous matter afforded by their decomposition.

I am enabled through the kindness of Dr. Mellichamp, of South Carolina, to show you some living and dried specimens of the S. variolaris or S. lacunosa, as Bartram calls it. This differs from the yellow trumpet hereafter to be mentioned in some particulars. It has an erect leaf, the lamina being hood-shaped, and curving over the mouth of the orifice. At its upper and back part are white spots, which are diaphanous and make a kind of skylight in the insect prison-house. The wing is broad, and up its front may be traced a track of honey-like exudation. Up this tube the insects are allured, and crawling over the collar at the mouth soon find their descent easier than their return, because of the incurved hairs which make

though, it has some significance connected with the nourishment of the

I have thus given a sketch of the of plants which are now classed insectivorous. I am aware the sketch too brief to enlighten those already studied the subject. If succeeded in arousing attention to fact that we are living in the midst wonders of the plant creation, and beauties which lie hidden there captivating than many which are at more pains and expense, I will spoken in vain of these too much neglected of God's creatures.

Nearly every mail carries away money from our mothers and sisters for plants which are not worth as much as those growing at our very doors. Ladies are willing to send North for the Caladium Esculentum, because it figures as such a showy tropical plant in the printed catalogues, while they would pass by the humble *lanier* which grows in our wet gardens and rice fields. It is the duty of our young folks at least to study the wonders which are so abundant at home, to be had for the gathering, before they send far away for the showy plants in a Northern catalogue.

If there is no other incentive to get a little knowledge of our Wilmington plants, it would be to give an intelligent account of them to the strangers who pay our city a visit to get such information. The young folks should certainly show as much actual interest in our Venus fly-trap in Wilmington, its "native heath" as the residents of London show.

Dr. Wood illustrated his subject with beautiful living plants, all in active condition. He demonstrated the character of the solvent juice of the Dionea by chemical test; showed the parasite caterpillar which infests the tubes of the trumpets; showed the possibilities of cross-fertilization in flowers of the yellow and purple sanacenia; showed fly-traps in the several stages of the digestive process; showed three species of sun-dew, with their graceful tentacles surrounding entrapped objects; showed the transparent blue and green bladders of the roots of the Bladderwort, and their singular cellular air-bag leaves which serve to float it. All these specimens, except the Spotted Sarracenia, we believe were collected within half a mile of the city limits.

© Reproduced with the permission of Cambridge University Library