Evidence is continually increasing that in different coral-growing areas different processes have gone on and that since all coral islands have not been made in the same way no single, all-comprehensive theory is possible.

Dr. Guppy found at the Solomon Islands that, adjacent to the shore, corals grew vigorously, while outside of this zone there was a space where debris from the shore so fouled the water that no corals grew, while still farther out they grew finely. It is easy to see that the first zone would make a fringing reef, the zone affected by debris would be open water, and the outer zone a barrier reef, and thus these varieties of coral formation be produced without the conditions of either theory. Nor is it at all improbable that other methods of coral island making may be discovered as further investigations reveal new facts, and, while it may be regarded as most probable that Mr. Murray's theory will be held sufficient to explain the larger part of the coral formations of the globe, it is also probabable that Mr. Darwin's views will never be wholly set aside, but will always be needed to account for extensive groups of reefs and islands, while here and there all over the region of coral island making there will be found phenomena which require other explanation because of special peculiarities.

THE PROTECTION OF OUR WILD PLANTS AND ANIMALS.

BY JOHN GIFFORD, SWARTHMORE COLLEGE, PA.

A FEW years ago an association for the protection of plants was founded in Switzerland at Geneva. Tourists, and even botanists, were guilty of such vandalism that many feared the extermination of certain rare plants. By the dissemination of seeds and other means, however, many species have been protected by this society in Switzerland and elsewhere.

Although we have forestry associations in this country we have as yet done nothing toward the protection of rare plants.

In south Jersey, for instance, there are many unusual and beautiful species, but owing to the action of winds, fires and voracious botanists they are becoming gradually scarcer.

Along the beaches of the seashore the forests are destroyed for the building of resorts, in other places they are buried by moving sand dunes. The *Schizæa pusilla* is a little fern, which is not found elsewhere in the United States. It grows in three or four isolated patches in the low pine barrens of south Jersey. One patch has already been almost wholly destroyed by forest fires, and from the others hundreds of specimens are carried away by greedy botanists every September. The extinction of this species is only a question of a very few years.

This applies to almost every locality in the United States. There are few places which cannot boast of a few rare species.

The writer knows of one instance where a class of young botanists exterminated a patch *Aplectrum hiemale*, in a region where it was very rare, by eating the corms.

In spite of game protective societies, owing to the thoughtlessness of sportsmen, many of our wild animals have disappeared. A few deer still linger in the pines of south Jersey, but every season their number is remarkably lessened. Had they a place of refuge where they could always remain unmolested, their extinction could be prevented.

It is hoped that the Government may set aside in every state a tract of guarded land. A few acres showing the nature of the country in the wild state will be appreciated more in years to come than at the present time. There the trees may remain untouched, there remarkable and unusual plants may grow in safety, and there the wild animals may find a refuge. The advantages of such a scheme are too numerous to mention. The retaining of a typical portion of each kind of territory in every state, together with its plants and animals, guarded every day of the year, would not only delight the naturalists and lovers of nature, but would insure at least a small portion of forest country here and there, which tends to lessen in many ways the destructive forces of nature.

Dr. Charles Dolley and others of the American Association for the Advancement of Education have arranged to collect and preserve on their property at Avalon all the plants peculiar to the beaches of the Jersey coast. This is one of the objects of the association, and it hopes to control some land in the low pine barren region where no man will be allowed to botanize or hunt.

*See Westwood's Modern Classification of Insects on Larval Mycetophilidæ.

SILK SPINNING FLY LARVÆ.

BY H. GARMAN, LEXINGTON, KY.

IN a brief paper printed in *Science* recently a silk spinning cave larva was described by me and referred to the order Diptera. Its general appearance and its habit of making a thread are features in which it approaches the larvæ of Lepidoptera, a resemblance which has been commented on by others in conversation with me since. Yet the larva in question is unmistakably Dipterous, and it was part of my object in publishing the note to call attention in an indirect way to the fact long, but not very generally, known,* that larvæ of certain flies approximate the Lepidoptera, in spinning silken threads. In saying that they produce silk, I wish, however, to be understood as in no way implying that the threads have the exact chemical and physical properties of the silken fibres made by the silkworm. They are silk from the biological, not from the commercial point of view. They are produced by special glands differing little, if at all, from the silk glands of other insects, are employed by these larvæ for a purpose, and are not consequently to be compared with the trail of slime left by a slug or worm.

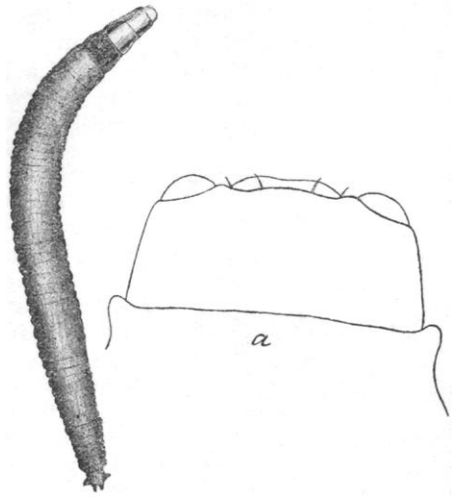

FIG. 1.

My attention was first attracted to such larvæ while making examinations of Kentucky caves. I have, however, been long familiar with other larvæ belonging to the same order, which habitually spin threads having a very important relation to their welfare. In small streams in McLean County, Illinois, occurs a larval Simulium which produces such threads. Another species is extremely abundant in rills in eastern Kentucky, where the rocks

over which water flows with considerable speed are literally blackened with it. Since the note referred to was published I have observed that these latter will when disturbed let themselves loose in the current and then shoot down stream emitting their threads at the same time so that they can check their descent and secure a fresh hold on the rocks, perhaps to return along the thread to their first position. By closing the blades of my forceps over the rocks I have repeatedly drawn out a string of these larvæ, each one suspended by the thread it had let out as it floated down stream.

In addition to this thread-spinning habit the cave larvæ have peculiarities of structure which render them worthy of careful study. I have already described two of them, and have collected several others in Kentucky. All are more or less vermiform, being long, slender, cylindrical, generally translucent, so that the internal organs show more or less distinctly through the body wall. The resemblance to a small Lumbricoid worm is heightened by the fact that their bodies are coated with a slime, the derivation of which is uncertain, but which is probably not

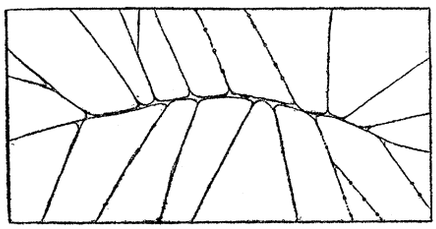

FIG. 2.

derived from the glands engaged in secreting the thread. There are common features also in the structure of the head and mouth-parts, and in the presence of a singular convex area above the base of the mandible resembling a very large ocellus. In several of those examined this is of enormous size, and gives the head a most bizarre appearance.

That they are Dipterous larvæ is sufficiently evident from their resemblance in general structure to larval Sciara. The recent discovery of the pupa of one of the species, with wing pads and halteres clearly apparent, confirms the opinion I had reached in this regard. While engaged in attempting to rear the adult of this species I received additional proof in the shape of a letter, quoted from below, from that most excellent observer and collector, Mr. H. G. Hubbard, together with three stages of a closely related species which he discovered some years ago in a cave in Jamaica. The larva of this species is closely allied to one found by me during the past August living in hammock-like webs slung across depressions on the under side of stones and lumps of earth. The latter species was taken in a small cave near Lexington, and has afforded me an opportunity to observe more closely the product of the spinning glands of these interesting insects, and to watch the larva while making its web. This larva shows the same attachment for its web as does the species previously described. In one instance an example was compelled by particularly rough treatment to creep to the earth at one side of its web, where it remained drawn up in an uncomfortable position, but turned promptly when left unmolested for a moment and made its way back on the web again. Three living examples were at one time thrown into a watch glass of water preparatory to killing them in an extended condition, when every one fastened itself to the bottom by pouring out the glutinous material from its mouth and then began to wriggle like an uncomfortable earthworm, always with the whole length of the body free from the glass. In this case the slime coating of the body showed no tendency to glue the body down, whereas the matter from the glands opening at the mouth retained all its adhesive properties—an evidence that the slime is of different origin, and is produced for a different purpose.

Since Sept. 3 a larva of this sort has been kept alive in a bottle. In the bottom of this is about half an inch of earth. The larva spends most of the time in the empty upper part and makes its way about in this space, building a web as it goes, with surprising rapidity. It is often fully two inches from the earth and very rarely touches the side of the bottle with its body. When engaged in web-building, it sways the forward part of the body from side to side until it strikes some object, when the thread is attached by a touch, and as the head draws away is seen to be connected with that underlying the whole length of the body. When first drawn out these threads appear under a hand lens as smooth and dry as any spider's web. The central strand upon which the larva usually lies, however, has a good deal of slime along it, forming triangular masses at the points of divergence of lateral threads. When they have been used for some time the lateral threads of a web may also show slime upon them in the form of minute scattered spherical droplets (See figure). As far as I can determine all this slime comes from the surface of the body. Occasionally a portion of the body has been seen to come in contact with the bottle, where a slimy trail nearly as wide as the body was left on the glass. If this slime had the properties of the glutinous material of which the thread is made the larva would have difficulty in getting about. On the contrary it is rather fluid, and the droplets left along the strand can be seen to be drawn up by the force of capillarity as the tip of the body passes them.

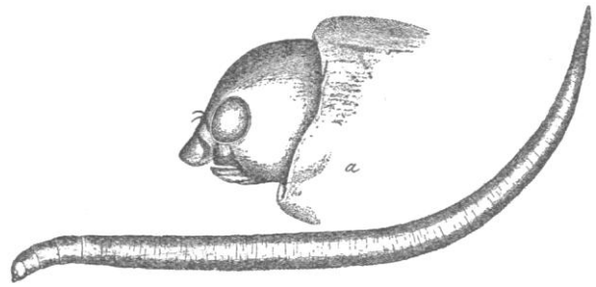

FIG. 3.

These larvæ live concealed in damp situations and it may be, as suggested by Mr. Hubbard, that the threads do not become perfectly dry. They are so fine and delicate that it would be difficult to determine this matter. The thread-making larva previously discribed in *Science* is at all times completely exposed on the rocks. I have had no recent opportunity to examine its threads, but the impression I have of those seen last spring is that they were dry. But the question whether or not the threads of these larvæ are completely dry has nothing to do with that concerning their essential nature. If silk must be chemically dry, then of course the thread of larval Simulium is not silk. It is not the product of a gland having to do with digestion. It is not a trail of slime left from the surface of the body. It is a special product, used by these larvæ exactly as the silkworm uses the product of its sericteria (even to enclosing the pupa in some cases in a very slight approach to cocoon).

Mr. Hubbard's larvæ are very much like the species upon which my observations have been made, and their threads of slime very probably have a supporting axis of other material. The following quotations are from his letter accompanying the specimens so kindly sent me. I hope to publish descriptions of all the cave species at

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

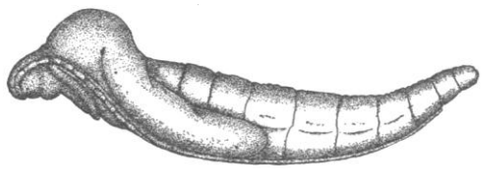

Fig. 4.

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-