some future time. Adult Mycetophilid flies have been collected by me on several occasions in parts of caves in which my larvæ were found, but it will be necessary to "breed" the pupæ and adults from the larvæ before the stages can be associated with certainty.

"I have never seen your larva, but I have from a cave in Jamaica, W. I., a Dipterous larva of similar form and habits, except that it lies suspended free from the rock on a thread of ropy slime-like material. I send you specimens of this larva and also its pupa in alcohol, likewise the imago which I bred from the pupa. You will see that it is a Mycetophilid fly. No doubt you have noticed similar flies in fungi and particularly on coatings of fungi under damp logs in dark woods. The larvæ of these fungus-inhabiting flies are similarly elongate creatures and form thread-like tracks of slime across the surface of the fungus. I have frequently observed that they can be made to glide back and forth along this track precisely in the manner of your cave larva, and that they can not be induced to quit their hold upon the thread. The interesting point to which I would like to call your attention is this. The silken thread of your Mammoth Cave larva and the slime thread of my Jamaican larva as well as the slime track of the fungus Mycetophilids may all be similar products of the salivary organs and more or less allied to true silk. The Jamaican cave fly makes a thread of six or eight inches in length fastened at both ends to the rock on the underside of a ledge or stalactite, but otherwise hanging free, and on this both larva and pupa are found suspended as in a hammock. In the damp air of the caves the thread never dries and hardens like ordinary silk, but remains viscous and slime-like as in

FIG. 4.

the case of other Mycetophilids. Nevertheless it possesses greater strength than an ordinary filament of mucus and it occurs to me that it is nothing more or less than a form of silk which does not lose its moisture and become hard. I have read somewhere quite recently of a process for the manufacture of artificial silk from a collodion produced by the action of nitric acid upon palm fibre. This silk remains moist until passed through anhidrous ether, which removes the moisture and hardens it. I would like much to know whether the silk thread of your cave larva is not also somewhat viscous, and it would be interesting also to note the action of ether upon it.

"In the *American Entomologist*, Vol. III., p. 30, 1880, I published a brief account of cave life in Jamaica. The article refers to the fly as follows; 'A Mycetophilid fly is found upon the stalactites, where its vermiform larva may also be seen suspended by ropes of slime.' Referring to my original field notes I find the following: 'Drunilly, Parish of Trelauny, Jamaica, W. I., April 18th, 1877,—among notes of examination of a large cave, much frequented by bats and containing many tons of bat guano—under ledges of stalagmite, long Dipterous larvæ slung in glutinous threads. Pupæ also collected slung in same manner. Probable imagoes also found. (I subsequently observed a pupa disclosing the fly and took specimens of all the stages.)' "

Explanation of the Figures.

Fig. 1. A dorsal view of a Mycetophilid larva found under a log. a, an outline of the head as seen from above.

Fig. 2. A web of one of the cave species.

Fig. 3. A web-making cave larva. a, an enlarged side view of the head.

Fig. 4. The pupa of the larva represented in Fig. 3.

SCARS ON APPLE TREE TRUNKS.

BY FRANK BOLLES, CAMBRIDGE, MASS.

OLD apple trees in New England are almost invariably thickly dotted with round scars in their bark. Chains of small holes seem at some more or less distant date to have been bored in the trunks and larger limbs, but to have healed without injury to the tree. I have seen trees which bore thousands of these marks, arranged with some appearance of regularity in rings encircling the trunk and extending tier upon tier from a few inches above the ground to a point much higher than a man's head. In meetings of ornithologists I have heard many of those best informed about birds' habits say that they were unable to name the maker of these marks. Farmers generally charge the Downy Woodpecker with doing the work, and they often call him a Sapsucker in consequence. Many people suppose that the holes were bored a long time ago, and that they are not now made, hence the impossibility of observing the bird while making them.

For several years I have kept close watch upon my old orchard at Chocorua, N. H., hoping that I might catch the little Sap-sippers at work. While my experience with the Yellow-breasted Woodpeckers inclined me to suspect them of being the birds concerned, I did not feel at all sure that the Downy, who is so fond of stealing a drink of sap from the drills of the Yellow-breasted, might not have learned to do some boring on his own account. This autumn I noticed half a dozen freshly made holes in a very old apple tree. That proved clearly the continued existence of the unknown worker. During September both Downy Woodpeckers and the Sapsuckers were abundant and very busy in my apple trees. The Downy was fearless and honest in his manner. He was after insects and he showed no shame and little timidity. The Yellow-breasted Woodpeckers, on the other hand, were very shy, and flew from a tree almost as soon as I came within sight of it. This led me to watch them persistently, and at last, not long before I was called back to Cambridge, I had the satisfaction of seeing one at work, drilling and drinking. After making perfectly sure that he was cutting new holes and drinking, I examined the holes closely and satisfied myself that they were identical with the kind so long in dispute. To wary *Sphyropicus varius*, therefore, in his autumn migration, is to be assigned the fretting of our old apple trunks. That he does all of this work, I believe, but cannot, of course, affirm without more evidence.

A MISTAKE IN TEACHING BOTANY.

BY B. FINK, FAYETTE, IA.

UNDER the above caption I wish to enter a protest against the method of teaching botany still in vogue in certain colleges and high schools. If the error named below prevails in any large University, it needs correction there as well. It exists in our village schools, and will till the higher schools make a change for the better, and send out teachers correctly trained in the subject.

The mistake is the old plan of a spring term in botany confined to a study of phanerogams, followed by the analysis of from fifty to one hundred plants. This way of studying botany came into use when the microscope was scarcely known among the masses, and when the eco-

nomic interest of the lower orders of vegetable life was not well understood.

It is a source of pleasure to be able to name the common flowering plants, and the practice in analysis is good; but the teacher might better tell the names of the plants and save the time for more important work if the pupil can spend only one term upon the study, and as for the analysis, experience shows that a large part of the work not done under the supervision of the teacher is accomplished by ascertaining the common name and then going to the index.

Some teachers who have followed the old line in elementary botanical instruction will hardly be convinced that other matter should precede. They think that phanerogams are the most noticeable plants and should therefore be studied a whole term even if the lower forms are never known. The fact that they are so noticeable that any one who is really interested and who has had some work in observing and describing phanerogams will learn their names by analyzing, or in some other way, is my reason why the limited time often given to the study should not be devoted exclusively to this class of plants.

Some who have been going on in the old rut will contend that phanerogams were the first plants investigated, and that the order of presentation should follow that of investigation. Let us see. In geology, investigation began at the surface, with the latest formation; but in the study we begin with the deepest stratified rocks, the first formation. In zoölogy the highest forms of life were first studied and first present themselves to the observer, but here again the order of presentation has been changed so that it is the reverse of that of investigation.

However, I think it is not of so much importance where we begin as that we give first a general knowledge of the orders of plants. If those who have been confining their work to flowering plants will give half of it to cryptogams I will not find much fault with them for beginning with the highest order. Yet I think I have proven that the other way is as good without even introducing the principle of going from the simple to the more complex.

Every one who studies botany at all should learn something about bacteria, which play so important a part in our welfare. The same may be said of the economic smuts, mildews and rusts, and many other forms that I need not mention. Vegetable physiology should also form an important part of the work of the first term if it is to be the only one, and the necessary time can be gained by omitting the analysis of so many phanerogams and substituting the examination and description of a plant from each of the more common orders, using the microscope when necessary.

Instead of the old plan I would have all schools, during the first term, take up the orders, proceeding from the lowest to the highest, and close the work with the leading facts of vegetable physiology. I would divide the time equally between cryptogams, phanerogams and physiology. This both gives the best foundation on which to build, and is the most essential knowledge for the student who can not give more time to the subject.

FUNGI VERSUS INSECTS.

BY GERALD MCCARTHYR, RALEIGH, N. C.

DURING the last twenty years the number of species of noxious fungi and insects infesting American fields, orchards, woods and storehouses has increased at a most alarming rate, with a commensurate increase in the damage they inflict. The time was when the substantially complete destruction of any crop by these pests was so rare as to be regarded as a special visitation of Providence. This increase is undoubtedly due to the perfection of modern commerce, which has made cosmopolitans of species formerly restricted in habitat, and to the opportunity for rapid multiplication that our large solidly planted fields afford. Notwithstanding the vast amount of study which has during the same decades been devoted to these pests and the many differentforms of apparatus, formulas and methods which have been devised for combatting them, the damage still done is very serious. In fact intelligent and practical men say that the claims put forth by economic scientists have not been fulfilled. While the copper salts against fungi and the arsenites and kerosene against insects have in individual cases given good results, they have not apparently reduced the numbers of these pests. The use of these substances, too, is not without drawbacks. The acrid copper mixtures often damage the trees or plants nearly as much as the fungi would have done, and fruit plastered with these chemicals does not sell well. To be sure, it is not necessary to plaster fruit with the fungicide, nevertheless it is done, and where spraying is in general use the fruit as marketed is seldom free from its presence. An example of this, which has made a vivid impression upon my mind and stomach, is a lot of Catawba grapes grown near Seneca Lake, N. Y., and sold in Raleigh, N. C. These grapes were considerably spotted with the Bordeaux mixture. As an experiment I purchased and ate a bunch of these grapes, rejecting the skins,—an experiment I am not likely to repeat very soon! The flavor was quite spoiled by the presence of the chemicals, and the effect upon the digestive organs was anything but pleasant. The use of chemical fungicides, like the use of patent medicines for human ailments, has a tendency to cause the user to neglect hygienic precautions, since these latter require more foresight and labor than the former. In spite of all that fungicides have done, the annual losses caused by noxious fungi are still, for the United States alone, $300,000,000.

The losses occasioned by noxious insects are scarcely smaller. In a single year Illinois has lost $75,000,000 by the clinch bug and Texas has lost $20,000,000 by the cotton caterpillar.

The capital fault in all topical treatment of these pests is that it is effective only so far as the treatment goes, and for the time being. Let us suppose A., B. and C. to be neighboring fruit growers. A takes every practicable hygienic precaution by burning all infectious matter, and by cultivation and fertilization stimulates his crops to outgrow their enemies. B has unlimites faith in his "pizen," and applies it with a liberal hand. C is a "one-horse" farmer and has no faith in anything. He lets the bugs alone. The net result is that C grows more fungi and insects than fruit, and enough to devastate his neighbors' crops after his own are ruined. B has bespattered his trees right and left and caused most of the leaves to drop or shrivel up, followed by the fall of the immature fruit. A in spite of all his trouble and expense sees his crop ruined, or if he overcomes his prejudice against the use of chemicals, saves only a part of the crop and that more or less deteriorated. Surely there is something lacking in this method of procedure!

What is wanted is an automatic antipest destroying agent which will do its work quickly, thoroughly and without the aid of such men as farmer B and in spite of such men as farmer C. Such an agent many think we have found in pathogenic, contagious disease producing fungi or bacteria. It is well known to the farmers of the west that in some seasons the swarming multitudes of clinch bugs after devouring the crops disappear suddenly and as if by providential interposition. This disappearance usually follows a period of wet weather and does not as a rule occur until the pests have done irreparable damage and increased until their loathsome presence is