fungus-shaped body was really only the extraordinarily inflated abdomen (full of eggs) of an Acaridan that was affixed by its beak to the nymph of an insect at whose expense it lived, and of which it caused the death.

In the course of our study, and in making bibliographic researches to ascertain whether this Acaridan was or was not already known, we learned that it had already been seen in England, in America, and even in France (although imperfectly studied), and under the following circumstances:

Newport, while making his splendid researches in England upon the Hymenoptera, met this Acaridan

FIG. 1.—A. FEMALE OF SPHEROGYNA VENTRICOSA.

upon a larva of *Monodontomerus*, which is itself a parasite of *Antophora retusa*. It thus rendered this bee the service of freeing it from a mortal enemy. Newport, struck with the extraordinary development of this Acaridan's abdomen, named the species *Heteropus ventricosus*; but he gave a very incomplete and even erroneous description of it, and inquired whether or not it might not be pathogenetic, as he had seen no male among the numerous specimens of females that he had had under observation.

Mr. Lichtenstein had found this Acaridan in the boxes in which he reared insects, and for six months it greatly interfered with his entomological studies by killing all his specimens. Without describing it, and believing it had not before been observed, Mr. Lichten-

FIG. 2.—A'. FEMALE FULL OF EGGS. B. MALE.

stein named this destroyer of insects, provisionally, *Physogaster larvarum*.

Finally, Webster, in America, has pointed out the great services that this Acaridan renders to wheat attacked by moths, through its slaughter of these injurious microlepidoptera.

Although this Acaridan renders our granaries the service of ridding them of the larvæ of the grain moth, it has nevertheless some inconveniences, and that is, when there are no longer any insect larvæ to eat, it sometimes gets on the men who are manipulating the moth-attacked grain, and through its bite, causes severe and insupportable itching. This fact was ascertained by Moissac near Montauban, where the Acaridan

was named *Acarus tritici*, and compared with the *Acarus* of the itch. But its bite, although as severe as that of the itch mite, is more easily cured, seeing that its effect disappears after a simple bath.

In the complete study that we made of this Acaridan we found that it was through an erroneous observation that Newport attributed the name *Heteropus* to it. This name, moreover, cannot be preserved, any more than can *Physogaster*, it having been given several times to different insects. We have established for it the genus *Sphero-gyna*, and have preserved the specific name imposed by Newport.

We shall terminate this *resumé* by saying that, through the organization of its beak, which includes three styliform mandibles and maxillary palpi with three articulations, the end one of which is provided with a hook, and through its tracheal respiratory apparatus, this Acaridan belongs to the family Trombidicæ; and that, through its doubly grouped feet, each composed of five articulations ending in hooks, simple in the first pair and double in the following, where they are accompanied with a spatulate caruncle, it must be referred to the tribe Cheyletidæ, and be placed in the vicinity of Haller's genus *Picobia*.

This Acaridan is remarkable for the rapidity with which it develops and multiplies. The female has its large abdomen stuffed with eggs, which develop through the complete assimilation, without residue, of the nutritive juices of which it has robbed its victim. Some of these eggs yield males, and others females, which are perfect and adult when they come from the mother, and which at once become fertile without having to pass through the larval or nymphal stages as other Acaridans do. This explains its rapid multiplication when there is an abundance of prey.

In Fig. 2, A represents a female in the most active period of reproduction, with an abdomen that has centupled in size, and that is full of eggs; B represents a male, the individuals of which are very rare, and are very much smaller than the females—a fact that explains why they had not been observed up to the present.

One male must suffice for several females, and these he fertilizes in measure as they come from the mother's body. Fig. 1, A, represents a female that has just been fertilized and the abdomen of which is beginning to swell.—P. Megnin.

[BULLETIN OF THE CHICAGO ACADEMY OF SCIENCES.]

THE NORTHERN PITCHER PLANT, OR THE SIDE-SADDLE FLOWER, *SARRACENIA PURPUREA*, L.

By W. K. HIGLEY, Seminary, Lake Geneva, Wisconsin.

THAT insects are of great use in the vegetable economy is a subject of much interest to many scientific minds of the present day, causing many investigations resulting in experiments that are leading us into a deeper and truer knowledge of the physiology of plants.

These investigations are transforming many theories into facts; many mere fancies into realities; many of the so-called "freaks of nature," of the older writers, into useful adaptations for aiding in the development of the plant. It is now obvious, even to the slack and unscientific observer of nature's laws and methods of work, that the insect world is necessary for the proper growth and propagation of many species belonging to the vegetable kingdom.

It is well known to the intelligent agriculturist that many of the plants used in our economy could not even mature their seeds unless aided by insects, notably the hive bees. The beautiful orchid family is a grand illustration of the usefulness of insects in fertilization. Dr. Charles Darwin has shown that each part of the flower is adapted to this end. It seems as if, in this family, nature truly abhors self-fertilization, and in some species, though giving the plant all the parts of a hermaphrodite, yet arranging them so that only an insect can bring about the proper relations for propagation. Our melon, pumpkin, squash, cucumber, and gourd plants are also worthy of note in this connection.

"The flowers" of these "are each furnished with a long or rather deep corolla, and the plants often lie flat on the ground, where the leaves cover the flowers from the action of the wind. Bees and other insects are the necessary agents in crossing the flowers," for they are either diocious or monœcious, "and to them we are indebted as one of the links in the chain which affords all our gourd-like fruits."

To this division of Entomophilous species belongs the plant under consideration in this paper. All the species of the genus *Sarracenia* are constructed in such a manner that in fertilization they are absolutely helpless without the aid of insects. The large umbrella-like expansion of the style, which is stigmatic at the termination of the five rays, completely hides the stamens, which are decidedly below it and shielded from the wind.

A still more peculiar use of insects to the vegetable world is that of a food, and many plants are specially fitted for catching and using the material of their bodies for nourishment.

Perhaps the most striking of all these plants are the pitcher-plants, some of which throw out a honeyed secretion which, trickling down the wing of the pitcher, forms a baited pathway to attract the unwary insect to the inside of the pitcher.

The genus *Sarracenia*, to which the plant under consideration belongs, is one of the three genera of the order Sarraceniacæ. The species of all the genera are natives of America and chiefly of the United States, the genus *Heliophora* being a native of Venezuela. Mr. Sereno Watson* makes the following enumeration of the species of the other two genera, *Darlingtonia* and *Sarracenia*:

- Darlingtonia* Californica, Torr.
- Sarracenia* Drummondii.
- " flava, L.
- " purpurea, Mx.
- " purpurea, L.
- " nigra, Walt.
- " Sweetii, D. C.
- " undulata, Denie.
- " variolaris, Mx.

All the species have root-leaves, and, excepting the

* Bibliographical Index to North America Botany, by Sereno Watson, Smithsonian Miscellaneous Collections.

genus *Heliophora*, have terminal scapes bearing a single flower. The exception has a scape bearing a few-flowered raceme. The leaves are all hollow and more or less pitcher-shaped, with a hood at the upper part, and a wing, that is often very broad, upon one side.

As to their position in classification, this family* quite closely resembles the poppy family (Papaveraceæ) on the one hand, and the water-lily family (Nymphæacæ) on the other. It is related to the former by the character of its petals, numerous stamens and seeds, capsular fruit, copious albumen, etc. It is connected with the latter by nearly the same characters,† and also by having all the leaves from the root, a one-flowered scape, and more or less aquatic habits. The poppy family differs in habits, juices, in having but two or three sepals and a one-celled ovary. The water-lily family differs in having, usually, numerous petals, in the attachment of the seeds and the sessile stigmas.

By certain analogies the pitcher-plants are closely related to the sundew family (Droseraceæ) and the Asiatic pitcher-plant family (Nepenthaceæ.)

A microscopic study of the minute structure of the families mentioned not only confirms the close relationship existing between them, but also adds new facts to those that appear from a study merely of the external characters of their representative species.‡

Our Northern pitcher-plant is, perhaps, the one of greatest interest to the people of the Northern States.

It is by far the most common form of the genus, extending in its range over the States east of the Mississippi and north from Florida far into the British Possessions. It is not so elaborate an insect catcher as some of the more Southern forms which have already been spoken of as throwing out a honeyed lure which attracts numerous ants, an insect rarely found in our species.

The pitcher leaves (Ascidia) of the side-saddle flower, as well as those of all the family, are evidently phyllodia. They have the parallel venation of petioles acting as blades, and the edge is invariably turned toward the sky. The hood may represent the blade of the leaf. The wing forms the greater part of the young leaf.

Inside these pitchers are found hairs, which cover more or less of the inner surface. Those which cover the hood continue to or a little beyond the junction with the tube. Following this area is a smooth surface which extends to near the point where the leaf begins to contract, when a patch of less stiff hairs are met with. This time they extend into the narrower portion of the tube. All the hairs point downward.

The position and form of these hairs, especially those on the hood and upper part of the tube, and in fact any that may be above the fluid, in the lower part of the leaf, would show that their function, in part at least, is to prevent the escape of any insect that may have entered the tube. The hairs in the lower part of the tube probably act to some extent as absorbents of the nitrogenous matter decaying within the leaf. Some acute observers claim that at the end of each hair there is a minute opening, thus allowing the nitrogenous fluid to pass directly into the apical cell of the hair. This does not seem to be the case, but instead the wall surrounding the entire cell is very thin. These hairs are simply trichomes, that is, they are rather cells than organs. Unlike the tentacles of the sundew, in no case do the spiral bundles enter their tissue. I am inclined to believe that these cellular hairs serve more than one purpose in the economy of the plant.

A study of the structure and physiology of the whole family shows that all the forms need a great deal of absorbing surface, for there seems to be a lack of stomata. The tissue of the leaf is almost constantly gorged with a large supply of nourishment consisting, evidently, of absorbed nitrogenous matter, and needs a great extent of surface exposed to the air for the purpose of absorption in carrying on the functions of assimilation and metastasis. In support of this there is considerable evidence, the most important of which is the fact that many of these hairs, especially those on the hood, contain chlorophyll. From a study of marked leaves through the whole season, I am led to believe that some of the hairs are absorbed as the leaf grows old. This would indicate that as the functions of the leaf are lessened the extent of absorbing surface is reduced.

When the leaf has apparently nearly stopped absorbing the moisture from the tube, it may still be an active insect trap. At this time an especially strong odor is given off from the decaying mass of insects. It would seem that the insects caught now could be of no use except as a fertilizer, when, by the decay of the leaves, all this mass of decomposing nitrogenous matter is deposited around the roots of the plant. The decaying material, moreover, seems to hasten the decay of the leaf, as its vitality is lessened, by the advancing season.

* General System of Botany, Le Maout and Decaisne, p. 212.

† The water-lily family in some of its forms has a definite number of stamens.

‡ Since the writing of this paper, Mr. J. F. James has published a very interesting article on "How the Pitcher-Plant got its Leaves." (American Naturalist, vol. xiv., p. 567.)

After tracing the apparent gradation of adaptability for taking insect food existing between the species of the genera Sarraceniacæ from the less marked trap and imperfect pitcher of *Heliophora* through the genus *Sarracenia* to the remarkable trap pitcher of *Darlingtonia* with its attractive appendages, digestive fluid, and sweet lure, Mr. James says: "Scarcely any of the steps showing the progress are needed to complete the line of development. It can be traced directly from *Heliophora* to *Darlingtonia*, and it is only necessary to have an ancestral form from which to start to have a complete pedigree. It seems probable that the water-lily family and the pitcher-plant family had a single ancestor in common. This ancestor was aquatic, or at least an inhabitant of swampy places. It had small, probably peltate, perhaps reniform leaves, and these had hollow petioles. The inner space was lined with hairs as are now the inner surfaces of the stems of *Nymphaea* and its allies; it had a four or five parted flower, with many stamens and a broad stigma. From such an ancestor came two or three branches. One of these developed into plants having an aquatic habit, large leaves and long petioles, and peduncles like those which are found at present in the water lilies. The other branch diverged to form plants living in boggy or swampy grounds, with pitcher-like leaves, whose insectivorous proclivities were developed later on."

Mr. James suggests that these proclivities were developed by a true process of natural selection. The more or less saucer-like peltate leaves may possibly have held some water in which insects were drowned. This fluid, by causing the decay of the blade at the insertion of the petiole, found its way into the hollow petiole, and finally by absorption of the nitrogenous matter the plant gained nourishment that could be used in its growth. This adaptation being of use to the plant might lead in the next generation to leaves better fitted for taking food in this manner. This in course of time would give rise to a generation of petioles peculiarly adapted to catching water and insects by being pitcher-like in form. The blade, no longer needed for absorption, would become a mere rudiment, and then would follow the further process of perfecting traced by Mr. James in Sarraceniacæ.

It is noticeable that there are many insects around the leaves just at twilight or when the sky is overcast with heavy clouds. Remains of nocturnal insects are also very common in the macerating mass. This seems to indicate that flies and other insects seek the hollow leaves in which to retreat during the hours when they are naturally at rest. It is a fact that insects seek retreats of this kind.

True to the habits of the spiders to seek those places for their homes that flies frequent, there is one that makes its home at the top of the leaves, spinning its web so that it nearly covers the whole opening. In each case that I have observed it is the same species, but whether it always seeks the pitchers I cannot state.

An insect lighting upon the leaf starts immediately to walk toward the inside. It seldom stops till the smooth place is reached, where sooner or later it loses its foothold and falls. In some cases they try to fly upward from the bottom of the pitchers. In but one case have I seen an insect escape in this manner. This, a beetle, obtained its freedom by flying from one side of the tube to the other till the opening was reached.

A slight secretion has been observed by many near the opening of the pitcher. This seemingly has but little power to attract insects, though at times it is quite copious.

Mr. Joseph Jackson says: "While collecting a few specimens of *S. purpurea*, L., I was surprised on drawing aside the petals to look at the stamens to see the whole cavity formed by the petals and the peltate expansion of the style filled with flies as large as the common house fly, all busy as could be eating the pollen, of which scarcely a grain could be seen. I counted fourteen flies in one flower. They were in no hurry to vacate the premises. There was a shower coming up at the time, but they were evidently there for food. Nearly every plant examined was filled in the same way."

Mr. J. F. James suggests† that perhaps "there is something in the pollen, or in some secretion of the flower, which has the effect of stupefying or intoxicating the insect, and that then they might easily be shaken from the flower, by the wind, into the open mouths of the rosette of leaves below."

My observations differ somewhat as to the usefulness of these insect visits to the flowers. There are two or three species of diptera found in the manner described. They are evidently attracted to the flower by some property of the pollen or a secretion of some other part of the flower, but it would seem mainly for the purpose of aiding in fertilization, for a lens reveals the fact that pollen is quite freely scattered over their backs. Moreover, these plants flower during the latter part of May and the first of June, while insects are caught during the months of May, June, July, and August. Though without question some of the flies from the flowers do eventually find their way into the pitchers underneath, yet these species are not nearly so common in the decomposing mass as some other species. Some time was spent in taking notes as to the effects of this food upon the flies, but without any results showing stupefaction.

The great question is, What purpose do the decaying remains in the bottom of the tube serve in the economy of the plant? In order to decide this question, it will be necessary to know the chemical nature of the fluid found in the pitchers. Several chemical analyses were made under as widely different conditions as a limited region of the country would allow. As a result of the examination of over eight hundred leaves, I find that none contained any fluid before they had opened. These were collected from several localities. After opening, there is no fluid till after the first rain, except in a few cases when there has been a heavy dew.

The oldest leaves to be found were in each case selected, and it is thought that in all cases they were the growth of the season up to date. In preparation the leaf was cut open and the contents removed to a crucible, but in no case was the mass used unless of such a consistency that it would flow easily. The reaction was acid in each case, but the degree of acidity increased each month, and was very marked through July and August. To just what acid, if any particular one, the reaction was due in the liquid of the earlier pitchers is not certain, but in the last two months both malic and citric acids appeared, the former in greater abundance.

The analysis of the ash and the residue of the filtered and evaporated fluid was qualitative. The object being simply to see if there was any relation existing between the inorganic matter contained in the fluid and the surrounding soil, etc., it was not minute. In each case, where it was possible, the soil near by at all liable to get into the pitcher was analyzed. However, not all the inorganic salts could be accounted for as from the soil. Whenever it was evident that the inorganic matter was similar to the soil near the plant, it is indicated by giving the character of the surrounding soil.

It seems highly probable that the first lot of insects merely decay after maceration in the water first collected in the pitchers, and that this mass acts not only as a stimulant to further decay, but also to render the liquid more capable of absorbing certain organic principles from the leaf, such as malic acid, which aid in the preparation of the abundant supply of food for absorption by the leaf. Thus the first mass might be called a digestive excitant. There being no glands, the process of exciting the leaf to the secretion of an acid would be quite slow.

That this is the case, I feel assured by the fact that absorption evidently takes place much more rapidly during the last days of June and the months of July and August. It is then that much nutriment is needed and the cells are filled with matter. The largest tubular cells in the structure of the lower part of the pitcher walls and in fact those extended downward into the root are at this time charged with matter, while earlier they are comparatively empty, though much nitrogenous matter has been in the leaves for several weeks.

By a set of experiments it was easily shown that the ammonia contained in the liquid, either having its source in the rain water brought to the plant, in the results of the decomposing remains of the insects, or in

the absorption from the atmosphere, was readily and quite rapidly absorbed by the leaf.

In these experiments it was assumed that but little would be absorbed by the liquid from the air, during the season of experiment, especially if it was a dry time. Such a time was therefore selected, and the leaves so turned and propped that no rain could fall unto them. The leaves marked were those that contained but few insect remains. Two in each case were examined from each plant. Great care was used that both should have the same age, amount of liquid, and nearly the same amount of remains, and especially that they should have as near the same size as possible.

One leaf was marked and treated as above, while the fluid of the other was immediately tested for organic ammonia and the amount estimated. At the end of a week the marked leaves were picked, quickly examined, and the fluid analyzed for organic ammonia. The fluid showed a decided decrease in each case, from the amount found in the one used in comparison. Though these analyses were perhaps quite far from sure in every detail, yet the average difference on comparison, viz., sixty parts in one hundred, would indicate quite rapid absorption, for such an amount could not possibly be removed in any other way.

THE LAPPS.

As well known, northern Scandinavia is inhabited by a race of men who differ considerably from their neighbors, and these are the Lapps. These people do not know this name, but call themselves *Sabme* or *Same*, plural *Sameh* or *Samelats*. They call their country *Same-Adnam*. The origin of the name Lapp, as well as its etymology, is obscure, and the word is cited in no document previous to the twelfth century. The Norwegians always call the Lapps *Finmer*, 'Finns,' and it is thus that they are designated in the most ancient Scandinavian documents; hence, the name of the most northerly province of Norway—*Finmark*, the country of the Finns.

FIG. 1.—LAPP MAN.

Lapland, the territory occupied by the Lapps, is divided between four States, viz., Norway, Sweden, Finland, and Russia. The area of the Lapp territories and their population is given in the following table:

	Area.	Population.
In Norway	16,049 sq. miles	15,718
" Sweden	48,830 " "	6,404
" Finland	26,125 " "	1,038
" Russia	60,610 " "	2,207
	151,614	25,367

The documents that we possess do not permit us to say whether the Lapps are diminishing or increasing, but there is one fact that is certain, and that is that the number of *pure* Lapps is considerably decreasing, for marriages between them and the Finns are very numerous in the north of Scandinavia. These Finns are slowly invading the Lapp territories in Sweden and Norway. The Lapps, who before the invention of steamboats lived almost outside of European civilization, have been gradually driven toward the north by Scandinavian colonists, who are settling upon territories of which they were once sole masters.

The Lapp is small, the mean height of 200 individuals being 5 feet for men, and 4'8" for women; he is brachycephalous; and he is round-faced. His cheekbones are very prominent, his eyes are small and deep set, and their color generally varies between the two first lines of Broca's chromatic table. His eyelashes are few, and often wanting, removed as they are by affections of the eyes to which these people are subject from living in a smoky atmosphere.

His eyesight is very good. His nose is quite small and pointed, as shown in Fig. 1. This at least is the type that we have oftenest observed. Its profile varies between Nos. 2 and 3 of Broca's instructions. The mean nasal index is 74.59 for men, and 73.64 for women (Fig. 2). The Lapp's mouth is large, the mean being above 2 inches in 120 individuals. His lips are straight, and his teeth are vertical and often worn away. His chin is pointed, and his hair is long, wavy, black, and shining. Many Lapps become bald early; they

have but little beard, and what they do have is scattered. The color of their skin varies between Nos. 24 and 26 of Broca's instructions. It is often darkened by the smoke in the midst of which they live, and by the dirt with which they are usually covered. Even the young people have numerous wrinkles, which, added to the characters already cited, make them appear prematurely aged. Their voice is strong and clamorous. Their legs are generally small, the proportion of the sitting to the upright posture being in 112 subjects 52.9 for men, and 52.98 for women. But appearances are often deceiving, since the Lapp generally stoops when walking. On account of his poor food, the Lapp is usually thin, but his muscular system is well developed. He is strong and agile, and is a great walker. In winter it takes him but a short time to get over great distances on the ice by means of his skates. In 1884, five Lapps, in one journey, made 136 miles with a mean speed of more than six miles per hour.

These people enjoy good health, but lose many children for want of care. Morally, the Lapp is gentle and peaceable, and often tries to gain his point through strategy. Although each individual has a knife with him continually, he rarely has a bloody altercation. His language has much affinity with the Finnic, but the two peoples are very different from a physical point of view.

Formerly the great majority of Lapps lived in a pastoral state, and raised immense herds of reindeers, which furnished them their food (meat and milk), and which served them as beasts of burden. These, along with a peculiar variety of dog that aided them in guarding their herds, were their sole domestic animals. Their state might be characterized by saying that they were in the age of the reindeer. But now, on account of the difficulties created by the Scandinavian colonists apropos of reindeers, many Lapps have had to give up their nomadic life and their herds and become sedentary. There are at present two sorts of Lapps, viz., the mountain Lapps (Norw.

FIG. 2.—LAPP WOMAN.

Fjeldlapperne; Swed. *Fjallapparne*) and sedentary Lapps.

The former are those who have preserved their nomadic life, and who live with their reindeers. In entire Lapland, there are still about 400,000 reindeers. In winter, when the earth is covered with snow, these Lapps inhabit the valleys, and live in tents made of a few rods covered with a woolen fabric, which in summer is replaced by linen. In the center of the tent there is a fireplace. The dogs lie pell-mell with the entire family. For traveling in the winter season they use sleds drawn by reindeers. In this manner they get over a very wide space in a very short time. Their food consists of game, coffee, and dishes made of milk. They formerly drank much brandy, but it is now against the law to sell this to them.

The winter costume of the Lapp consists of a sort of large fur blouse fastened at the waist by a belt, from which hangs a knife in its sheath. His head is covered with a gaudy colored cap, which is either square, as in Norway, or pointed, as in Sweden. His foot covering consists of a pair of waterproof leather shoes called *komager*. In the interior of these is placed a species of herb to support the foot. The lower extremity of the trousers is tucked into the leg of the shoe and tied with strong ribbon. A pair of gloves completes this costume.

The women's dress is about the same. For walking upon the snow they have a pair of snowshoes two yards in length, and to help themselves along they hold in the hand a large stick that has an enlargement at one of its extremities to prevent it from sinking into the snow. When summer comes, and the valleys are changed into swamps, where swarm mosquitoes that are insupportable to the reindeer, the Lapp, who can no longer use his sled, loads his tent and furniture upon the back of his reindeers, and departs for the pastures on the high plateaux. The women carry their children upon their back in wooden cradles. Summer is the bad season for the mountain Lapp.

As for the sedentary, fishing, forest, river, etc., Lapps, they have partially adopted the life of the Scandinavian fishermen and peasants. They construct either wooden houses (in which the windows are sometimes

* *Bot. Gazette*, vol. vi., No. 7.

† *Amer. Nat.*, vol. xvii., p. 284.