THE CURIOUS LIFE-HISTORY OF OUR BLISTER BEETLES.

BY PROFESSOR C. V. RILEY.

Along with the honey bee, the silkworm, and the cochineal, the Spanish fly, or cantharis, ranks among the insects most useful to man. Everyone is familiar with this last insect, as it is found in our drug stores, and with its blistering properties; but the fact is not so well known that we have in this conntry several allied species which have the same valuable vesicatory property. Their curious habits in the preparatory stages formed the subject of a recent communication of mine to the St. Louis Academy of Science, the substance of which I propose to lay before the readers of the SCIENTIFIC AMERICAN in two papers, first narrating what has been made public of the habits of the family, and afterwards what has been recently discovered by myself.

The larval habits of the European cantharis of commerce, as also those of its congeners in our own country and other parts of the world, have remained a mystery, notwithstanding the frequency with which the beetles occur, their great abundance at times, and their commercial value and interest. The same remark holds true of all the blister beetles in this country. Some of these species are very common in the United States, and quite injurious to vegetation, swarming at times on potato vines, beans, clematis, and other plants. Their great numbers and destructive habits make it all the more remarkable that so little has hitherto been discovered of their early life. Harris, who evidently had hatched the first larva of the ash-gray blister beetle (*macrobasis unicolor*, Kirby), says: "The larvæ are slender, somewhat flattened grubs, of a yellowish color, banded with black, with a small reddish head, and six legs. These grubs are very active in their motions, and appear to live upon fine roots in the ground; but I have not been able to keep them till they arrived at maturity, and therefore know nothing further of their history."

Latreille states that the larvæ live beneath the ground, feeding on the roots of vegetables, but the statement is evidently founded on conjecture. Ratzeburg, who well describes the method of oviposition of the European *cantharis vesicatoria*, and roughly figures the first larva, believed that it was a plant feeder in the immature state. Audouin, who studied the cantharides profoundly, making them the subject of his thesis in his medical examination, was obliged to confess that absolutely nothing was known of their larval history; and Mr. Wm. Saunders, of London, Ont., in a paper on the same subject, read at the 1876 meeting of the American Pharmaceutical Society, could add nothing more definite. Among the older writers, the opinion was general that, like their parents, the blister beetle larvæ were vegetable feeders.

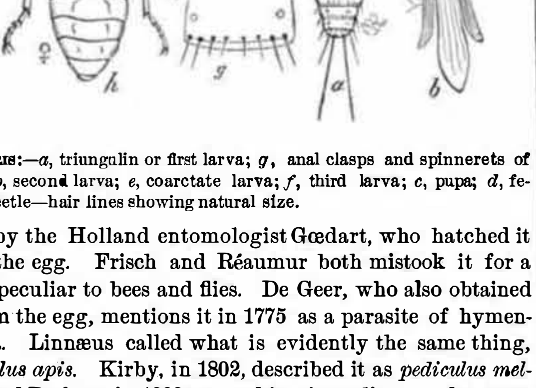
M. J. Lichtenstein, of Montpellier, France, has endeavored to discover the larval habits of the European species, and in 1875 he succeeded, after many fruitless attempts, in causing the first larva to feed on honey kept in glass tubes, and to undergo one molt. He afterwards kept two other specimens in the same way until they were nearly full grown.

These facts, as well as analogy, point to a parasitic life and partly carnivorous, partly mellivorous diet for our own common species, since the life-history of genera in the family, namely, *meloe*, Linn., and *sitaris*, Latr., has been fully traced. Indeed, the young of all the insects belonging to the *meloidæ*, which includes the blister beetles, so far as anything has yet been known of them, develop in the cells of honey-making bees, first devouring the egg of the bee and then appropriating the honey or bee-bread stored up by the same. They are all remarkable, in individual development, for passing through seven distinct stages, namely, (1) the egg; (2) the first larva or *triungulin*; (3) the second larva; (4) the pseudo-pupa or coarctate larva; (5) the third larva; (6) the true pupa; and (7) the imago.

HISTORY OF MELOE.

The history of *meloe*, popularly known as the oil beetle, may be briefly summed up as follows; The newly hatched or first larva (now generally called *triungulin* from its characteristic three claws to the tarsus), was first mentioned in

Fig. 1.



SITARIS:—*a*, triungulin or first larva; *g*, anal clasps and spinnerets of same; *b*, second larva; *e*, coarctate larva; *f*, third larva; *c*, pupa; *d*, female beetle—hair lines showing natural size.

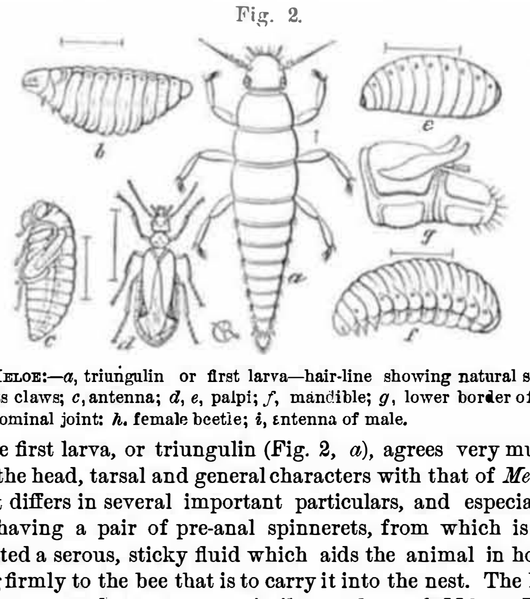
1700 by the Holland entomologist Gœdart, who hatched it from the egg. Frisch and Réaumur both mistook it for a louse peculiar to bees and flies. De Geer, who also obtained it from the egg, mentions it in 1775 as a parasite of hymenoptera. Linnæus called what is evidently the same thing, *pediculus apis*. Kirby, in 1802, described it as *pediculus melittæ*, and Dufour, in 1828, named it triongulinus andrenetarum. Newport, in 1845, first rightly concluded that it was carried into the nests of bees, and described in addition the full grown larva from exuvial characters, and the coarctate larva and pupa which he found in the cells of a mason bee (*anthophora retusa*). He failed, however, to fill the gap between the first and the full grown larva, and this Fabre first did, inferentially, in 1858, by tracing the analogous stages in sitaris.

The female *meloe* is very prolific. She lays at three or four different intervals, in loose, irregular masses in the grouna, and may produce from three to four thousand eggs. These are soft, whitish, cylindrical, and rounded at each end. They give birth to the triungulius which, in a few days after hatching—the number depending on the temperature—run actively about and climb on to Composite, Ranunculaceous and other flowers, from which they attach themselves to bees and flies that visit the flowers. Fastening alike to many hairy Diptera and to Hymenoptera which can be of no service to them, many are doomed to perish; and only the few fortunate ones are carried to the proper cells of some *Anthophora*. Once in the cell, the triongulin falls upon the bee egg, which it soon exhausts. A molt then takes place and the second larva is produced. Clumsy and with locomotive power reduced to a minimum, this second larva devours the thickened honey stored up for the bee larva. It then changes to the pseudo-pupa, with the skin of the second larva only partially shed; then to a third larva within the partially rent pseudo-pupal skin; and finally to the true pupa and imago. These different changes of form are known by the name of Hypermetamorphoses, the term first given them by Fabre to distinguish them from the normal changes from larva to pupa and imago, experienced by insects generally.

HISTORY OF SITARIS.

The history of *Sitaris* is also well known, and agrees very closely with that of *Meloe*. The complete life history of the genus was first given by Fabre in 1857, who studied the *S. humeralis*, Fabr., while that of *S. colletis*, V-M, has been more recently given by Valery-Mayet of Montpellier, France.

Fig. 2.



MELOE:—*a*, triungulin or first larva—hair-line showing natural size; *b*, its claws; *c*, antenna; *d*, *e*, palpi; *f*, mandible; *g*, lower border of an abdominal joint: *h*. female beetle; *i*, antenna of male.

The first larva, or triungulin (Fig. 2, *a*), agrees very much in the head, tarsal and general characters with that of *Meloe*, but differs in several important particulars, and especially in having a pair of pre-anal spinnerets, from which is secreted a serous, sticky fluid which aids the animal in holding firmly to the bee that is to carry it into the nest. The hypermetamorphoses are very similar to those of *Meloe*. The The triungulin, after absorbing the contents of the bee egg, molts, and thereafter floats upon and devours the honey; the the pseudo-pupa, third larva, and true pupa all forming in due time with the second larval skin. The female does not feed, and on account of her heavy abdomen, travels but a short distance from the bee burrows where she developed.

Test on the Covering of Steam Pipes.

The building committee having in charge the erection of the several structures on the Trinity College site, at Hartford, Conn., recently instituted on the premises some experiments with materials at present extensively used for covering of steam pipes, whereby radiation of heat is prevented and condensation and freezing prevented. As there are about 8,000 lineal feet of pipe, varying in diameter from two to six inches, in the buildings, the question regarding the best and most suitable non-conducting material for this purpose became an important one. After the reception of tenders by competing firms for the covering of the pipes, it was deemed best to make an exhaustive test upon a portion of the pipe. Accordingly samples of pipe covering were put on by the following companies: The H. W. Johns' Manufacturing Company, the Asbestos Felting Company, the United States and Foreign Salamander Felting Company, and the Chalmers-Spence Company, all of New York.

The samples were placed around a six inch pipe to the satisfaction of the respective parties. A wooden box was constructed with an open bottom and two of the sides cut in a semicircle to fit closely to the covering. A light of glass was fitted in one side of the box, through which a thermometer could be seen suspended from the top until it hung within an inch of the pipe covering. This done, all cracks or openings were securely fastened up so that the box was perfectly airtight. The H. W. Johns Company's covering consisted of one and a half inches of asbestos mixed with other ingredients, upon a lining of heavy felt paper laid next the pipe. During thirty minutes in which this test was made the thermometer rose from 97° to 103°. The Asbestos Felting Company's covering, two inches in thickness, was next tried, and in ten minutes the thermometer rose from 97° to 102°, and in half an hour from 97° to 105°. The patented "Air-space" covering of the Chalmers-Spence Company was next tested. This, as the name indicates, is a method of covering by which a dead air chamber is formed between the covering and the surface covered. This air space is formed in the following ingenious manner: Heavy wire cloth is used, to which is fastened every four or six inches a stud one inch or more in length. The wire cloth is then placed over the surface to be covered, the studs keeping it at the proper distance. Plastic covering is then applied to the thickness of half an inch, and this partly penetrates the meshes of the wire cloth and keys itself, thus giving a strong durable hold. The second coat of plastic is then applied and finished smoothly. At this test the thermometer did not rise above 94°, the time allowed being thirty minutes. A test was also made of the "plain" covering made by the same firm. This consisted of one and a half inches of the composition used in the first method, without the air space. During thirty minutes when it was tested the thermometer rose from 97° to 102°. On the application to the Salamander covering, consisting of one and a half inches of cement, the thermometer rose from 97° to 102°. All the the above tests were made under a pressure of ten pounds of steam. A synopsis of these trials, as communicated to us, is as follows:

Covering.	Test commenced when thermometer reached	Rose in 30 minutes to
H. W. Johns' Manufacturing Co............	97°	103°
Asbestos Felting Co.	97°	105°
U. S. and Foreign Salamander Felting Co...	97°	102°
Chalmers-Spence Co.'s "plain"............	97°	102°
Chalmers-Spence Co.'s "air space".........	90°	94°

During the test the method employed was to watch the thermometer inside the box until it indicated a temperature of 97°, when, after leaving it in for thirty minutes, the temperature was again noted. But in testing the "air space" covering the temperature was so much less than the others, that after waiting until the thermometer indicated 90° it was found that it would not reach over 94°, although left in over one hour.

It was thus demonstrated that the "air space" covering showed the best results, and the contract was accordingly awarded to the Chalmers-Spence Company.

On the Manufacture of Plaster Casts.

BY J. J. MERTINS.

There are two little points which require special care in casting plaster of Paris: one is greasing the article to be moulded, and the other is stirring up the gypsum with water. For the first purpose it does not require a penetrating fat, but one that remains on the surface and covers it. In making the paste, water must not be poured upon the plaster of Paris, but the latter must be strewn in as loose condition as possible upon the water until the plaster reaches the surface of the water, and then quickly stirred together. The substance employed to oil the moulds is prepared by adding some fatty oil, generally lamp oil, to a solution of soap in water; this is called "smear."

If, for example, a rosette 12 inches in diameter is to be cast on a 4 inch high rim, the following method is employed. The pattern made by the artist in gypsum must be repeatedly coated with shellac solution, to prevent, as much as possible, the oil from penetrating and make it easier to separate the casting from the model.

The wedge-shape pieces that are to form the vertical part of the rosette are cast first and are three in number, a strip of clay being used to form three sides of the first one, two sides of the second (for a side of No. 1 forms one side of No. 2), and one side of the third, for this is bounded on two two sides by Nos. 1 and 2.

Each part of the mould must be varnished and greased or oiled before a second part is cast in contact with it, to insure separation when dry. The surface of the model is again carefully oiled and a cast made of the whole model without taking away the side pieces, but making a fresh wall of clay close about the model. To preserve the necessary sharpness and avoid bubbles, and bare places, the first layer of plaster poured upon the model should be as thin as possible, and a soft pencil be employed to remove bubbles and bring it into contact with the edges and cavities. Thick plaster is next poured upon this and finally the thick sediment can be scraped out upon the cast and smoothed off. In a short time it can be removed from the model, the side pieces taken apart, and all carefully dried. Before making a cast from this mould the separate parts are placed together, after oiling, backed up and adjusted with clay walls, etc.

The Coquito Palm.

In Chili a sweet syrup, called *miel de palm*, or palm honey, is prepared by boiling the sap of the *jubœa spectabilis* to the consistence of treacle, and it forms a considerable article of trade, being much esteemed for domestic use as sugar. The sap is obtained by the very wasteful method of felling the trees, and cutting off the crown of leaves, when it immediately begins to flow, and continues to do so for several months, until the tree is exhausted, providing a thin slice is shaved off the top every morning, each tree yielding about 90 gallons. The small nuts, which resemble miniature cocoanuts, are used by the Chilian confectioners in the preparation of sweetmeats, and by the boys as marbles.—*Journal of Applied Science.*

TO REMOVE rust from steel, cover the metal with sweet oil well rubbed in; 48 hours after rub with finely pulverized unslaked lime.