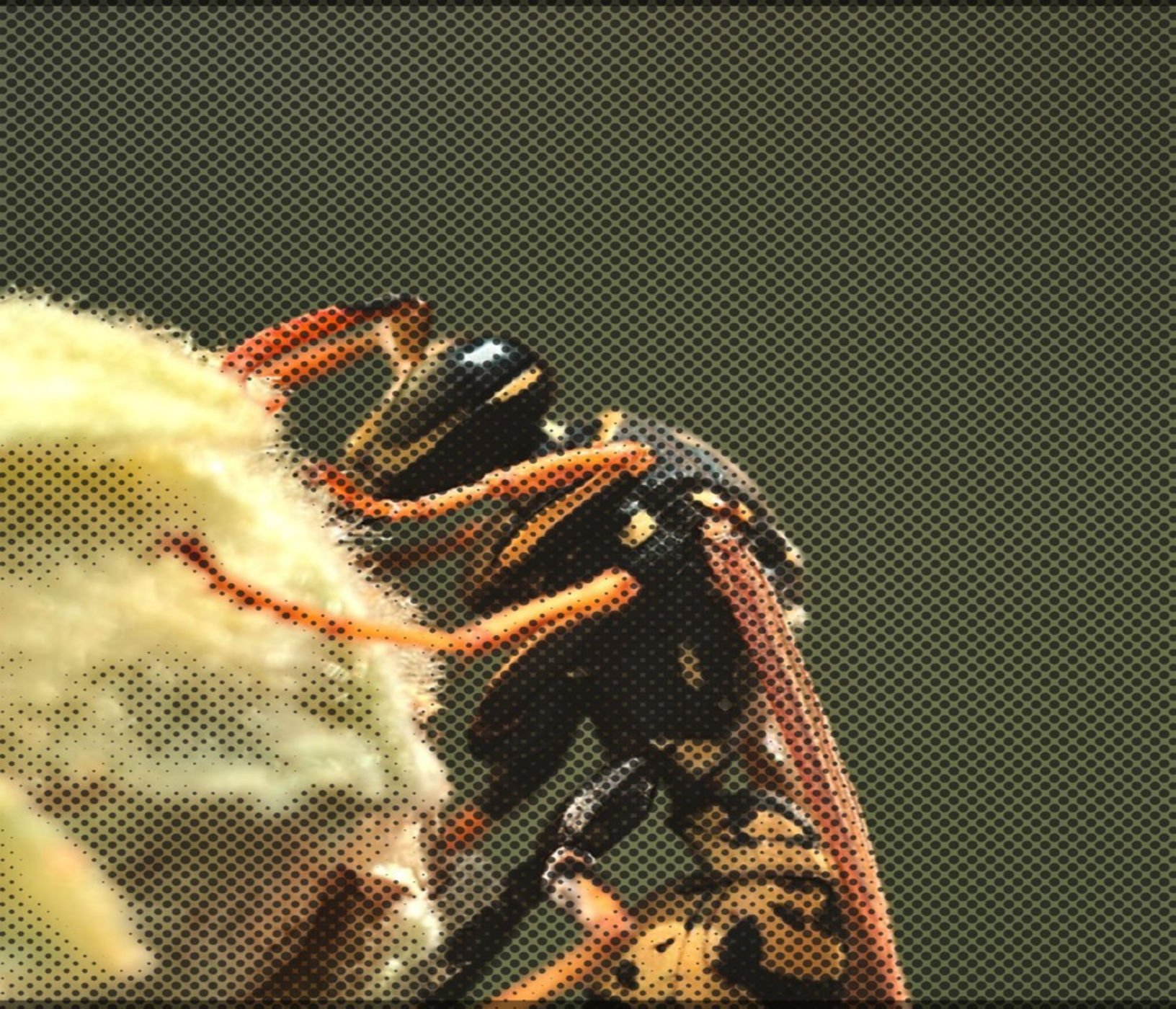
Jean-Henri Fabre



The Hunting Wasps

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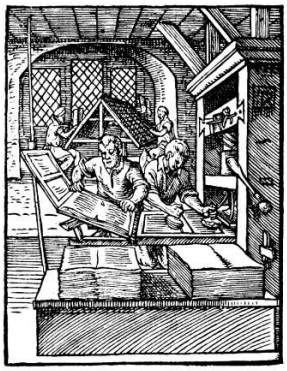

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Table of Contents

Chapter i

THE BUPRESTIS-HUNTING CERCERIS

Table of Contents

There are for each one of us, according to his turn of mind, certain books that open up horizons hitherto undreamed of and mark an epoch in our mental life. They fling wide the gates of a new world wherein our intellectual powers are henceforth to be employed; they are the spark which lights the fuel on a hearth doomed, without its aid, to remain indefinitely bleak and cold. And it is often chance that places in our hands those books which mark the beginning of a new era in the evolution of our ideas. The most casual circumstances, a few lines that happen somehow to come before our eyes, decide our future and plant us in the appointed groove.

One winter evening, when the rest of the household was asleep, as I sat reading beside a stove whose ashes were still warm, my book made me forget for a while the cares of the morrow: those heavy cares of a poor professor of physics who, after piling up diplomas [2]and for a quarter of a century performing services of uncontested merit, was receiving for himself and his family a stipend of sixteen hundred francs, or less than the wages of a groom in a decent establishment. Such was the disgraceful parsimony of the day where education was concerned; such was the edict of our government red-tape: I was an irregular, the offspring of my solitary studies. And so I was forgetting the poverty and anxieties of a professor's life, amid my books, when I chanced to turn over the pages of an entomological essay that had fallen into my hands I forget how.

It was a monograph by the then father of entomology, the venerable scientist Léon Dufour,1 on the habits of a Wasp that hunted Buprestis-beetles. Certainly, I had not waited till then to interest myself in insects; from my early childhood I had delighted in Beetles, Bees, and Butterflies; as far back as I can remember, I see myself in ecstasy before the splendour of a Ground-beetle's wing-cases or the wings of *Papilio machaon*, the Swallowtail. The fire was laid; the spark to kindle it was [3]absent. Léon Dufour's essay provided that spark.

New lights burst forth: I received a sort of mental revelation. So there was more in science than the arranging of pretty Beetles in a cork box and giving them names and classifying them; there was something much finer: a close and loving study of insect life, the examination of the structure and especially the faculties of each species. I read of a magnificent instance of this, glowing with excitement as I did so. Some time after, aided by those lucky circumstances

which he who seeks them eagerly is always able to find, I myself published an entomological article, a supplement to Léon Dufour's. This first work of mine won honourable mention from the Institute of France and was awarded a prize for experimental physiology. But soon I received a far more welcome recompense, in the shape of a most eulogistic and encouraging letter from the very man who had inspired me. From his home in the Landes the revered master sent me a warm expression of his enthusiasm and urged me to go on with my studies. Even now, at that sacred recollection, my old eyes fill with happy tears. O fair days of illusion, of faith in the future, where are you now? [4]

I am sure that my readers will welcome an extract from the essay that formed the starting-point of my own researches, especially as this extract is necessary for the due understanding of what follows. I will therefore let the master speak for himself, abridging his words in parts:2

> 'In all insect history, I can think of no more curious, no more extraordinary fact than that which I am about to describe to you. It concerns a species of Cerceris who feeds her family on the most sumptuous species of the genus Buprestis. Allow me to make you share the vivid impressions which I owe to my study of this Hymenopteron's habits.
>
> 'In July 1839, a friend living in the country sent me two specimens of *Buprestis bifasciata*, an insect at that time new to my collection, informing me that a kind of Wasp that was carrying one of these pretty Beetles had let it fall on his coat and that, a few moments later, a similar Wasp had dropped another on the ground.
>
> 'In July 1840, I was visiting my friend's house professionally and reminded him of his capture of the year before and asked for details of the circumstances that accompanied it. [5]The identity of the season and place made me hope to make a similar capture myself; but the weather that day was overcast and chilly; and therefore but few Wasps had ventured out. Nevertheless, we made a tour of inspection in the garden; and, seeing nothing coming, I thought of looking on the ground for the homes of Burrowing Hymenoptera.
>
> 'My attention was attracted by a small heap of sand freshly thrown up and forming a sort of tiny mole-hill. On raking it, I saw that it masked the opening of a shaft running some way down. With a spade we carefully turned over the soil and soon saw the glittering wing-cases of the coveted Buprestis lying scattered around. Presently I discovered not only isolated and fragmentary wing-cases, but a whole Buprestis, then three or four of them, displaying their emerald and gold. I could not believe my eyes.

‘But this was only a prelude to the feast. In the chaos of rubbish produced by the exhumation, a Wasp appeared and fell into my hands: it was the kidnapper of the Buprestes, trying to escape from among her victims. In this burrowing insect I recognized an old acquaintance, a Cerceris whom I have found hundreds of times, both in Spain and round about Saint-Sever. [6]

‘My ambition was far from satisfied. It was not enough for me to identify the kidnapper and her victim: I wanted the larva, the sole consumer of those rich provisions. After exhausting this first vein of Buprestes, I hastened to make fresh excavations and, planting my spade more carefully still, I at last succeeded in discovering two larvæ which crowned the good fortune of this campaign. In less than an hour I ransacked the haunts of three Cerceres; and my booty was some fifteen whole Buprestes, with fragments of a still larger number. I calculated, keeping, I believe, well within the mark, that this particular garden contained five-and-twenty nests, making an enormous total of buried Buprestes. What must it be, I thought, in places where in a few hours I have caught on the garlic-flowers as many as sixty Cerceres, whose nests were apparently in the neighbourhood and no doubt victualled just as abundantly? And so my imagination, never going beyond the bounds of probability, showed me underground, within a small radius, *Buprestis fasciata* by the thousand, whereas, during the thirty years and upwards that I have been studying the entomology of this district, I never discovered a single one in the open.

‘Once only, perhaps twenty years ago, I found the abdomen of this insect, together [7]with its wing-cases, stuck in a hole in an old oak. This fact was illuminating. By informing me that the larva of *Buprestis fasciata* must live in the wood of the oak, it completely explained why this Beetle is so common in a district which has none but oak-forests. As *Cerceris bupresticida* is rare in the clay hills of such districts, as compared with the sandy plains thickly planted with the maritime pine, it became an interesting question to know whether this Wasp, when she inhabits the pine country, victuals her nest in the same way as in the oak country. I had a strong presumption that this was not the case; and you will soon see, not without surprise, what exquisite entomological discrimination our Cerceris displays in her choice of the numerous species of the genus Buprestis.

‘We will therefore hasten to the pine region to reap new delights. The field to be explored is the garden of a country-house standing amid forests of maritime pines. One soon recognized the dwellings of the Cerceris; they had been made solely in the main paths, where the firm,

compact soil offered the Burrowing Hymenopteron a solid foundation for the construction of her subterranean abode. I inspected some twenty, I may say, by the sweat of my brow. It is a very laborious sort of undertaking, for [8]the nests, and consequently the provisions, are not found at less than a foot below the surface. It becomes necessary, therefore, lest they should be damaged, to begin by inserting a grass-stalk, serving as a landmark and a guide, into the Cerceris' gallery and next to invest the place with a square of trenches, some seven or eight inches from the orifice or the landmark. The sapping must be done with a garden-spade, so that the central clod can be completely detached on every side and raised in one piece, which we turn over on the ground and then break up carefully. This was the method that answered with me.

'You would have shared our enthusiasm, my friend, at the sight of the beautiful specimens of Buprestes which this original method of treasure-hunting disclosed, one after the other, to our eager gaze. You should have heard our exclamations each time that the mine was turned upside down and new glories stood revealed, rendered more brilliant still by the blazing sun; or when we discovered, here, larvæ of all ages fastened to their prey, there, the cocoons of those larvæ all encrusted with copper, bronze, and emerald. I who had been studying insects at close quarters for three or four decades—alas!—had never witnessed such a lovely sight nor enjoyed so great a treat. It [9]only needed your presence to double our delight. Our ever-increasing admiration was devoted by turns to those brilliant Beetles and to the marvellous discernment, the astonishing sagacity of the Cerceris who had buried and stored them away. Will you believe it, of more than four hundred Beetles3 that we dug up, there was not one but belonged to the old genus Buprestis! Not even the very smallest mistake had been made by the wise Wasp. What can we not learn from this intelligent industry in so tiny an insect! What value would not Latreille4 have set upon this Cerceris' support of the natural method!

'We will now pass to the different manœuvres of the Cerceris for establishing and victualling her nests. I have already said that she chooses ground with a firm, compact, and smooth surface; I will add that this ground must be dry and fully exposed to the sun. She reveals in this choice an intelligence, or, if you prefer, an instinct, which one might be tempted to consider the result of experience. Loose earth or [10]a merely sandy soil would doubtless be much easier to dig; but then how is she to get an aperture that will remain open for goods to pass in and out, or a gallery whose walls will not constantly be liable to fall in, to

lose their shape, to be blocked after a few days of rain? Her choice therefore is both sensible and nicely calculated.

‘Our Burrowing Wasp digs her gallery with her mandibles and her front tarsi, which are furnished for this purpose with stiff spikes that perform the office of rakes. The orifice must not only have the diameter of the miner’s body: it must also be able to admit a capture of large bulk. It is an instance of admirable foresight. As the Cerceris goes deeper into the earth, she casts out the rubbish: this forms the heap which I likened above to a tiny mole-hill. The gallery is not perpendicular, for then it would inevitably become blocked up, owing either to the wind or to other causes. Not far from where it starts, it forms an angle; its length is seven or eight inches. At the end of the passage the industrious mother establishes the cradles of her offspring. These consist of five separate cells, independent of one another, arranged in a semicircle and hollowed into the shape and nearly the size of an olive. Inside, they are polished and firm. Each of them is [11]large enough to contain three Buprestes, which form the usual allowance for each larva. The mother lays an egg in the middle of the three victims and then stops up the gallery with earth, so that, when the victualling of the whole brood is finished, the cells no longer communicate with the outside.

‘*Cerceris buprestícida* must be a dexterous, daring, and skilful huntress. The cleanliness and freshness of the Buprestes whom she buries in her lair incline one to believe that she must seize these Beetles at the moment when they are leaving the wooden galleries in which their final metamorphosis has taken place. But what inconceivable instinct urges her, a creature that lives solely on the nectar of flowers, to procure, in the face of a thousand difficulties, animal food for carnivorous children which she will never see, and to take up her post on utterly dissimilar trees, which conceal deep down in their trunks the insects destined to become her prey? What yet more inconceivable entomological judgment lays down the strict law that she shall confine herself in the choice of her victims to a single generic group and capture specimens differing greatly among themselves in size, shape, and colour? For observe, my friend, how slight the resemblance is between *Buprestis biguttata*, with a long, slender body [12]and a dark colour; *B. octoguttata*, oval-oblong, with great patches of a beautiful yellow on a blue or green ground; and *B. micans*, who is three or four times the size of *B. biguttata* and glitters with a metallic lustre of a fine golden green.

‘There is another very singular fact about the manœuvres of our Buprestis-slayer. The buried Buprestes, like those whom I have seized in

> the grasp of their kidnappers, are always deprived of any sign of life; in a word, they are decidedly dead. I was surprised to remark that, no matter when these corpses were dug up, they not only preserved all their freshness of colouring, but their legs, antennæ, palpi, and the membranes uniting the various parts of the body remained perfectly supple and flexible. There was no mutilation, no apparent wound to be seen. One might at first believe the reason, in the case of the buried ones, to be due to the coolness of the bowels of the earth, in the absence of air and light; and, in the case of those taken from the kidnappers, to the very recent date of their death. But please observe that, at the time of my explorations, after placing the numerous exhumed Buprestes in separate screws of paper, I often left them in their little bags for thirty-six hours before pinning them out. Well, notwithstanding the dryness of the air and the burning July heat, [13]I always found the same flexibility in their joints. Nay more: I have dissected several of them, after that lapse of time, and their viscera were as perfectly preserved as if I had used my scalpel on the insects' live entrails. Now long experience has taught me that, even in a Beetle of this size, when twelve hours have passed after death in summer, the internal organs become either dried up or putrefied, so that it is impossible to make sure of their form or structure. There is some special circumstance about the Buprestes killed by the Cerceres that saves them from desiccation and putrefaction for a week and perhaps two. But what is this circumstance?'

To explain this wonderful preservation of the tissues which makes of an insect smitten for many weeks past with a corpse-like inertness a piece of game which does not even go high and which, during the greatest heat of summer, keeps as fresh as at the moment of its capture, the able historian of the Buprestis-huntress surmises the presence of an antiseptic fluid, acting similarly to the preparations used for preserving anatomical specimens. This fluid, he suggests, can be nothing but the poison of the Wasp, injected into the victim's body. A tiny drop of the venomous liquid accompanying [14]the sting, the needle destined for the inoculation, would therefore serve as a kind of brine or pickle to preserve the meat on which the larva is to feed. But how immensely superior to our own pickling processes is that of the Wasp! We salt, or smoke, or tin foodstuffs which remain fit to eat, it is true, but which are very far indeed from retaining the qualities which they possessed when fresh. Tins of sardines soaked in oil, Dutch smoked herrings, codfish reduced to hard slabs by salt and sun: which of these can compare with the same fish supplied to the cook, so to speak, all alive and kicking? In the case of flesh-meat, things are even worse. Apart from salting and

curing, we have nothing that can keep a piece of meat fit for consumption for even a fairly short period.

Nowadays, after a thousand fruitless attempts in the most varied directions, we equip special ships at great cost; and these ships, fitted with a powerful refrigerating-plant, bring us the flesh of sheep and oxen slaughtered in the South American pampas, frozen and preserved from decomposition by the intense cold. How much more excellent is the Cerceris' method, so swift, so inexpensive, and so efficacious! What lessons can we not learn from her transcendental chemistry! With an imperceptible drop of her poison-fluid, she straightway renders [15]her prey incorruptible! Incorruptible, did I say? It is much more than that! The game is brought to a condition which prevents desiccation, leaves the joints supple, keeps all the organs, both internal and external, in their pristine freshness, and, in short, places the sacrificed insect in a state that differs from life only by its corpse-like immobility.

This is the theory that satisfied Léon Dufour, as he contemplated the incomprehensible marvel of those dead Buprestes proof against corruption. A preserving-fluid, incomparably superior to aught that human science can produce, explains the mystery. He, the master, the ablest of them all, an expert in the niceties of anatomy; he who, with magnifying-glass and scalpel, examined the whole entomological series, leaving no nook or corner unexplored; he, in short, for whom insect organism possessed no secrets can think of nothing better than an antiseptic fluid to give at least the semblance of an explanation of a fact that leaves him confounded. I crave permission to emphasize this comparison between animal instinct and the reasoning power of the sage in order the better to bring to light, in due season, the overwhelming superiority of the former.

I will add but a few words to the history of the Buprestis-hunting Cerceris. This Wasp, [16]who is common in the Landes, as her historian tells us, appears to be very rarely found in the department of Vaucluse. I have met her only at long intervals, in autumn—and then only isolated specimens—on the spiny heads of the field eryngo (*Eryngium campestre*), in the neighbourhood either of Avignon or of Orange and Carpentras. In this last spot, so favourable to the work of the Burrowing Wasps owing to its sandy soil of Molasse formation, I have had the good fortune, not to witness the exhumation of such entomological treasures as Léon Dufour describes, but to find some old nests which I attribute without hesitation to the Buprestis-huntress, basing my opinion upon the shape of the cocoons, the nature of the provisioning, and the presence of the Wasp in the neighbourhood. These nests, dug in the heart of a very crumbly sandstone, known in the district as *safre*, were crammed with remains of Beetles, remains easily recognized and consisting of detached wing-cases, gutted corselets and entire legs. Now these broken victuals of the larva's banquet all belonged to a

single species; and that species was once more a Buprestis, the Double-lined Buprestis (*Sphenoptera geminata*).5 Thus from [17]the west to the east of France, from the department of the Landes to that of Vaucluse, the Cerceris remains faithful to her favourite prey; longitude makes no difference to her predilections; a huntress of Buprestes among the maritime pines of the sand-dunes along the coast remains a huntress of Buprestes among the olive-trees and evergreen oaks of Provence. She changes the species according to place, climate, and vegetation, which alter the nature of the insect population so greatly; but she never departs from her favoured genus, the genus Buprestis. What can her reason be? That is what I shall try to show. [18]

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1 Léon Dufour (1780–1865) was an army surgeon who served with distinction in several campaigns and subsequently practised as a doctor in the Landes. He attained great eminence as a naturalist. Cf. *The Life of the Spider*, by J. Henri Fabre, translated by Alexander Teixeira de Mattos, chap, i.—*Translator's Note.*↑

2 For the complete monograph, cf. *Annales des sciences naturelles*: Series II., vol. xv.—*Author's Note.*↑

3 The 450 Buprestes unearthed belong to the following species: *Buprestis octoguttata*; *B. fasciata*; *B. pruni*; *B. tarda*; *B. biguttata*; *B. micans*; *B. flavomaculata*; *B. chrysostigma*; and *B. novemmaculata*.—*Author's Note.*↑

4 Pierre André Latreille (1762–1833), a French naturalist who was one of the founders of entomological science.—*Translator's Note.*↑

5 The Beetle known to Fabre as *Sphenoptera geminata*, Uliger, is now considered identical with *S. lineola*, Herbst, which was known many years earlier.—*Translator's Note.*↑

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Chapter ii

THE GREAT CERCERIS

Table of Contents

With my memory full of the prowess of the Buprestis-huntress, I watched for an opportunity to observe in my turn the labours of the Cerceres; and I watched to such good purpose that I ended by being successful. True, the Wasp was not the one celebrated by Léon Dufour, with her sumptuous victuals whose remains, when unearthed, suggest the dust of some nugget broken by the gold-miner's pick: it was a kindred species, a gigantic brigand who contents herself with humbler prey; in short, it was *Cerceris tuberculata* or *C. major*, the largest and most powerful of the genus.

The last fortnight in September is the time when our Burrowing Wasp digs her lairs and buries in their depths the victim destined for her grubs. The site of the home, always selected with discrimination, is subject to those mysterious laws which differ in different species but are invariable throughout any one species. Léon Dufour's Cerceris requires a level, well-trodden, [19]compact soil, such as that of a path, to prevent the possibility of landslips and other damage which would ruin her gallery at the first shower of rain. Ours, on the contrary, is not very particular about the nature of her soil, but must have that soil vertical. With this slight architectural

modification, she avoids most of the dangers that might threaten her gallery; and consequently she digs her burrows indifferently in a loose and slightly clayey soil and in the soft sand of the Molasse formation, which makes the work of excavation much easier. The only indispensable condition appears to be that the earth should be dry and exposed to the sun's rays for the best part of the day. It is therefore in the steep roadside banks, in the sides of the ravines hollowed by the rains in the sandstone, that our Wasp elects to establish her home. These conditions are common in the neighbourhood of Carpentras, in the part known as the Hollow Road; and it is here that I have observed *Cerceris tuberculata* in her largest numbers and that I gathered most of my facts relating to her history.

The choice of this vertical site is not enough for her: other precautions are taken to guard against the inevitable rains of the season, which is already far advanced. If there be [20]some bit of hard sandstone projecting like a ledge, if there be naturally hollowed in the ground some hole large enough to put one's fist in, it will be under that shelter or in this cavity that she contrives her gallery, thus adding a natural vestibule to the edifice of her own construction. Though no sort of communism exists among them, these insects nevertheless like to associate in small numbers; and I have always observed their nests in groups of about ten at least, with the orifices, which

are usually pretty far apart, sometimes close enough to touch one another.

On a bright, sunny day it is wonderful to watch the different operations of these industrious miners. Some patiently remove with their mandibles a few bits of gravel from the bottom of the pit and push the heavy mass outside; others, scraping the walls of the corridor with the sharp rakes of their tarsi, collect a heap of rubbish which they sweep out backwards and send streaming down the sides of the slopes in a long thread of dust. It was these periodical billows of sand discharged from the galleries in process of building that betrayed the presence of my first Cerceres to me and enabled me to discover their nests. Others, either because they are tired or because they have finished their hard task, seem to rest and [21]polish their antennæ and wings under the natural eaves that most frequently protect their dwelling; or else they remain motionless at the mouth of the hole, merely showing their wide, square faces, striped black and yellow. Others, lastly, flit gravely humming on the neighbouring kermes-oak-bushes, where the males, always on the watch near the burrows in course of construction, are not slow to join them. Couples form, often disturbed by the arrival of a second male, who strives to supplant the happy possessor. The humming becomes threatening, brawls take place and often the two males roll in the dust until one of them acknowledges the superiority of his rival. Near by, the female awaits the outcome

of the struggle with indifference; she finally accepts the male whom the chances of the contest bestow upon her; and the couple fly out of sight in search of peace and quiet on some distant brushwood. Here the part played by the males ends. Only half the size of the females and nearly as numerous, they prowl all around the burrows, but never enter and never take part in the laborious mining operations nor in the perhaps even more difficult hunting expeditions by means of which the cells are to be stocked.

The galleries are ready in a few days, especially [22]as those of the previous year are employed with the aid of a few repairs. The other Cerceres, so far as I know, have no fixed home, no family inheritance handed down from generation to generation. A regular gipsy tribe, they settle singly wherever the chances of their vagrant life may lead them, provided that the soil suits them. But the Great Cerceris is faithful to her household gods. The overhanging blade of sandstone that sheltered her predecessors is adopted by her in her turn; she digs in the same layer of sand wherein her forbears dug; and, adding her own labours to those which went before, she obtains deep retreats that are not always easy of inspection. The diameter of the galleries is wide enough to admit a man's thumb; and the insect moves about in them readily, even when laden with the prey which we shall see it capture. Their direction, at first horizontal to a depth of four to eight inches, describes a sudden bend and dips more

or less obliquely now to this side, now to that. With the exception of the horizontal part and the bend, the direction of the rest of the tube seems to be regulated by the difficulties presented by the ground, as is proved by the twists and turns observed in the more distant portion. The total length of the shaft attains as much as eighteen inches. At the [23]far end of the tube are the cells, few in number and each provisioned with five or six corpses of the Beetle order. But let us leave these building details and come to facts more capable of exciting our admiration.

The victim which the Cerceris chooses whereon to feed her grubs is a large-sized Weevil, *Cleonus ophthalmicus*. We see the kidnapper arrive heavily laden, carrying her victim between her legs, body to body, head to head, and plump down at some distance from her hole, to complete the rest of the journey without the aid of her wings. The Wasp is now dragging her prey in her mandibles up a vertical, or at least a very steep surface, productive of frequent tumbles which send kidnapper and kidnapped rolling helter-skelter to the bottom, but incapable of discouraging the indefatigable mother, who, covered with dirt and dust, ends by diving into the burrow with her booty, which she has not let go for a single moment. Whereas the Cerceris finds it far from easy to walk with such a burden, especially on ground of this character, it is a different matter when she is flying, which she does with a vigour that

astonishes us when we consider that the sturdy little creature is carrying a prize almost as large as herself and heavier. I had the curiosity to compare the weight of the Cerceris and [24]her victim: the first turned the scale at 150 milligrammes;1 the second averaged 250 milligrammes,2 or nearly double.

These figures are eloquent of the powers of the huntress, nor did I ever weary of admiring the nimbleness and ease with which she resumed her flight, with the game between her legs, and rose to a height at which I lost sight of her whenever, tracked too close by my indiscretion, she resolved to flee in order to save her precious booty. But she did not always fly away; and I would then succeed, not without difficulty, lest I should hurt her, in making her drop her prey by worrying her and rolling her over. I would then seize the Weevil; and the Cerceris, thus despoiled, would hunt about here and there, enter her lair for a moment and soon come out again to fly off on a fresh chase. In less than ten minutes the skilled huntress had found a new victim, performed the murder and accomplished the rape, which I often allowed myself to turn to my own profit. Eight times in succession I have committed the same robbery at the expense of the same Wasp; eight times, with unshaken consistency, she has recommenced her fruitless expedition. Her patience outwore mine; and I [25]left her in undisturbed possession of her ninth capture.

By this means, or by violating cells already provisioned, I procured close upon a hundred Weevils; and, notwithstanding what I was entitled to expect from what Léon Dufour has told us of the habits of the Buprestis-hunting Cerceris, I could not repress my surprise at the sight of the singular collection which I had made. Whereas the Buprestis-slayer, while confining herself to one genus, passes indiscriminately from one species to another, the more exclusive Great Cerceris preys invariably on the same species, *Cleonus ophthalmicus*. When going through my bag I came upon but one exception, and even that belonged to a kindred species, *Cleonus alternans*, a species which I never saw again in my frequent visits to the Cerceris. Later researches supplied me with a second exception, in the shape of *Bothynoderus albidus*; and that is all. Is this predilection for a single species adequately explained by the greater flavour and succulence of the prey? Do the grubs find in this monotonous diet juices which suit them and which they would not find elsewhere? I do not think so; and, if Léon Dufour's Cerceris hunts every sort of Buprestis without distinction, this is doubtless because all the Buprestes possess the same [26]nutritive properties. But this must be generally the case with the Weevils also: their nourishing qualities must be identical; and then this surprising choice becomes only a question of size and consequently of economy of labour and time. Our Cerceris, the mammoth of her race, tackles

the Ophthalmic Cleonus by preference because this Weevil is the largest in our district and perhaps also the commonest. But, if her favourite prey should fail, she must fall back upon other species, even though they be smaller, as is proved by the two exceptions stated.

Besides, she is far from being the only one to go hunting at the expense of the snouted clan, the Weevils. Many other Cerceres, according to their size, their strength and the accidents of the chase, capture Weevils varying infinitely in genus, species, shape, and dimensions. It has long been known that *Cerceris arenaria* feeds her grubs on similar provisions. I myself have encountered in her lairs *Sitona lineata*, *S. tibialis*, *Cneorinus hispidus*, *Brachyderes gracilis*, *Geonemus flabellipes* and *Otiorhynchus maleficus*. *Cerceris aurita* is known to make her booty of *Otiorhynchus raucus* and *Phynotomus punctatus*. The larder of *Cerceris Ferreri* has shown me the following: *Phynotomus murinus*, *P. punctatus*, *Sitona lineata*, *Cneorinus hispidus*, *Rhynchites [27]betuleti*. The last, who rolls vine-leaves in the shape of cigars, is sometimes a superb steel-blue and more ordinarily shines with a splendid golden copper. I have found as many as seven of these brilliant insects victualling a single cell; and the gaudiness of the little subterranean heap might almost stand comparison with the jewels buried by the Buprestis-huntress. Other species, notably the weaker, go in for lesser game, whose small size is

atoned for by larger numbers. Thus *Cerceris quadricincta* stacks quite thirty specimens of *Apion gravidum* in each of her cells, without disdaining on occasion such larger Weevils as *Sitona lineata* and *Phynotomus murinus*. A similar provision of small species falls to the share of *Cerceris labiata*. Lastly, the smallest Cerceris in my district, *Cerceris Julii*,3 chases the tiniest Weevils, *Apion gravidum* and *Bruchus granarius*, victims proportioned to the diminutive huntress. To finish with this list of game, let us add that a few Cerceres observe other gastronomic laws and raise their families on Hymenoptera. One of these is *Cerceris ornata*. We will dismiss these tastes as foreign to the subject in hand.

Of the eight species then of Cerceres whose provisions consist of Beetles, seven adopt a diet [28]of Weevils and one a diet of Buprestes. For what singular reasons are the depredations of these Wasps confined to such narrow limits? What are the motives for this exclusive choice? What inward likeness can there be between the Buprestes and the Weevils, outwardly so entirely dissimilar, that they should both become the food of kindred carnivorous grubs? Beyond a doubt, there are differences of flavour between this victim and that, nutritive differences which the larvæ are well able to appreciate; but some graver reason must overrule all such gastronomic considerations and cause these curious predilections.

After all the admirable things that have been said by Léon Dufour upon the long and wonderful preservation of the insects destined for the flesh-eating larvæ, it is almost needless to add that the Weevils, both those whom I dug up and those whom I took from between the legs of their kidnappers, were always in a perfect state of preservation, though deprived for ever of the power of motion. Freshness of colour, flexibility of the membranes and the lesser joints, normal condition of the viscera: all these combine to make you doubt that the lifeless body before your eyes is really a corpse, all the more as even with the magnifying-glass it is impossible to perceive the smallest wound; [29]and, in spite of yourself, you are every moment expecting to see the insect move and walk. Nay more: in a heat which, in a few hours, would have dried and pulverized insects that had died an ordinary death, or in damp weather, which would just as quickly have made them decay and go mouldy, I have kept the same specimens, both in glass tubes and paper bags, for more than a month, without precautions of any kind; and, incredible though it may sound, after this enormous lapse of time the viscera had lost none of their freshness and dissection was as easily performed as though I were operating on a live insect. No, in the presence of such facts, we cannot speak of the action of an antiseptic and believe in a real death: life is still there, latent, passive life, the life of a vegetable. It alone, resisting yet a little while longer the all-

conquering chemical forces, can thus preserve the structure from decomposition. Life is still there, except for movement; and we have before our eyes a marvel such as chloroform or ether might produce, a marvel which owes its origin to the mysterious laws of the nervous system.

The functions of this vegetative life are no doubt enfeebled and disturbed; but at any rate they are exercised in a lethargic fashion. I have as a proof the evacuation performed [30]by the Weevils normally and at intervals during the first week of this deep slumber, which will be followed by no awakening and which nevertheless is not yet death. It does not cease until the intestines are emptied of their contents, as shown by autopsy. Nor do the faint glimmers of life which the insect still manifests stop at that; and, though irritability of the organs seems annihilated for good, I have nevertheless succeeded in arousing slight signs of it. Having placed some recently exhumed and absolutely motionless Weevils in a bottle containing sawdust moistened with a few drops of benzine, I was not a little astonished to see their legs and antennæ moving a quarter of an hour later. For a moment I thought that I could recall them to life. Vain hope! Those movements, the last traces of a susceptibility about to be extinguished, soon cease and cannot be excited a second time. I have tried this experiment in some cases a few hours after the murderous blow, in others as late as three or four days after, and always with the same success. Still,

the movement is feeble in proportion to the time that has elapsed since the fatal stroke. It always spreads from front to back: the antennæ first wave slowly to and fro; then the front tarsi tremble and take part in the oscillation; next the tarsi of the [31]second pair of legs and lastly those of the third pair hasten to do likewise. Once movement sets in, these different appendages execute their vibrations without any order, until the whole relapses into immobility, which happens more or less quickly. Unless the blow has been dealt quite recently, the motion of the tarsi extends no farther and the legs remain still.

Ten days after an attack I was unable to obtain the least vestige of susceptibility by the above process; and I then had recourse to the Voltaic battery. This method is more powerful and provokes muscular contractions and movements where the benzine-vapour fails. We have only therefore to apply the current of one or two Bunsen cells through the conductors of some slender needles. Thrusting the point of one under the farthest ring of the abdomen and the point of the other under the neck, we obtain, each time the current is established, not only a quivering of the tarsi, but a strong reflexion of the legs, which draw up under the abdomen and then straighten out when the current is turned off. These flutterings, which are very energetic during the first few days, gradually diminish in intensity and appear no more after a certain time. On the tenth day I have still obtained perceptible movements; on the

fifteenth day the battery [32]was powerless to provoke them, despite the suppleness of the limbs and the freshness of the viscera. To effect a comparison, I subjected to the action of the Voltaic pile Beetles really dead, Cellar-beetles, Saperdæ and Lamiæ, asphyxiated with benzine or sulphuric acid gas. Two hours at most after the asphyxiation, it was impossible for me to provoke the movements so easily obtained in Weevils who have already for several days been in that curious intermediate state between life and death into which their formidable enemy plunges them.

All these facts are opposed to the idea of something completely dead, to the theory that we have here a veritable corpse which has become incorruptible by the action of a preservative fluid. They can be explained only by admitting that the insect is smitten in the very origin and mainspring of its movements; that its susceptibility, suddenly benumbed, dies out slowly, while the more tenacious vegetative functions die still more slowly and keep the intestines in a state of preservation for the space of time required by the larvæ.

The particular thing which it was most important to ascertain was the manner in which the murder is committed. It is quite evident that the chief part in this must be played by the Cerceris' venom-laden sting. But where [33]and how does it enter the Weevil's body, which is covered with a hard and well-riveted cuirass? In the various insects pierced by the

assassin's dart, nothing, even under the magnifying-glass, betrayed her method. It became a matter, therefore, of discovering the murderous manœuvres of the Wasp by direct observation, a problem whose difficulties had made Léon Dufour recoil and whose solution seemed to me for a time undiscoverable. I tried, however, and had the satisfaction of succeeding, though not without some preliminary groping.

When flying from their caverns, intent upon the chase, the Cerceres would take any direction indifferently, turning now this way, now that; and they would come back, laden with their prey, from all quarters. Every part of the neighbourhood must therefore have been explored without distinction; but, as the huntresses were hardly more than ten minutes in coming and going, the radius worked could not be one of great extent, especially when we allow for the time necessary for the insect to discover its prey, to attack it and to reduce it to an inert mass. I therefore set myself to inspect the adjacent ground with every possible attention, in the hope of finding a few Cerceres engaged in hunting. An afternoon devoted to this thankless task ended by persuading me of [34]the futility of my quest and of the small chance which I had of catching in the act a few scarce huntresses, scattered here and there and soon lost to view through the swiftness of their flight, especially on difficult ground, thickly planted with vines and olive-trees. I abandoned the attempt.

By myself bringing live Weevils into the vicinity of the nests, might I not tempt the Cerceres with a victim all ready to hand and thus witness the desired tragedy? The idea seemed a good one; and the very next morning I went off in search of live specimens of *Cleonus ophthalmicus*. Vineyards, cornfields, lucerne-crops, hedges, stone-heaps, roadsides: I visited and inspected one and all; and, after two mortal days of minute investigation, I was the possessor—dare I say it?—I was the possessor of three Weevils, flayed, covered with dust, minus antennæ or tarsi, maimed veterans whom the Cerceres would perhaps refuse to look at! Many years have passed since the days of that fevered quest when, bathed in sweat, I made those wild expeditions, all for a Weevil; and, despite my almost daily entomological explorations, I am still ignorant how and where the celebrated Cleonus lives, though I meet him occasionally, roaming on the edge of the paths. O wonderful power of instinct! In the [35]selfsame places and in a mere fraction of time, our Wasps would have found by the hundred these insects undiscoverable by man; and they would have found them fresh and glossy, doubtless just issued from their nymphal cocoons!

No matter, let us see what we can do with my pitiful bag. A Cerceris has just entered her gallery with her usual prey; before she comes out again for a new expedition, I place a Weevil a few inches from the hole. The insect moves about; when it strays too far, I restore it to its position. At last the Cerceris

shows her wide face and emerges from the hole; my heart beats with excitement. The Wasp stalks about the approaches to her home for a few moments, sees the Weevil, brushes against him, turns round, passes several times over his back and flies away without honouring my capture with a touch of her mandibles: the capture which I was at such pains to acquire. I am confounded, I am floored. Fresh attempts at other holes lead to fresh disappointments. Clearly these dainty sports-women will have none of the game which I offer them. Perhaps they find it uninteresting, not fresh enough. Perhaps, by taking it in my fingers, I have given it some odour which they dislike. With these epicures a mere alien touch is enough to produce disgust. [36]

Should I be more fortunate if I obliged the Cerceris to use her sting in self-defence? I enclosed a Cerceris and a Cleonus in the same bottle and stirred them up by shaking it. The Wasp, with her sensitive nature, was more impressed than the other prisoner, with his dull and clumsy organization; she thought of flight, not of attack. The very parts were interchanged: the Weevil, becoming the aggressor, at times seized with his snout a leg of his mortal enemy, who was so greatly overcome with fear that she did not even seek to defend herself. I was at the end of my resources; yet my wish to behold the catastrophe was but increased by the difficulties already experienced. Well, I would try again.