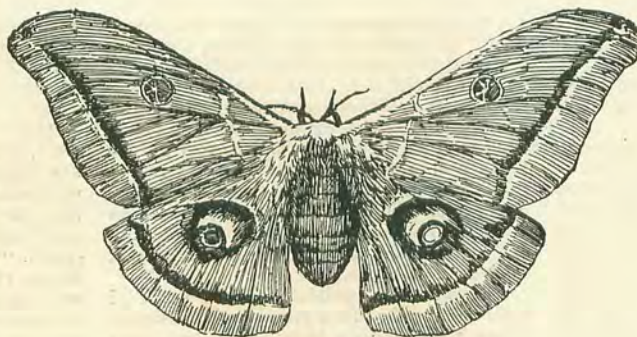


## BUTTERFLIES, MOTHS AND OTHER STRANGE INSECTS AT THE ZOO.

The nursery of many beautiful, rare and strange insects is situate on the north side of the canal, and is approached by an iron bridge. It is one of the latest additions to the Zoological Society's Gardens, though it has been built some fourteen years. I don't think it is as well known as it deserves to be, and possibly a good many visitors are hardly aware of its existence, placed as it is in a comparatively out-of-the-way corner of the Zoo. Yet this insect house carries on a most interesting work, rearing insects from the eggs or showing insects which have rarely, if ever before been seen alive in England. The Tarantula spider for instance, which I sketched as he was crawling up the glass of his dwelling, is a creature well-known from descriptions, and yet inhabiting much warmer countries than this, has rarely been seen alive by stay-at-home folk. Butterflies and moths, both British and foreign, are reared every year either from eggs laid in the house, or from imported chrysalides, and altogether this insectarium is full of interest to the visitor who does not attempt to see the whole place in an hour or two. As I have studied and sketched in this insect-house a good deal from time to time, let me act as *cicerone* to the readers of the G. O. P.

The moths claim our first attention, and in Fig. 1 I give a drawing (adapted from a

photograph taken by Mr. Dresser) of a case of the Polyphemus silk moth, in which can be seen the perfect insect and also the moth just as it emerges from the cocoon. Now it may be as well here to make it clear to the reader



POLYPHEMUS MOTH.

the life history of a moth, for a good deal of misconception exists as to the transformation these insects undergo. The caterpillar or worm is the produce of an egg laid by the female moth. The eggs vary in size from a very small to a large pin's head, and when hatched the worm is very minute, but grows very rapidly, for he is a voracious feeder, until he is from one to three or more inches long, and bulky in proportion.

As a general rule moth worms are much larger than butterfly larvae, the bodies of moths being so much more bricky than butterflies, but the size of the worm is not always in relation to the imago, for the common silk-worm moth is a small insect; yet the worm is nearly as large as that of one of the large moths. When full grown the worm (or larva as it is called) passes into the chrysalis state (or pupa), in due time to re-appear as a moth (or imago) whose life is very brief, and in the case of the female terminates when she has laid her eggs. There are four stages then; the egg, or ova, the larva, the pupa and the imago, for it is as well to become familiar with these scientific terms.

In many cases the insects are reared from eggs laid in the house, but in others

from chrysalides sent over from abroad, for eggs would be very liable to hatch out on the journey and the young, for want of food, would therefore die. Some of the most perfect insects are procured by collectors in this way, for the imago is at its best before it has knocked its wings about.

Now let us take a more detailed view of this polyphemus moth, for it is the only one among some eight species of American silk producers which is likely to have any textile value. But here let me say that some moths before passing into the chrysalis or pupa state spin themselves a home in which to undergo this curious transformation away from prying eyes. This home, usually oval in shape, is called a cocoon, and in the case of the silk-bearing moth, gives us the well-known fibre known as silk.

This Polyphemus spins a strong, dense oval cocoon with silk of a very strong and glossy fibre.

In 1860 L. Trouvelot began his experiments in raising these silk-worms, but it was two years before he could raise a stock of worms from eggs. The larva feed on oak trees, and the difficulty was to protect the caterpillars from birds, who, though the enclosure where the larva fed was netted over, the small birds worked through the mesh, while larger ones found or made holes in the net.

Early in the summer the chrysalis, which has been imprisoned for eight or nine months in the cocoon, begins to awaken from his torpor. As the creature has no teeth or instrument to cut through the hard gummy substance enclosing it, he is provided with two glands which secrete a liquid composed of a great part of bombycic acid (this family of moths are called Bombycidae) which softens the cocoon and enables the inmate to push its way out without breaking the fibre.

Its wings at first are small pad-like members, and the swollen abdomen contains the nutriment which flows to the wings to develop them and enable them to grow to the large size of the perfect insect.

The incubation of the eggs lasts ten or twelve days. As soon as the larva is fairly hatched out it continues for some time eating its egg-shell, and then crawling upon a leaf goes to the end of it, and after waiting a few hours, begins to eat. The Polyphemus, like other silk worms, changes its skin five times during its larval life. This moulting takes place at regular intervals, which come round about every ten days during the first four moultings, while about twenty days elapse between the fourth and last. The worm ceases to eat for a day before moulting, and spins some silk on the vein of the under surface of a leaf; it then secures the hooks of its hind legs in this web it has spun, and then remains motionless. The moulting generally takes place after four o'clock in the afternoon; a little before this time the worm holds its body erect, grasping the leaf or twig with two pair of hind legs only. The skin is wrinkled and detached from the body by a fluid which circulates between it and the worm, whose contractions, which increase in energy, burst the old skin, and the worm finally crawls out newly-clothed. In these moultings the colouring and markings are changed or modified, a worm turning from a deep red brown to pale green, to mention the instance of our own death's-head moth.

The great atlas moth, a native of India, has been reared very successfully in this house. It is one of the largest known, one bred in the



FIG. 1.—CASE OF SILKWORM MOTHS IN ZOO.  
(Adapted from photo by A. R. Dresser.)



gardens measuring eleven inches and a half across from tip to tip! Its general colouring is a deep-red brown with yellowish markings, forming a beautiful pattern around the wings, and it has conspicuous bands of black and white crossing the wings. A striking feature are the four triangular spaces, which are transparent, and look like pieces of thin talc let in the wings. These "windows" are found in many moths, and also in some butterflies, and I have drawn three where they occur. I believe there is a legend in India that in the Tusseh these spots, which are round, were caused by Buddah rubbing off the feathers with his fingers when he picked up the moth.

The ornaments suggested by moths are full of decorative quality, and I have added two borders derived from the atlas, both of which are to be seen on the wings.

The Cynthia or Ailanthus is a native of India, but has been bred in America, and in spinning its cocoon it folds a leaf around it, as can be seen in the sketch. The caterpillar is hardy, and being covered with a fine white powder can withstand rain. It drinks greedily, and the branches upon which it feeds should be dipped in water or sprinkled freely, particularly after the third moult.

The Tusseh silk-moth is a native of Bengal, Behar, and Assam, and from its cocoons is obtained the silk of that name. Its cocoon is attached to the branches of the tree upon which it feeds by a ligature which it spins, so that the chrysalis is kept out of the damp by swinging in the wind during its pupa state. Its cousin, the Japanese variety called Yamamai, is a handsome moth of a deep golden-brown or golden-ochre, with slightly darker markings, and has four conspicuous circular "windows," one of which I have enlarged.

I want you to look at these four moths and notice the modifications the patterning of the wings undergo. The "windows" are crescent-shaped in Cynthia, triangular in atlas, circular in Yamai-mai, while the bands and markings undergo interesting changes, yet preserve a family likeness which shows their kinship.

The moon-moth, with its lower wings prolonged into tails, is a beautiful insect of a very pale sea-green colour with reddish-brown markings. To see it in the insect-house is alone worth a visit, as it clings to an old cocoon or the branch placed inside its case. It spins a web so frail and thin that it is impossible to reel it.

The caterpillars of all these moths are striking objects, being ornamented in various ways with bands, spots, tufts of hair, etc. The one drawn with tubercles (Cynthia) is a pale bluish-green, though the moth itself is dark-coloured. The other is the Tusseh. They are provided with three pairs of hook-like feet near the head, and four pairs of elephant-looking ones in the centre of the body, while the end of the creature is bifurcated so that the worm can grasp a leaf, stalk, or twig, allowing the rest of the body to move freely in searching for food. While the caterpillars are voracious creatures and consume an immense amount of food, the moths themselves do not feed, and live but a brief space. The antennae of most of these moths is like a feather, as can be seen in sketch.

*Silk and its Producers.*—It may not be out of place here, as we have been dealing with silk-producing moths, to just glance very briefly at the subject of its production and manufacture. Though used in China for a long period of time, stretching back indeed to a past so remote as to become mythical, silk has not been used extensively in Europe for more than a few hundreds of years. The Romans valued silk at its weight in gold, and it was only worn by the few. The story of two monks secreting the eggs of the small mulberry-moth in a cane when they journeyed from China to Constantinople in the sixth

## HER COMING.

By M. HEDDERWICK BROWNE.



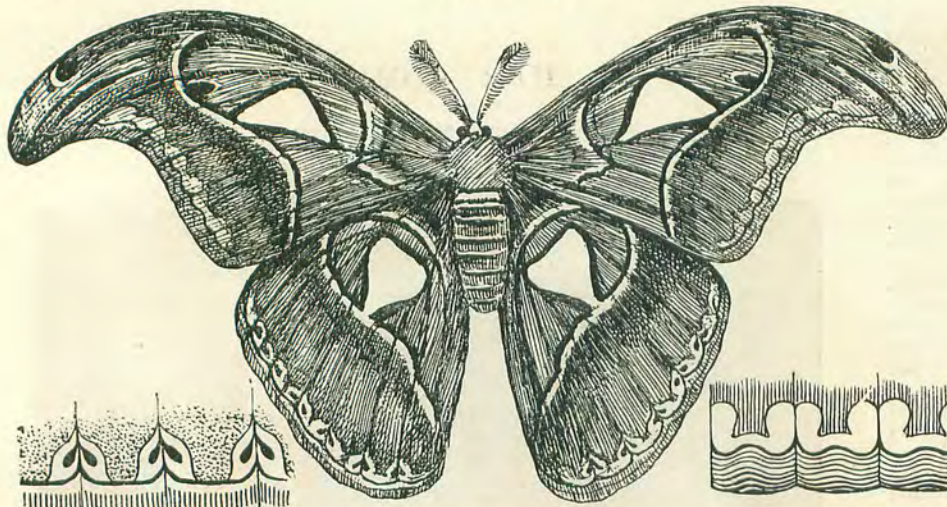
THERE'S a rustle in the roses  
That tells me she is nigh,  
And a lark has sprung to heaven  
To flash the news on high.  
The old gate will swing open  
And she'll come smiling thro',  
Just like a living sunbeam  
'Twixt the sentinels of yew.

The great world lies beyond her,  
She knows not of its ways;  
In quiet and contentment  
Pass her uneventful days.

The lilies are not purer  
Nor whiter soul'd than she;  
She wears her crown of beauty  
In sweet humility.

My heart is glad and grateful  
That it finds joy and rest  
In the love of one, who loveth  
God, and home and nature best.  
There's a rustle in the roses  
That tells me she is nigh  
And the lark that springs to heaven  
Bears my thankfulness on high.

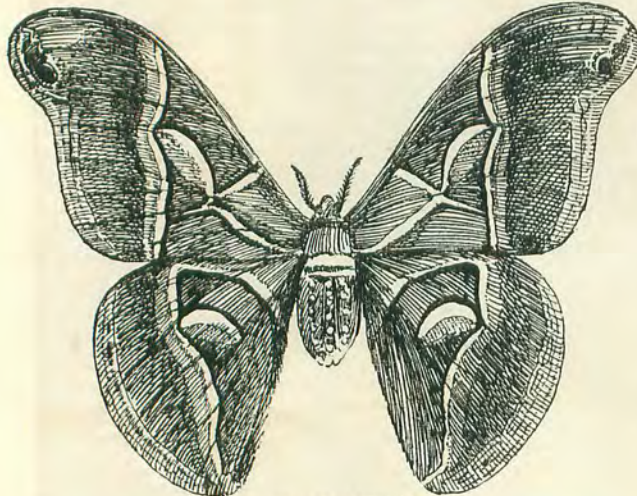




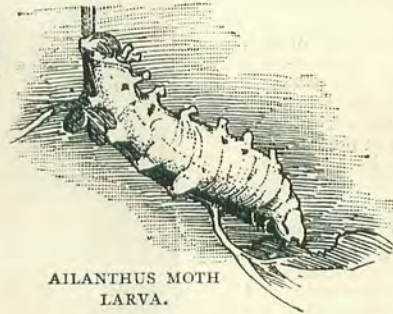
GREAT ATLAS MOTH.



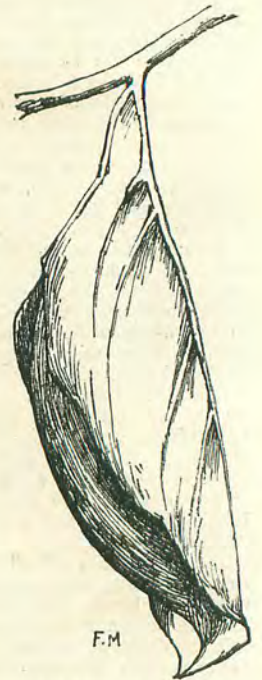
ANTENNÆ OF ATLAS MOTH.



CYNTHIA OR AILANTHUS MOTH.



AILANTHUS MOTH LARVA.



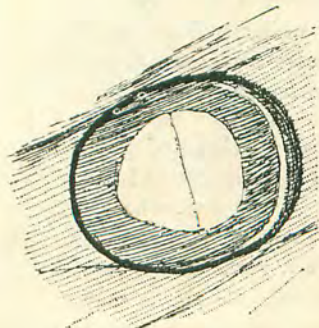
AILANTHUS COCOON.



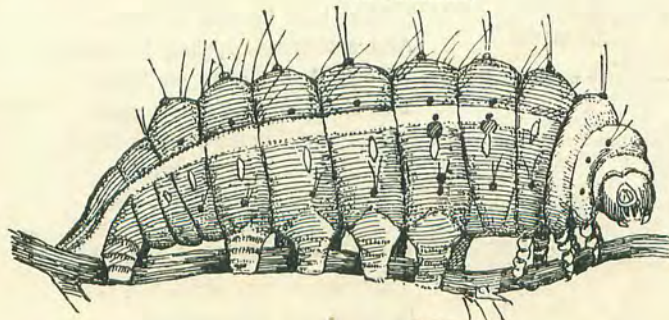
JAPANESE TUSSEH MOTH, YAMA-MAI.



TUSSEH COCOON AFTER IMAGO HAS ESCAPED.



EYE FROM WING OF YAMA-MAI, ENLARGED.

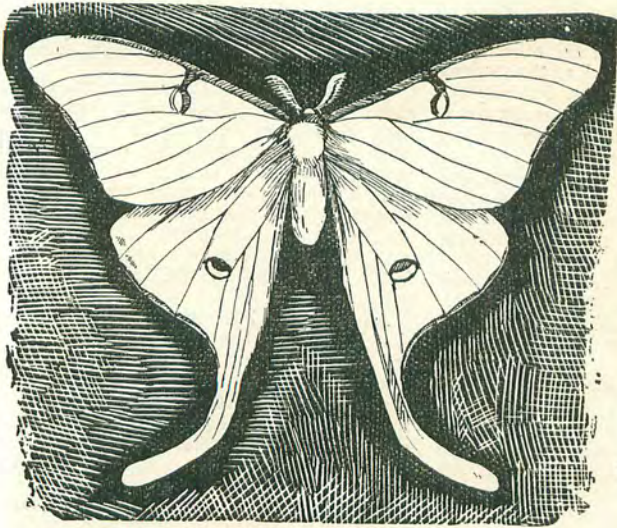


TUSSEH MOTH LARVA.

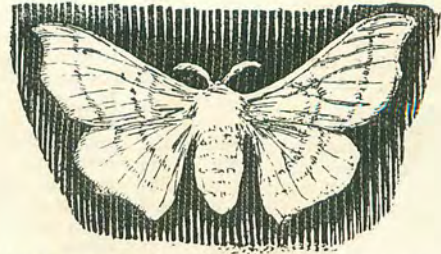


TUSSEH COCOON.

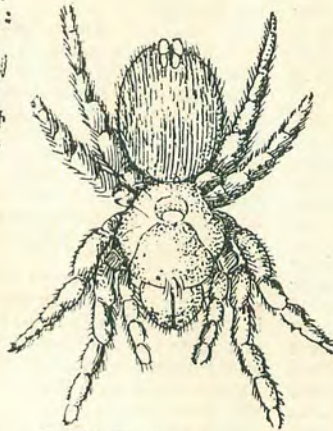
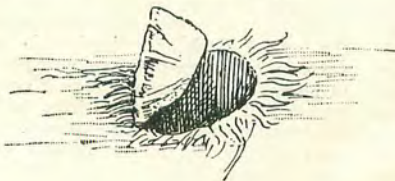




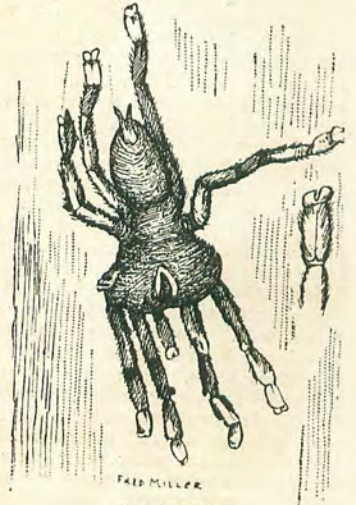
MOON MOTH.



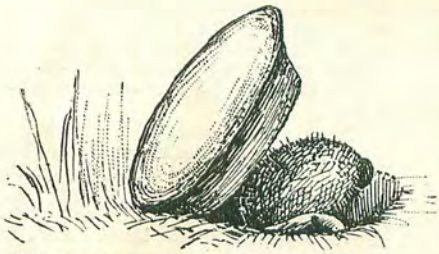
MULBERRY MOTH (*Bombyx mori*), THE COMMON SILKWORM.



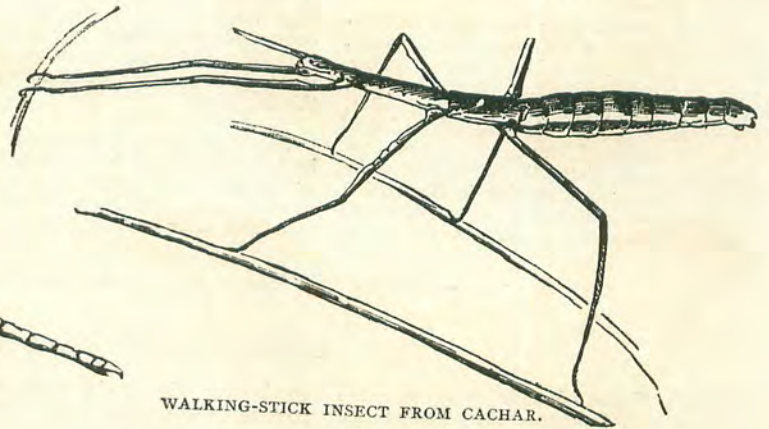
NATAL TRAP-DOOR SPIDER.



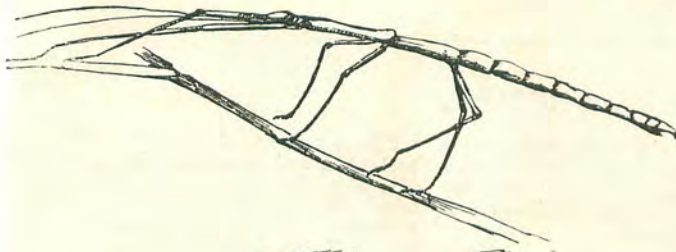
TARANTULA.



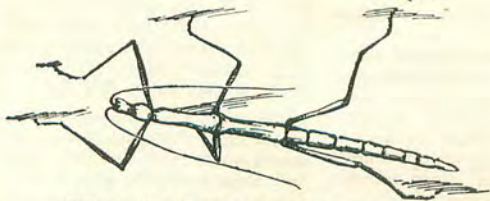
TRAP-DOOR SPIDER'S HOLES. (Showing two kinds of lids.)



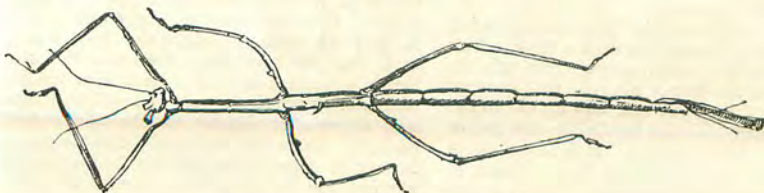
WALKING-STICK INSECT FROM CACHAR.



TEXAS WALKING-STICK INSECTS.



WALKING-LEAF INSECT FROM SEYCHELLES.



WALKING-STICK INSECT FROM BRAZIL.



century, is one of those legends which we can accept or reject: proof is wanting. The length of time such a journey would take in those days, and the liability of the eggs hatching out before they reached their destination, needs explanation.

Another story, and one which seems credible, is that the Crusaders introduced the rearing of the silkworms into Sicily in the twelfth century, the cultivation of the silkworm having spread from China eastward by slow degrees. The Saracens obtained a monopoly of the trade, and established it in the thriving cities of Asia Minor. Sicilian silks, with Saracen patterns, dating from the twelfth century, have come down to us. Silk has been an important industry in Italy and the South of France for the last three or four hundred years. Silk-weaving was introduced at Tours by Louis XI. in 1480, and Francis I. brought the industry of rearing silkworms to the Rhone Valley in 1520.

I daresay many of my readers either keep or have brothers who keep silkworms; such know what an insignificant insect this moth is compared to those I have been speaking about. It is whitish, with faint yellow-brown markings, which follow the same arrangement as those of its larger and more striking kinsfolk. It is a native of China, but has been so long domesticated that it is said to be no longer found wild. Domestication has produced varieties of it, and has also induced diseases of various kinds, which have played great havoc with the rearing of silkworms in Southern Europe. It only thrives on the mulberry, while atlas, polyphemus, and others feed on oak, willow, elm, and many other trees. This worm spins a cocoon of glossy soft silk, from white to yellow in colour, and unquestionably when woven yields the most beautiful textile known.

Several attempts have been made to introduce the rearing of silkworms into England. Henry VI. and James I. lent it their patronage, and tried hard to induce people to plant mulberry-trees to feed the worms upon. But, though no success attended the production of silk, the influx of weavers from the Low Countries in the sixteenth century, and of the refugees who came here after the Revocation of the Edict of Nantes in the seventeenth century, made silk-weaving an important industry.

A guild of silk throwsters was incorporated in Spitalfields in 1585.

Tusseh or Tussoire silk on the other hand is a coarser, heavier fibre, and as the cocoons are larger than the mulberry moth, the yield is greater and the price consequently much less. Its scientific name is *Antheraea mylitta*, and in India it is not domesticated, for the moths so soon as they emerge from the chrysalis take flight. The natives look under the trees upon which the larva feeds, and upon finding evidence of their presence cut down the branches upon which the caterpillars are feeding, and place them near their homes on Asseen trees. The hill people guard the insects night and day to preserve them from crows and other birds by day and bats by night.

To wind the cocoons, for the silk is glued together with a secretion which the worm emits, the natives steep them for about two hours into plantain ashes and water, afterwards placing them in an earthen vessel until soft enough. The implement used for taking off the thread is a reel of four bars which is turned by the right hand. The thread of four or five cocoons is made to pass over the left thigh of the spinner who gives the thread thus formed a twist with his left hand on his thigh.

The natives of Central Africa use the fibre spun by a colony of caterpillars, which is found in large branches on trees, for the production of a fibre; but this has to be spun like cotton into a thread whereas in the silkworm and Tusseh, the cocoon itself is unwound. The silk from Cynthia cannot be wound but has to be spun. The web of spiders has been used, but the difficulty of collecting the webs and the impossibility of breeding spiders in numbers, confines such efforts to the region of scientific playing. The silky beard of a large bivalve found in the Pacific has also been used for weaving and in the museum at Oxford is shown a pair of gloves of a soft, warm, green colour made of a fibre spun from this fish beard.

Trap-door spiders have several times been kept in the insect house. Their habit of travelling in the ground and covering the entrance with a lid composed of particles of earth and other matter glued together with

a secretion is well known. The spider itself is larger and of thicker build than any in this country, and somewhat resembles a small tarantula.

Tarantulas are found in many parts of the globe; those from South Africa and Texas have both been on view in the gardens. They are forbidding-looking creatures, and though their bite is rarely if ever fatal to an adult it produces severe illness which may last several days. Those in the Zoo are fed on small mice and cockroaches.

In the sketch I have enlarged one of the feet to show how the creature can cling to glass, as the feet act not unlike a sucker.

Among the interesting insects I have sketched in this house the "walking sticks" are certainly the most unique. These creatures, classed under the name of Phasma, so nearly resemble dry twigs that when clinging to a shrub they are hardly visible. A case in the Natural History Museum is mounted to show how these insects and their allies the "walking leaves" are so like their surroundings as to be seen only when carefully searched for. This "protective mimicry," as it is called, though strikingly manifested in these creatures, may be said to be shown by all living forms to a greater or less degree, from the bars of black on a tiger's skin like dark reeds in the jungle to the colouring of insects to resemble their surroundings. These stick insects and walking leaves have so imitated their environment that finding them in a wild state is a matter of considerable difficulty. The colouring too changes with their surroundings which is a further help to them. There are an enormous number of species, three of them are shown in sketches, and they are found in North America, South Africa while Central America gives us some of the largest and most grotesque varieties. Ugly as they look these Phasma are purely vegetable feeders.

The "walking leaves" from Seychelles imitate their surroundings in a still more striking way, the body of the insect being green and marked just like a leaf.

Numbers of British moths and butterflies are also reared in this insect house, and I shall have something more to say about the former in the subsequent articles on butterflies.

FRED MILLER.

## SOME AUSTRIAN RECIPES.

*Vanilla Sugar.*—Vanilla sugar so often finds a place in Austrian cookery that a recipe for it must preface the following directions for making some very delicious dishes often enjoyed in that country. The pod of vanilla bean can be had at most grocers, and the flavouring it gives is most delicate and preferable to any of the liquid essences. Take a piece of this vanilla bean and some sifted sugar and pound the two together until quite fine. You must judge of the quantity of both vanilla and sugar by adding the latter gradually until on tasting it, it is well-flavoured with vanilla. Pass this through a sieve and keep it in a tin. When required for use add it to other fine sugar according to taste.

*Vanilla Crescents.*—Ingredients: Eight ounces of best flour, six ounces of fresh butter, three ounces of peeled almonds chopped very finely indeed, and two yolks of egg. Mix all this up with a knife on your pastry board, and then roll it out with a rolling pin. Cut the paste thus formed into small pieces and form them into little crescents about two or three inches long and as thick as your thumb—if you have a small hand. Bake in a very moderate oven, and remember that they must

not brown. Cover with finest vanilla sugar powdered thickly over them. These biscuits, if properly made, should be very light and extremely brittle. They keep good and fresh if placed in an air-tight tin.

*Lemon Soufflé.*—The Austrian recipe for the above is as follows:—

Ingredients: Five tablespoonfuls of sifted sugar, five yolks of egg, the flavour of one rind of a lemon, and the juice of one lemon. This should all be stirred for half an hour, and then a hard snow-like mixture should be added, made of the five whites of egg whipped until quite consistent. Bake about fifteen minutes in a brisk oven, in an ordinary pie-dish in which the mixture has been heaped up. Serve immediately it is done.

*Apricot Soufflé.*—Take five tablespoonfuls of apricot jam, passed through a sieve. Two spoonfuls of fine sifted sugar. Stir this up well for half an hour. Make a stiff snow of five whites of egg, and add very lightly to the above. Heap this up lightly in any pie or soufflé-dish, and ornament with some sliced almonds on the top. Bake from fifteen to twenty minutes in a brisk oven. Serve immediately it is cooked.

*Chestnut Cream.*—Boil some large chestnuts, peel them and pass them through a sieve. Mix with a little cream and vanilla sugar to taste. Heap part of this paste in the middle of a dish. With a fancy forcing bag make part of it into balls the size of a chestnut, and glaze these balls with sugar. Surround the centre heap with whipped cream, flavoured with vanilla sugar, on which the glazed chestnuts are to be laid.

*Chocolate Pudding.*—Dissolve three ounces of the best chocolate in half a pint of single cream which is on the fire. Let this get cold and then gradually mix it with two spoonfuls of flour and two ounces of white sugar. This should be done while the mixture is on the fire until it is of the consistence of a thick batter. Let this cool in one basin, and in another stir well two ounces of fresh butter with five yolks of egg; then add the cold batter and mix it up well. Next beat up five whites of egg until they are in a stiff froth, and add slowly but lightly to the aforementioned mixture. Bake this in a soufflé dish for about twenty to twenty-five minutes. The same mixture can be made with essence of coffee instead of the chocolate.