

these insects is very interesting and shows very strikingly that an insect that is troublesome or destructive in one stage may be very serviceable in another. Riley has shown that the larvæ feed upon the egg masses of grasshoppers in the ground, where the eggs are laid by the

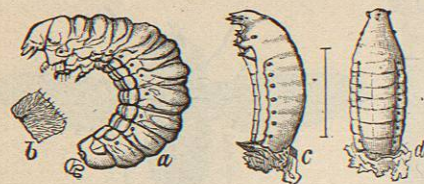


FIG. 2902.—a, Lateral view of the ultimate or full-grown stage of the second larva of *E. vittata*; b, portion of the dorsal skin showing short setaceous hairs; c, lateral view of the pseudo-pupa or coarctate larva of *E. vittata*, with the partially shed skin adhering behind; d, dorsal view of the same. (After Riley.)

adult beetles; furthermore, that there is a distinct hypermetamorphosis. The egg hatches into a carabid-like larva with legs and active habit, and this form proceeds to search out the locust eggs and feed upon them and at its first moult changes its form to become much thicker; and after another period of feeding it moults again, changing this time to a still thicker form and having the mouth parts and legs become atrophied. After still another period it moults again with little change except in size, and finally after another period it forsakes the egg mass and burrows into the soil to assume the pupa stage. The changes here sketched most briefly are shown very fully in the accompanying figures.

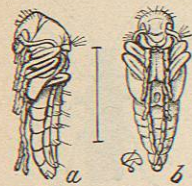


FIG. 2903.—a, Lateral view of true pupa of *Epicauta cinerea*; b, ventral view of same. (After Riley.)

The vesicant property is due to a peculiar volatile, crystalline chemical principle, *cantharidin*, which is very soluble in alcohol, ether, or essential oils. Externally it produces blisters and internally it is a violent irritant poison. It is said that gr. $\frac{1}{10}$ on the lip will rapidly cause a blister. Its use is mainly as a topical application in cases of indolent ulcers or as an excitant.

Mylabris cichorii, the "Telini fly" of India, possesses

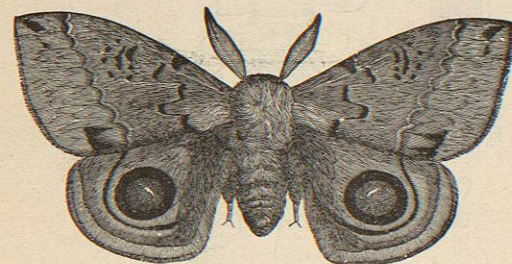


FIG. 2904.—*Automeris io*. Male moth. Natural size. (After Riley.)

also very strong vesicating properties equal to or greater than those of the preceding species.

Lepidoptera, moths and butterflies. Wings four in number and covered with minute imbricated scales, appearing as fine dust; mouth parts developed into long suctorial tube for feeding upon the nectar of flowers, though in some cases rudimentary, and the adults not feeding. A complete and striking metamorphosis, the

early stages being called caterpillar and chrysalis for larva and pupa. None of these insects is poisonous in the adult stage, but a few have larvæ that possess urticating properties, or that poison or irritate the skin either from the presence of a poisonous fluid or the breaking off

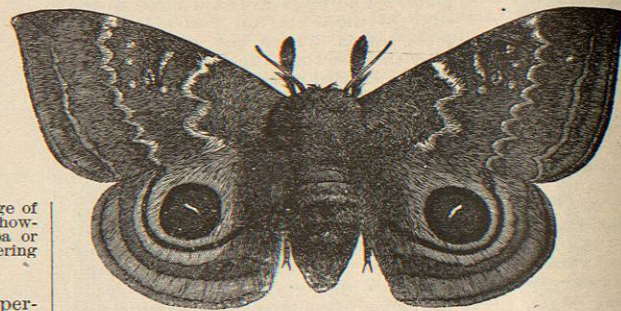


FIG. 2905.—*Automeris io*. Female. (After Riley.)

of minute spines. Some which are popularly supposed to be poisonous are perfectly harmless, as is the case with the large tomato worm *Phlegothontius celeus*.

The species which possess injurious properties belong mainly to a few families of the night-flying *Lepidoptera*, and include some of our very common species.

Automeris io, Io moth. A very handsome moth, the male considerably smaller than the female, brighter colored, deep yellow marked with purple brown, the body and the hind wings being of a deep ochre color; the antennæ are large, plumose. The female is darker with predominance of purple, the markings on the front wings somewhat differently arranged. The cream white eggs have a small black spot on the apical end. They are laid on leaves of various plants, the insect having a wide range of food plants, such as willow, corn, cotton, hops, clover, elm, cherry, etc. The larvæ are of a green color, and when full grown have longitudinal stripes on the sides of white and lilac red. The spines arise in clusters from papillæ and have various shapes, some with few and others with many tips. The spines are evidently connected with glands which secrete the urticating fluid, and when broken off in the skin produce an intense netting sensation. Aside from the spines the io



FIG. 2906.—*Automeris io*. Larva. Natural size. (After Riley.)

caterpillar possesses eversible organs on the fourth and tenth segments which probably serve to drive off some of their enemies, but they do not appear to have anything to do with the urticating property.

Hemitevea maia Drury, buck moth. Another handsome moth the larva of which possesses urticating spines, but less severe in their action than those of the Io. The larvæ are brownish-black, covered with more or less conspicuous small, oval, yellow protuberances, with a lateral yellow stripe made up of papillæ and broken, irregular yellow marks.

Empretia stimulea Cl., "saddle back." A brown caterpillar with a very distinctive saddle-shaped green spot on the back. The poisonous spines are set on large processes at anterior and posterior ends and along the sides. Here probably the poison is secreted in the larger processes and fills the small spines so that when they are broken off in the skin they cause the smarting sensation. The moth is of a rich brown color but not so striking in appearance as the larva. The larva

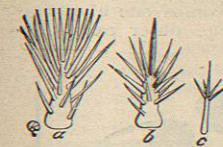


FIG. 2907.—*Automeris io*. Poisonous spines. Enlarged. (After Riley.)

occurs on a variety of plants, such as corn, cotton, and various trees and shrubs, but fortunately is not a very abundant species. It is also conspicuous enough to attract attention and hence less likely to be brought in contact with the hand.

Lagoa crispata opercularis Harr. is another urticating species, the poisonous spines being hidden beneath a clothing of long hairs. In the tropics are a number of related species which are much feared by the natives.

In Europe the processionary caterpillars, *Cnethocampa processionæ*, are counted objectionable on account of the urticating properties of a farinaceous substance derived from drying of an acrid secretion from the entire surface of the body. It is particularly irritating on contact and especially on delicate mucous surfaces as in the air passages. Workmen in forests where the caterpillars are plentiful are reported to sicken rapidly from this cause. The long hairs under the microscope are seen to be branched, and are said to be filled with formic acid. When broken off in the human skin, they produce a terrible itching and burning sensation. There are many cases on record in which such hairs have found their way by some means to the interior organs of people and animals, producing dangerous inflammation, resulting even in death. Certain Brazilian species are reported to be even more distressing in the effects produced on the human skin. Ammonia may be used to relieve the irritation.

Hymenoptera, bees, wasps, ants. Four membranous wings, the hinder ones the smaller; mouth parts adapted

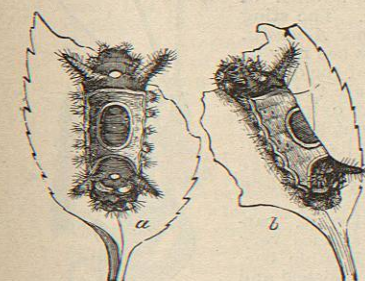


FIG. 2908.—*Empretia stimulea*. Natural size. (After Riley.)

for either biting or sucking; the body regions sharply marked; the abdomen connected to the thorax in most forms, by a slender pedicel. This group includes very poisonous and aggressive species provided with a sharp sting, in a large portion of the group, from which a distinct poison is discharged. Even in the *Terebrantia*, in which the sting is not so specially developed, there are some species, as in *Ophion* and other ichneumonids, which may pierce the skin with the ovipositor, giving a quick, sharp sting that is momentarily very painful but seldom of any lasting effect. In the *Aculeata*, or true stinging forms, there is an elaborate sting modified from the ovipositor, and hence present only in the females, through which the secretion of large poison glands is discharged. Carlet found the poison glands of the bee to con-

sist of two kinds, one secreting a feebly alkaline fluid, and the other an acid product. The poison is effective only when the two are mixed. In those which poison with the sting both kinds of glands are well developed; while in those forms which paralyze their victims to preserve them as food for their larvæ, the alkaline glands are vestigial. In ants, wasps, and bees there are two substances, according to Will, viz., formic acid and a bitter

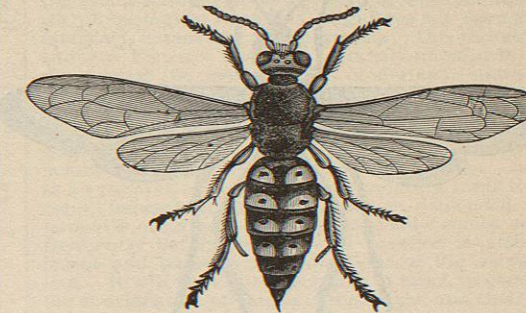


FIG. 2909.—*Sphectus speciosus*. Giant digger. (After Riley.)

fatty residue, the formic acid being the essential part of the poison. In some ants the sting is wanting, but the poison glands are extraordinarily developed.

Formicidae, ants. The ants usually seen are the wingless workers which are noticeable for their large heads and jaws, and their sharply separated abdomen. The males and females are winged, but the latter lose the wings after being fertilized and taking up their duties as the mother of a colony. The workers which are undeveloped females have, like the queens, a sting, and in some forms it is used with severity upon any disturber. In other species the bite is poisonous, being accompanied with an injection of formic acid. The colonies when disturbed attack the intruder with great fury, and some of the larger species inflict such serious wounds that death is said to result from their attacks.

Mutillidae, "velvet ants," "cow-killers." Brightly colored ant-like insects with a dense covering of hair giving them a velvety appearance. The body is exceedingly hard, very difficult to crush, and the sting is quite severe. They occur particularly in open and sandy places and seldom sting unless caught.

Fossoræ, digger wasps. This group includes a large number of our common wasps, among them some of the most poisonous we have.

While as a rule inclined to attend strictly to their own affairs and not to sting except on provocation, they will sometimes make unprovoked attacks. They agree in constructing nests in the ground, are mostly strong-bodied, and capture other insects or spiders with which to provision the nests for their young. The stings they inflict on these victims are directed to the nerve centres and serve to paralyze but not to kill, so that they are kept fresh but helpless till such time as the young hatch and are ready to feed upon them.

Sphecius speciosus Drury. This is one of the largest species, and a common insect in the Central and Southern States. It provisions its nests with Cicadas, which are frequently much larger than itself. Its sting is very

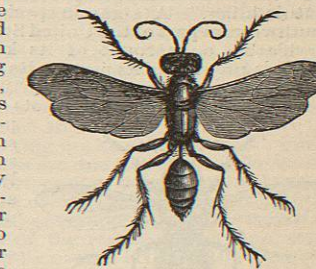


FIG. 2910.—*Chlorion cerulium*. Blue digger wasp. (After Riley.)

severe, and Riley states that two or more inflicted on a man at one time might easily endanger his life. It may certainly be counted as dangerous as the scorpion and ought never to be provoked to try its power.

Chlorion carulivum Drury. A handsome blue species with dusky wings. It occurs very frequently around

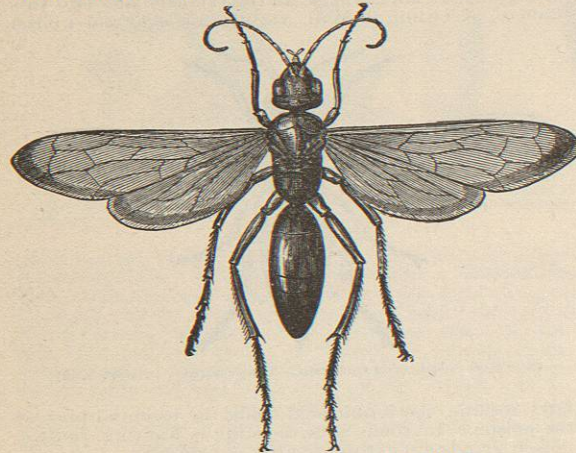


FIG. 2911.—*Pepsis formosa*. (After Riley.)

houses, seeking spiders which it captures, stings, and stores away in its nest for its young. Its sting, while not so severe as that of the preceding species, is by no means to be despised, and since it is a more frequent visitor in houses it is more likely to be incited to attack.

Sphex ichneumonea L. is a large species with brilliant golden markings. It frequents flowers and captures meadow katydids to store in its nests which are placed in gravelly walks or along roadsides where the ground is very hard.

Sphex pennsylvanicus L. is another common species equalling the preceding in size, but of a brilliant blue-black color.

Pepsis formosa Say, "tarantula killer." A gigantic species, which occurs in the Southwestern part of the United States, where it is counted serviceable on account of its killing tarantulas, with which it provisions its nests. Its sting is very poisonous.

Pelopaeus cementarius Drury, "mud dauber." A dark species, with yellow lunate spots and with a very slender petiole supporting a small abdomen. This species is very frequently noticed in houses, in attics, or even in much-used rooms, where it can gain access through some crack, and in barns, sheds, and tents. Its nest is constructed from pellets of mud, and the cells each containing a larva are stored with small spiders. They seldom molest people, even when passing very near them to reach the nest, but sting severely if provoked, and their presence is in itself annoying on account of the fear. There are many related species, some of which also build nests in houses.



FIG. 2913.—*Vespa maculata*. (After Riley.)

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Vespa, paper wasps. Wings folding longitudinally when at rest; bodies rather robust, the abdomen attached by a short pedicel. All the species sting viciously when disturbed, and do not always wait for any serious provocation. Two species may serve as examples of the group.

Vespa maculata L., bald-faced hornet. A heavy-bodied species with light yellow, almost white face, and yellow spots on the thorax and abdomen. The large nest is built by degrees of a strong gray paper and contains, when fully formed, a number of combs one above another all enclosed within the large outer case. The



FIG. 2914.—*Polistes*. (After Riley.)

opening is at the lowest point and the whole nest is hung by a stout cord to a branch of a tree or the under side of a fence rail or other suitable support. If disturbed these hornets make a fierce attack on the intruder and a number of stings will cause pretty serious symptoms and a number of stings will cause pretty serious symptoms and a number of stings will cause pretty serious symptoms. Applications of ammonia, glycerin, bicarbonate of soda if made promptly will much relieve the swelling and inflammation.

The "yellow jackets," *Vespa vulgaris* L. and *V. germanica* F., are smaller, but similar in habit, and fully as vicious.

Polistes pallipes St. Farg. The more slender species included here also build paper nests, but only a single comb and this without any outer case; so the growing larvae may be easily seen by any one with sufficient nerve carefully to inspect the nest. They are frequently built in houses in window frames and the wasps may become troublesome as the number increases and they grow irritable.

Apis, bees. Robust, usually hairy, the mouth parts with a long tongue adapted to lapping the nectar from flowers. This family includes the bumble bees and the honey bee as well as a large number of species less familiar. The sting is like that of the other *Aculeata*, and that of the honey bee may be noted as an example of the others. The principal parts are the three pieces of the normal ovipositor, the centre one of which constitutes a sharp lancet-like instrument. At its base is the large poison reservoir fed by the poison gland.

Xylocopa virginica Drury, "carpenter bee." This species very much resembles a bumble bee, but has the abdomen polished and without hair. They bore into wood to construct nests and so may prove troublesome around houses, as their sting is very painful.

Bombus spp. The common bumble bees are very familiar objects, several different species occurring in almost any locality. They build nests in holes in the ground or, rarely, in deserted bird nests or other places at some distance above ground.

Apis mellifera, honey bee. The domesticated bee



FIG. 2915.—Sting of Bee. Enlarged. a, Tip of lancet, still more enlarged. (After Gosse.)

now represented by several varieties. They are the most frequent source of stings since they are so commonly kept in the vicinity of houses. The sting affects different persons very differently, some suffering intensely from a single sting, while others suffer no inconvenience, after the temporary pain, from a number of stings. Inflammation, rapidly extending from a sting on the hand even so far as the length of the arm, and sometimes so as to close the eyes, may follow. Prompt application of ammonia, bicarbonate of soda, or even of moist clay will serve to give relief.

Herbert Osborn.

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INSOLATION. See *Heat-Stroke*.

INSOMNIA is defined as the loss of the normal amount of sleep, and this involves a recognition of the fact that with different individuals different amounts of sleep constitute what is normal to each. Absolute loss of sleep is of much less frequent occurrence than the statements of patients would indicate. When such is the case, it is a symptom of serious import, and the statement impresses upon one the fact that as the absolute so also the minor degrees of this abnormality are to be regarded as symptoms. Often they are of great significance, but still rather as indications of the existence of morbid states, which it therefore becomes the duty of the practitioner to look for and treat, than as in themselves diseases which demand the direct application of remedies. In other words, the physician should not feel that he has done his duty by his patient in simply prescribing hypnotic drugs, though this may often be all the sufferer expects, but should search out the causes which underlie this symptom and endeavor to remove them and incidentally this one of their results. Of course there are many cases coming under our attention in which the chief object of treatment is the relief of the insomnia, in which the habit of sleeplessness once broken up, we may expect the bodily functions to be restored and strength recovered; but he will probably achieve the best results who endeavors to ascertain the causes leading to the loss of sleep in each instance and to base his therapeutics upon a classification of such causes.

Recognizing that sleep is a normal and healthy function, it is quite in accord with the best traditions of medical science to endeavor to understand its mechanism and relation to other vital phenomena as a foundation for the study of its abnormalities; in other words, to make physiology the guide to pathology. It has proved, however, to be a difficult problem, and no conclusion seems to have been reached which is accepted as wholly satisfactory. The following statement by Professor Howells is an expression of recent views of an acknowledged authority. "We might therefore say that three factors combine to produce normal sleep. I. A diminution of irritability, caused by fatigue, of large portions of the cortical area. II. Voluntary withdrawal of sensory and mental stimuli involved in the preparations for sleep. III. A diminished blood supply to the brain, owing to a relaxation of tone in the vaso-motor centre and the fall of general arterial pressure thereby produced. The last factor is the immediate cause of sleep and explains its comparatively sudden and nearly simultaneous occurrence over the entire cortex."

As a foundation for a theory of therapeutics applied to insomnia, the view of a diminished blood supply to

the brain as a feature of normal sleep has been very attractive, and many attempts have been made to explain the action of well-known hypnotics or to base new methods of combating the trouble upon the accepted or supposed action of such remedies in increasing or diminishing the blood supply of the brain. Such efforts have contributed to an intelligent study of the causes of insomnia, and analysis of the reasons why certain remedies succeed in certain cases, but have sometimes been less successful than their authors have expected, because the theories of the physiological causes of sleep have not been fully established (Granville, R. Ferguson). The former author adduces Bichat's view that general or complete sleep is the sum of the special sleeps or dormant states of the various faculties or senses, while Ferguson contends that hyperæmia is sometimes accompanied by sleep, which to be sure may not be very good, and likewise that anæmia leads to a sleep just as far from normal. Their arguments are against the routine use of soporifics. Insomnia as a symptom most constantly presenting itself for treatment, independently of medication demanded by the patient's other requirements, probably comes up most frequently before those whose practice is among the insane and patients with affections of the nervous system. It will be well to keep this in mind, in considering the classification of causes of insomnia, and their indications for treatment, for the general practitioner will find quite a different class of causes predominant in his daily experience from those met with by the asylum specialist.

A few words should be said on the results of insomnia. Manacéne, for example, ascribes to the injurious effects of imperfect and broken sleep the interruption of the nutrition of the tissues. Duval says insomnia leads to emaciation and debility, and in sickness, when prolonged, is an unfavorable sign. Bulkley tells us of eczema appearing as a result of long-continued loss of sleep. These statements are of course quite apart from what might be said of insomnia as a precursor of insanity or cerebral disease.

Most writers on this subject give a grouping of the causes they recognize as predisposing to or directly inducing insomnia. Thus Tuke ranks among the predisposing causes the female sex, old age, nervous temperament, intellectual pursuits; while among exciting causes he mentions organic or functional diseases of the brain, worry, anxiety, grief and bodily pain, noise if not monotonous, fever, coffee, tea, etc. Sanger Brown divides insomnia into functional, symptomatic, and that of insanity, and states that neurasthenia is often sooner or later associated with the first of these. He also quotes Folsom as specifying the following causes or conditions of insomnia, viz.: habit, such reflex causes as indigestion and genitourinary disorders, autotoxic causes, such as gout, lithæmia, syphilis, habitual constipation; then anæmia, vaso-motor changes, neurasthenia, hallucinations of sight or hearing, astigmatism, and the neurotic temperament. These brief quotations indicate in how many ways this question of etiology presents itself to different trained minds. Among them I find no more comprehensive and simple classification than that of Professor Bradbury in Allbutt's "System of Medicine." I cannot give it *in extenso*, but the following are its chief features: First, *Irritative Causes*, such as are due to pain and like uneasiness, comprising such various ones as teething in children, eye-strain, the irritation of an eczema, the discomforts often following a surgical operation, even when pain is absent, various affections of the respiratory organs, especially when accompanied by cough, acute inflammations of the serous membranes, many tumors and surgical diseases. Insomnia from many of these may involve other etiological factors, but *pain* is the predominant one and that which necessitates treatment.

Second, *Toxic Causes*. In many diseases a toxic agent is present in the blood. Such are alcoholism, the exanthemata, most of the zymotic diseases, dyspepsia and intestinal disorders, gout, Bright's disease. To these he adds, under this heading, heart disease and altered vascular conditions, though in them the insomnia may be