

# THE NATURAL HISTORY REVIEW:

A  
QUARTERLY JOURNAL OF BIOLOGICAL SCIENCE.

---

## Reviews.

---

### XIII.—THE WRITINGS OF M. FABRE.

OBSERVATIONS SUR LES MŒURS DES CERCERIS. Ann. des Sci. Nat.  
Tome IV. Ser. 4.

ETUDE SUR L'INSTINCT ET LES MÉTAMORPHOSES DES SPHÉGIENS.  
Ann. des Sci. Nat. Tome VI. Ser. 4.

MÉMOIRE SUR L'HYPERMÉTAMORPHOSE ET LES MŒURS DES MÉLOÏDES.  
Ann. des Sci. Nat. Tome VII. Ser. 4.

RECHERCHES SUR L'ANATOMIE DES ORGANES REPRODUCTEURS ET  
SUR LE DÉVELOPPEMENT DES MYRIAPODES. Ann. des Sci. Nat.  
Tome III. Ser. 4.

MISS MARTINEAU in her "Eastern Life" expresses her wonder that after a co-existence of 6000 years or more we cannot understand the language of a single animal. But how few men are there who make any effort to do so. Even among naturalists, how large a proportion catch but to kill, and study only the dead. In Entomology we have had but two Hubers, nor can we be said yet to understand thoroughly the habits of a single insect. The most startling discovery of the last few years relates to a species which has been domesticated from time immemorial. Gladly, therefore, do we welcome an Entomologist who steps boldly out of the common path; in some cases, indeed, we may feel disposed to think that M. Fabre's enthusiasm leads him to attribute to his favourites, feelings of which we can hardly suppose them capable; but we cannot criticise what we have enjoyed so much, and the error, if it be one, throws an additional charm over his writings. Out of the many species whose manners and customs are described by M. Fabre, we must confine ourselves to three; and even then we cannot in so short an abstract do anything like justice to the wit and brilliancy of the original.



In the memoir which we have placed at the head of this article, M. Fabre devotes himself to the genus *Cerceris*.

In the latter part of September, this insect, which is one of the solitary wasps, begins to hollow out a sort of gallery in the earth—horizontal or vertical, according to the species—and to enclose therein her progeny, together with the food destined for their future support. She shews herself in no wise particular as to the nature of the soil in which she works, provided it be perfectly dry, and exposed during a great part of the day to the heat of the sun. She takes ingenious advantage of any projection in the ground, or bunch of weeds, under the shelter of which she can pierce her gallery, and thus add as it were a peristyle to her dwelling. Though the *Cercerides* do not form themselves into communities, M. Fabre observes that they generally choose to live near each other, and the nests lie close together, to the number of eight or ten. It is curious to watch the labours of these insects in forming their habitations, and the patience with which they drag up successive heavy loads of sand, and eject it from the entrance of their holes. The sight of their tiny jets of sand constantly recurring attracted the attention of M. Fabre, in the first instance, to these little excavators. He watched them, resting from their labours and basking in the sun, the females often flying to the surrounding trees, pursued by the males, who hover about, idle spectators of the toil carried on before their eyes. Fights frequently ensue between them for the possession of some particular female, who sits an apparently unconcerned beholder of the struggle for supremacy, and, when the victory is decided, quietly flies away in company with the conqueror. The males, which are only half the size of the females, do not condescend even to enter the galleries which are in course of excavation; and neither by carrying a single grain of sand, nor by assisting in the subsequent troublesome task of collecting provisions for the young, do they share in the industry around them. Having completed the nests for the reception of her eggs, it now remains for the thoughtful parent to provide the nourishment requisite for her young, when they shall emerge from the shell. The victim chosen for this purpose is a large *Curculio* (*Cleonus ophthalmicus*). On her return from a foraging expedition, the *Cerceris* may be seen flying homewards, heavily weighed down by her prey, which she embraces, the underside of her body opposed to that of her victim. Alighting at a short distance from her hole, she proceeds to drag the *Cleonus* painfully up to the entrance of its prison, often slipping back, and rolling with it down among the loose grains of sand, only to recommence undauntedly her toilsome ascent. M. Fabre had the curiosity to weigh both the *Cerceris* and her prey; the first averaged 150 milligrammes, the second 255; a fact which would render the flight of the *Cerceris* a matter of considerable surprise to any one not aware of the great muscular power possessed by insects.

Either by robbing her nest of the prey, or by attacking the *Cerceris* at the moment when she arrived with her booty, and forcing



her by means of a straw to relinquish it, M. Fabre succeeded in possessing himself of about 100 Curculios. The insect to which he directed his attention is not the *Cerceris Bupresticida*, which attacks indiscriminately all the Buprestes, but one of its congeners, and more exclusive, apparently, in its tastes; as all the Curculios he examined belonged, with one single exception, to the same species.

It is difficult to see why, of four kinds of *Cerceris*, two should make choice exclusively of Curculios, two of Buprestes; thus restricting their chance of finding victims within such narrow limits: and the total want of outward resemblance between Curculios and Buprestes also raises the question why these two groups especially are selected. As, however, we shall see hereafter, this problem has been satisfactorily solved by M. Fabre.

After what has been written on the subject by M. Dufour, it is needless to state that the Curculios examined by M. Fabre, though deprived absolutely and entirely of all power of motion, were still not *dead*. In fact, from their freshness of colour, suppleness of membrane, and general internal condition, it was almost impossible to realize their being utterly incapable of the least movement. Through heat sufficient to have dried up any animal which had suffered ordinary death, through damp which would have caused rapid decomposition, M. Fabre preserved these beetles in paper cornets or in glass tubes: and after a fortnight the viscera were as fresh, the act of dissection was as easy, as they would have been in the case of a living creature. In the face of facts like these, we cannot possibly attribute this immoveable state to antiseptic agency alone. Life is there, but numbed, as it were, and paralysed: a miracle beyond the power of chloroform or æther to perform, having its origin in the mysterious laws of the nervous system.

In this state of vegetation the animal functions still faintly exert themselves: digestion continues as long as the stomach contains food. By the aid of benzine vapour and of a voltaic battery, M. Fabre succeeded in obtaining some feeble movements of the legs and antennæ, even up to the fifteenth day after this extraordinary suspension of muscular power had taken place; whereas, the same experiments, when made upon beetles *dead*, in the true sense of the word, only two hours, were productive of no result whatever.

These facts, indeed, militate strongly against the supposition that the Curculios are dead, and merely preserved by some means from natural decay. The weapon with which they are overcome is of course the venomous sting of the *Cerceris*: but how can this penetrate through the coat of mail worn by the Curculio? in which, moreover, there is no trace of injury or wound to be discovered after the combat is over. The key to this mystery has been obtained by M. Fabre, after an amount of patient investigation which would have wearied out a less persevering and intelligent observer.

With great difficulty, and after a long search in fields and hedges, he succeeded in capturing several live specimens of Curculio, which



he placed at the entrance of their enemies' abode, in the hope of tempting the *Cercerides* to attack the prey thus brought to their very doors, and to perform under his eyes the act of which he had already in many cases witnessed the marvellous results. But the victims thus offered were scornfully rejected: the inglorious booty treated with disdain. The experiment of putting a *Cerceris* and a *Curculio* together in a bottle was attended with no better success. Their positions seemed reversed: the *Cerceris*, too overcome by fear to attempt resistance, tried vainly to escape, while her antagonist fiercely seized one of her legs between its jaws. Thus baffled, M. Fabre was struck with the ingenious idea of waylaying a *Cerceris* returning with her booty, and contriving to substitute for it a living *Curculio*. This experiment succeeded to admiration. As soon as the *Cerceris* perceived her prey to have slipped from her grasp, she struck the earth with her feet, and turned impatiently hither and thither: then, suddenly perceiving the living *Curculio* placed close to her by M. Fabre, pounced upon it, and proceeded to carry it off. Instantly, however, discovering it to be still uninjured, she placed herself face to face with it, seized its rostrum between her powerful mandibles, and pressed her forelegs heavily upon its back, as if to cause the opening of some ventral articulation. Quickly then she slid her abdomen beneath the *Curculio*, and struck her venomous dart sharply twice or thrice into the joint of the prothorax, between the first and second pair of legs. In one second, without a convulsive movement, without those twitches of the limbs which generally accompany the death agony of any animal, the victim dropped motionless, struck as if by lightning. The *Cerceris* then, turning the apparently lifeless insect on its back, embraced it as before described, and bore it away in triumph. Three times did M. Fabre repeat this interesting experiment, each time with precisely similar results. It must be clearly understood, that on each occasion he restored to the *Cerceris* her original captive, and took possession of that which he had himself provided, in order to examine it at his leisure. Greatly did he marvel at the dexterity with which the fatal stroke had been dealt. Not the slightest trace of a wound was to be found: not the least drop of vital liquid spilt. The puncture made by the sting of the *Cerceris* is indeed so microscopic, that chemistry can furnish no poison sufficiently powerful to produce with so small a quantity so startling an effect: and it is, in fact, not so much to the venom of the dart as to the physiological importance of the exact point at which it enters, that we must ascribe the cessation, so complete, so instantaneous, of all active life.

In most insects there are three ganglia, which furnish the nerves of the wings and legs, and on which the power of movement principally depends. The first, that of the prothorax, is distinct from the others in all *Coleoptera*; but the two last, those of the meso- and meta-thorax, though generally separate, are in some species united together. Now, it is a well-known fact, that, in most cases, the more



closely the nervous system is united, *centralized* as it were, the more perfect are the animal functions, and also, of course, the more easily vulnerable. Therefore the *Cerceris*, whose instinct teaches her at one stroke to annihilate these functions, chooses her victims precisely from the species in which this centralization is most complete: the *Buprestes*, namely, of which the nervous centres of the meso- and meta-thorax are confounded in one large mass; the *Curculionidæ*, of which the three thoracic ganglia lie near together, the two last quite contiguous to each other.

The green larvæ found by Réaumur in the nests of his solitary wasps (*Odynerus spinipes*) were full of life, though apparently plunged by some mysterious means into a state of lethargy: the simple explanation of which is, that, in these creatures, the nervous system is more diffused over the body and consequently less affected by an attack at any given point. It is, we must remember, of the greatest importance to the *Cerceris* that her prey should be completely numbed and incapable of the least movement: otherwise, what would become of the precious egg laid among struggling *Coleoptera*? what of the tender little grub, which should emerge in the midst of their great horny claws, writhing convulsively about in a narrow cell? If she attacked feeble and apathetic larvæ, one can imagine that a less complete annihilation of muscular action would suffice; but in the case of beetles twice her own size it would be worse than useless; and she therefore picks out, with unerring precision, from the numerous tribes of *Coleoptera*, two of those best calculated by the peculiarities of their nervous system to be rendered thoroughly powerless.

In order completely to establish his opinion, it remained for M. Fabre to prove that he could by similar means produce a similar result. And this he found himself able to perform with perfect ease, by puncturing the insect with a needle dipped in ammonia at the prothoracic joint, behind the first pair of legs. Any corrosive liquid applied to the thoracic medullary centre would have the same effect. His experiments were made in the first instance upon *Lamellicorns* (*Scarabæus sacer*, *S. laticollis*); on *Buprestes* (*B. ænea*), and on *Curculionidæ*, especially on the particular species so often previously examined by him. He afterwards tried his skill upon *Carabidæ* (*Carabus*, *Proustes*, *Chlænius*, *Sphodrus*, *Nebria*, &c.); upon *Longicorns* (*Saperda*, *Lamia*), and upon *Melasomas* (*Blaps*, *Scaurus*, *Asida*). In the case of *Scarabæi*, *Buprestes*, and *Curculionidæ*, the effect of his experiments was instantaneous: all motion ceased suddenly, without a single convulsion, at the instant the fatal drop touched the medullary centre. Not the dart of the *Cerceris* herself could have a more prompt or lasting effect. Notwithstanding their complete immobility, M. Fabre's victims remained alive for three weeks or a month, preserving the flexibility of all their joints, and normal freshness of viscera. Digestion proceeded for the first few days, and movements could be provoked by a voltaic current. In the case of *Scarabæus*, however, this state cannot always



be produced. If the wound made by the needle be too deep, or the drop of ammonia too large, the victim really dies, as is speedily proved by its decomposition. If, on the contrary, the puncture be too slight, the insect recovers, after a shorter or longer period of profound lethargy, and regains, at any rate partially, its pristine vigour. On those Coleoptera, the thoracic medullary centres of which are distant from each other, the effect produced by ammonia is very different. A wound which would have completely and permanently stunned a vigorous *Scarabæus sacer* causes only violent convulsions in a *Carabus* of moderate size. Gradually the insect becomes calm, and slowly regains its original condition. If the experiment be repeated several times on the same individual the same results ensue, until the wound becomes too severe, and the poor animal expires. *Melasomas* and *Longicorns* are more sensitive. The corrosive liquid plunges them instantly into a stupor, which is however only temporary; and the next day they are lively as ever. Thus, by the process so perfectly successful in the case of *Scarabæi*, *Curculionidæ*, and *Buprestes*, it is impossible to produce the same state of paralysis in those Coleoptera of which the three thoracic ganglia are situated at a distance from each other.

M. Fabre's second paper is as interesting as the first: it relates to the habits and metamorphoses of the *Sphex* in general, and of *Sphex flavipennis* in particular. He opens the subject in his own inimitable style, with a beautiful description of insect life, an abridgment of which would give no adequate idea of the richness of colouring, and felicitous arrangement of epithets which invest all the writings of this author with a peculiar charm.

Towards the end of July, the *Sphex flavipennis*, tearing open the cocoon which has hitherto enveloped her, takes flight from her subterranean abode: and during the month of August she may be observed, enjoying her brief holiday, flying gaily from plant to plant, and basking in the bright rays of the summer sun. But the preservation of her race exacts from her the sacrifice of the few remaining days of her short life, and from the beginning of September she devotes herself to labour for the good of her posterity. She is not more fastidious than the *Cerceris* in the choice of a site for her operations: a loose sandy soil and plenty of sun being the only desiderata. She takes no precautions for sheltering her work during its progress, and it is pitiable to observe the destruction often caused by a shower of rain, by which many a half-finished nest is washed into a heap of undistinguishable ruins.

The *Sphex flavipennis* rarely works alone: from ten to twenty individuals generally combine to excavate a gallery; accompanying their labours with a species of song, sharp and intermittent, modulated by the vibration of their wings and body. A keen enjoyment of their task seems to animate these little sappers and miners: they spring here and there with delighted activity, and in the course of a few hours a gallery is completed. When examined it is found to consist of a horizontal corridor, serving as an avenue to the hidden cells



destined for the larvæ. After proceeding for a distance of two or three inches, this corridor takes an abrupt curve, and tends for a corresponding depth more or less obliquely downwards, terminating in an oval cell, placed horizontally. The sides of this cell have not been in any way cemented or plastered together: but it is easy to perceive that they have been fashioned with peculiar care, and the sand diligently smoothed and planed down, so that the tender grub shall incur no danger from the crumbling of its prison walls. On the completion of one of these little chambers, it has to be provisioned: and then the *Sphex*, closing it up, proceeds to hollow out another of the same dimensions alongside it. This process she repeats twice or thrice before finally filling up the entrance to her subterraneous nursery, and effacing all outward trace of its existence by smoothing and patting down the outside sand. There are thus three, sometimes four cells connected with each corridor: and as the number of eggs laid by every female *Sphex* is about thirty, it follows that from seven to ten galleries are required by each.

And as the energetic little insect has finished her labours before the end of September, it is evident that only two or three days can be devoted to the excavation of a gallery, to the task of furnishing the separate cells with provisions, laying an egg in each, closing the door, and in fact winding up the whole establishment. If we consider from how great a distance the *Sphex* often has to bring the captives of her bow and spear, and also how often rainy days must intervene to prevent her from following the chase, it is easy to see that she must toil hard to make the best of her time, and cannot pretend to give to her nest that solidity and finish which characterize the abode of the young *Cercerides*. For the nest of the *Cerceris* is the work of years, transmitted from one generation to another, added to and improved by each; while that of the *Sphex* resembles a tent, pitched hastily by the belated traveller, and intended only to serve as shelter for a single night. A slight variation is observable in the excavations of *Sphex albisepta* and the *Ammophila*; they dispense altogether with the horizontal corridor, digging merely a vertical passage, two or three inches in depth, connected with a single cell. Pursuing their labours apart from each other, they have obtained the name of "Solitary wasps."

Let us now, in company with M. Fabre, watch for the return of a *Sphex flavipennis* to her nest; she carries her booty, a grasshopper many degrees heavier than herself. Alighting at some distance from her nest, she proceeds to drag her victim along with her powerful mandibles. After much exertion on her part, he is placed in such a position as to touch the door of his future prison with the ends of his antennæ. The *Sphex* then relinquishes her hold, descends into her nest, and immediately reappearing, seizes her prey, according to M. Fabre, with a little joyful cry, and drags him down into the cell prepared to receive him. Other Hymenoptera dispense with this preliminary visit to the interior of their strongholds; the



Cerceris merely relinquishes her captive for an instant at the entrance, in order to turn round and crawl backwards—thus more conveniently pulling him after her. Why then should the *Sphex* persist in paying this domiciliary visit before introducing her victim? Perhaps through apprehension lest one of the *Tachytes*, who make use of the same kind of cells for their offspring, and are accustomed to provision them in like manner, should have taken advantage of the lawful owner's absence, to deposit an egg in the cell ready scooped out. But however this may be, the manœuvres of the *Sphex* are invariably the same. M. Fabre's experiments on this head are very curious. He took advantage of her momentary absence to remove the grasshopper, and place it at a few inches distance. The proprietor returned, uttering her usual cry, looked anxiously about, and finally, perceiving her prey, dragged it back to her door, and placed it again in precisely its former position; then leaving it, descended as before into her nest. The same process was repeated by M. Fabre thirty or forty times, in the hope that the *Sphex*, taught by experience, would cease to lose sight for a moment of her captive and convey it at once into the earth. But the perseverance of the insect triumphed over that of the philosopher; or rather, her acts not being dictated by reason, she knew not how to leave the path marked out for her by instinct.

In the case also of a *Sphex albisecta*, an inflexible adherence to settled laws in this respect was strikingly manifest, presenting a still more curious instance of the rigidity of instinct and its inapplicability to unusual conditions. Having, in the course of one of his experiments, removed her victim from the sight of a *Sphex albisecta*, M. Fabre observed the insect, after seeking vainly in all directions, descend for a few instants into her cell, and then emerging, proceed to cover up the entrance, as if her task were now satisfactorily accomplished; a striking exemplification of the manner in which acts of instinct depend one upon another, and admit of no variation, notwithstanding that their object may be entirely defeated by the alteration of surrounding circumstances. In the normal state of things, observes M. Fabre, the *Sphex* pursues her prey, lays an egg and closes her nest; an accident deprives her of her booty; no matter—that part of her duty is over, she therefore performs the remainder, and shuts up the unlucky egg quite unprovided for. Think of the melancholy fate entailed by maternal stupidity upon the helpless little new-born larva—fancy it emerging from the shell, in the full expectation of a satisfactory meal, and the miserable disappointment awaiting it, ending in despair and a lingering death. Many larvæ must so perish; for the case above-mentioned is by no means exceptional. M. Fabre repeated the experiment several times, meeting almost invariably with the same results; and on opening the nests he frequently found cells either supplied inadequately with provisions, or containing none at all.

The rest of this paper is chiefly anatomical, and devoted to an



account of the metamorphoses undergone by those larvæ which are fortunate enough on leaving the shell to find their larders well supplied; but we must pass on to give a short summary of M. Fabre's paper on the habits and metamorphoses of *Sitaris humeralis*.

This interesting beetle is parasitic on *Anthophora*, in the galleries of which it lays its eggs. These are hatched at the end of September or beginning of October; and M. Fabre not unnaturally expected that the young larvæ, which are active little creatures with six serviceable legs, would at once eat their way into the cells of the *Anthophora*. No such thing: till the month of April following they remain without leaving their birthplace, and consequently without food; nor do they in this long time change either in form or size. M. Fabre ascertained this, not only by examining the burrows of the *Anthophoras*, but also by direct observation of some young larvæ kept in captivity. In April, however, his specimens at last threw off their long lethargy, and hurried anxiously about their prisons. Naturally inferring that they were in search of food, M. Fabre supposed that this would consist either of the larvæ or pupæ of the *Anthophora*, or of the honey with which it stores its cell. All three were tried without success. The two first were neglected, and when placed on the latter they hurried away, or perished in the attempt, being evidently unable to deal with this sticky substance. M. Fabre was in despair: "Jamais experience," he says, "n'a éprouvé pareille déconfiture. Larves, nymphes, cellules, miel, je vous ai tout offert; que voulez-vous donc, bestioles maudites?"

The first ray of light came to him from our countryman, Newport, who ascertained that a small parasite found by Léon Dufour on one of the wild bees, and named by him *Triungulinus*, was, in fact, the larva of the *Meloe*. The larvæ of *Sitaris* much resembled Dufour's *Triungulinus*, and acting on this hint, M. Fabre examined many specimens of *Anthophora*, and found on them the larvæ of his *Sitaris*. The males of *Anthophora* emerge from the pupæ before the females, and as they come out of their galleries, the little larvæ fasten upon them. Not, however, for long: their instinct teaches them that they are not yet in the straight path of development; and watching their opportunity they pass from the male to the female Bee. Guided by these indications, M. Fabre examined several cells of *Anthophora*: in some, the egg floated by itself on the surface of the honey; in others, on the egg of the *Anthophora*, as on a raft, sat the still more minute larva of the *Sitaris*. The mystery was solved. By a process of reasoning too long for us to insert, M. Fabre convinced himself that at the moment when the egg is laid, the *Sitaris* larva springs upon it. Even while the poor mother is carefully fastening up her cell, her mortal enemy is beginning to devour her offspring. For the egg of the *Anthophora* serves not only as a raft, but as a repast. The honey, which is enough for either, would be too little for both; and the *Sitaris*, therefore, in its first meal, relieves itself from its only rival. After eight days the egg is



consumed, and on the empty shell the *Sitaris* undergoes its first transformation. The life of almost all insects is divided into four stages; the Egg, Larva, Pupa, and Imago: the larva, indeed, may moult several times, but the conditions of life being unaltered, the form is generally the same, and the change is only in size. Very different is the case with our *Sitaris*: the honey which was before fatal is now necessary; the activity which before was necessary, is now useless; consequently, with the change of skin the active, slim larva changes into a white, fleshy grub, so organised as to float on the surface of the honey, with the mouth below, and the spiracles above the surface; "grace à l'embonpoint du ventre, la larve est à l'abri de l'asphyxie." In this state it remains till the honey is consumed; then the animal contracts, and detaches itself from its skin, within which the other transformations take place. In the next stage, which M. Fabre calls the *Pseudochrysalis*, the larva has a solid corneous envelope, and an oval shape, and in its colour, consistence, and immobility reminds one of a Dipterous Pupa. The time passed in that condition varies much. When it has elapsed, the animal moults again, and once more resembles the second stage (?). After this it becomes a pupa without any remarkable peculiarities; and finally, after these wonderful changes and adventures, in the month of August the perfect *Sitaris* makes its appearance.

We wish that we could have done M. Fabre's paper more justice; that we could have given some specimens of his peculiar raciness of style, his wonderful power of description. But already we have been tempted beyond our limits. We can do no more than mention his observations on *Meloe*, and his excellent paper on the *Myriapodes*. All lovers of nature, however, should read what he has written, and we think we can promise them that they will not be disappointed. For ourselves, we offer our cordial thanks to M. Fabre for the pleasure which his writings have given us.

---

XIV.—A HISTORY OF BRITISH SESSILE-EYED CRUSTACEA. By C. Spence Bate, Esq., F.R.S., F.L.S., and J. O. Westwood, Esq., M.A., F.L.S., Hope Professor of Zoology at Oxford. (J. Van Voorst.)

RECHERCHES SUR LA FAUNE LITTORALE DE BELGIQUE; CRUSTACÉS. Par P. J. Van Beneden, Professor à l'Université Catholique de Louvain.

THE work which we have placed at the head of the present article, and of which three numbers only have as yet appeared, will be a very valuable addition to our knowledge of the British Crustacea. The classification proposed by Messrs. Spence Bate and Westwood is as follows:—