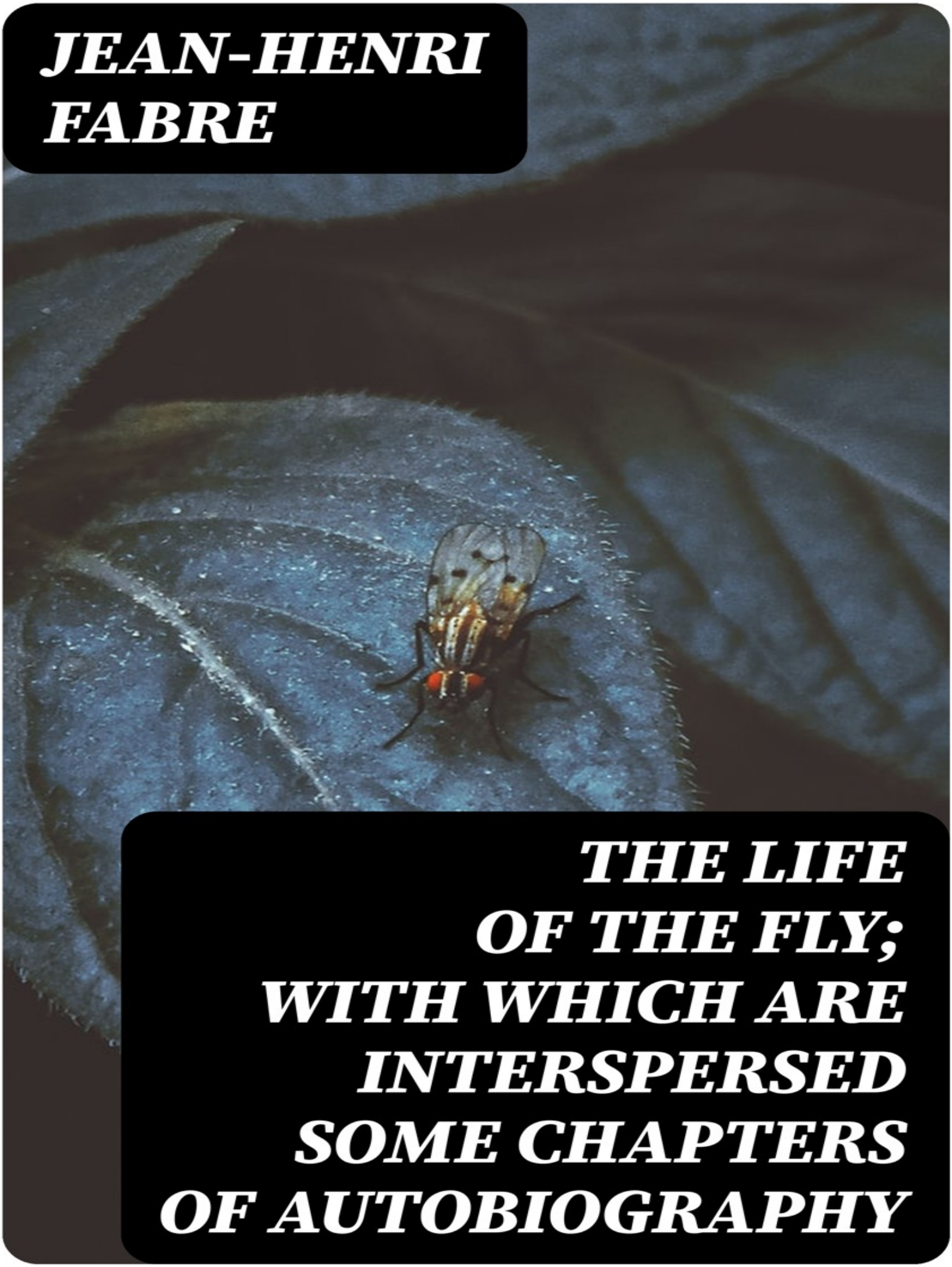
JEAN-HENRI FABRE



THE LIFE OF THE FLY; WITH WHICH ARE INTERSPERSED SOME CHAPTERS OF AUTOBIOGRAPHY

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The Life of the Fly; With Which are Interspersed Some Chapters of Autobiography

EAN 8596547336532

DigiCat, 2022
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CHAPTER I. THE HARMAS

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This is what I wished for, hoc erat in votis: a bit of land, oh, not so very large, but fenced in, to avoid the drawbacks of a public way; an abandoned, barren, sun scorched bit of land, favored by thistles and by wasps and bees. Here, without fear of being troubled by the passersby, I could consult the Ammophila and the Sphex [two digger or hunting wasps] and engage in that difficult conversation whose questions and answers have experiment for their language; here, without distant expeditions that take up my time, without tiring rambles that strain my nerves, I could contrive my plans of attack, lay my ambushes and watch their effects at every hour of the day. Hoc erat in votis. Yes, this was my wish, my dream, always cherished, always vanishing into the mists of the future.

And it is no easy matter to acquire a laboratory in the open fields, when harassed by a terrible anxiety about one's daily bread. For forty years have I fought, with steadfast courage, against the paltry plagues of life; and the long-wished-for laboratory has come at last. What it has cost me in perseverance and relentless work I will not try to say. It has come; and, with it—a more serious condition—perhaps a little leisure. I say perhaps, for my leg is still hampered with a few links of the convict's chain.

The wish is realized. It is a little late, O my pretty insects! I greatly fear that the peach is offered to me when I am beginning to have no teeth wherewith to eat it. Yes, it is a little late: the wide horizons of the outset have shrunk into a

low and stifling canopy, more and more straitened day by day. Regretting nothing in the past, save those whom I have lost; regretting nothing, not even my first youth; hoping nothing either, I have reached the point at which, worn out by the experience of things, we ask ourselves if life be worth the living.

Amid the ruins that surround me, one strip of wall remains standing, immovable upon its solid base: my passion for scientific truth. Is that enough, O my busy insects, to enable me to add yet a few seemly pages to your history? Will my strength not cheat my good intentions? Why, indeed, did I forsake you so long? Friends have reproached me for it. Ah, tell them, tell those friends, who are yours as well as mine, tell them that it was not forgetfulness on my part, not weariness, nor neglect: I thought of you; I was convinced that the Cerceris [a digger wasp] cave had more fair secrets to reveal to us, that the chase of the Sphex held fresh surprises in store. But time failed me; I was alone, deserted, struggling against misfortune. Before philosophizing, one had to live. Tell them that; and they will pardon me.

Others again have reproached me with my style, which has not the solemnity, nay, better, the dryness of the schools. They fear lest a page that is read without fatigue should not always be the expression of the truth. Were I to take their word for it, we are profound only on condition of being obscure. Come here, one and all of you—you, the sting bearers, and you, the wing-cased armor-clads—take up my defense and bear witness in my favor. Tell of the intimate terms on which I live with you, of the patience with

which I observe you, of the care with which I record your actions. Your evidence is unanimous: yes, my pages, though they bristle not with hollow formulas nor learned smatterings, are the exact narrative of facts observed, neither more nor less; and whoever cares to question you in his turn will, obtain the same replies.

And then, my dear insects, if you cannot convince those good people, because you do not carry the weight of tedium, I, in my turn, will say to them: 'You rip up the animal and I study it alive; you turn it into an object of horror and pity, whereas I cause it to be loved; you labor in a torture chamber and dissecting room, I make my observations under the blue sky to the song of the cicadas, you subject cell and protoplasm to chemical tests, I study instinct in its loftiest manifestations; you pry into death, I pry into life. And why should I not complete my thought: the boars have muddied the clear stream; natural history, youth's glorious study, has, by dint of cellular improvements, become a hateful and repulsive thing. Well, if I write for men of learning, for philosophers, who, one day, will try to some extent to unravel the tough problem of instinct, I write also, I write above all things for the young. I want to make them love the natural history which you make them hate; and that is why, while keeping strictly to the domain of truth, I avoid your scientific prose, which too often, alas seems borrowed from some Iroquois idiom.

But this is not my business for the moment: I want to speak of the bit of land long cherished in my plans to form a laboratory of living entomology, the bit of land which I have at last obtained in the solitude of a little village. It is a

harmas, the name given, in this district [the country round Serignan, in Provence], to an untilled, pebbly expanse abandoned to the vegetation of the thyme. It is too poor to repay the work of the plow; but the sheep passes there in spring, when it has chanced to rain and a little grass shoots up.

My harmas, however, because of its modicum of red earth swamped by a huge mass of stones, has received a rough first attempt at cultivation: I am told that vines once grew here. And, in fact, when we dig the ground before planting a few trees, we turn up, here and there, remains of the precious stock, half carbonized by time. The three pronged fork, therefore, the only implement of husbandry that can penetrate such a soil as this, has entered here; and I am sorry, for the primitive vegetation has disappeared. No more thyme, no more lavender, no more clumps of kermes oak, the dwarf oak that forms forests across which we step by lengthening our stride a little. As these plants, especially the first two, might be of use to me by offering the Bees and Wasps a spoil to forage, I am compelled to reinstate them in the ground whence they were driven by the fork.

What abounds without my mediation is the invaders of any soil that is first dug up and then left for a long time to its own resources. We have, in the first rank, the couch grass, that execrable weed which three years of stubborn warfare have not succeeded in exterminating. Next, in respect of number, come the centauries, grim looking one and all, bristling with prickles or starry halberds. They are the yellow-flowered centaury, the mountain centaury, the star thistle and the rough centaury: the first predominates.

Here and there, amid their inextricable confusion, stands, like a chandelier with spreading, orange flowers for lights, the fierce Spanish oyster plant, whose spikes are strong as nails. Above it, towers the Illyrian cotton thistle, whose straight and solitary stalk soars to a height of three to six feet and ends in large pink tufts. Its armor hardly yields before that of the oyster plant. Nor must we forget the lesser thistle tribe, with first of all, the prickly or 'cruel' thistle, which is so well armed that the plant collector knows not where to grasp it; next, the spear thistle, with its ample foliage, ending each of its veins with a spear head; lastly, the black knapweed, which gathers itself into a spiky knot. In among these, in long lines armed with hooks, the shoots of the blue dewberry creep along the ground. To visit the prickly thicket when the Wasp goes foraging, you must wear boots that come to mid-leg or else resign yourself to a smarting in the calves. As long as the ground retains a few remnants of the vernal rains, this rude vegetation does not lack a certain charm, when the pyramids of the oyster plant and the slender branches of the cotton thistle rise above the wide carpet formed by the yellow-flowered centaury saffron heads; but let the droughts of summer come and we see but a desolate waste, which the flame of a match would set ablaze from one end to the other. Such is, or rather was, when I took possession of it, the Eden of bliss where I mean to live henceforth alone with the insect. Forty years of desperate struggle have won it for me.

Eden, I said; and, from the point of view that interests me, the expression is not out of place. This cursed ground, which no one would have had at a gift to sow with a pinch of

turnip seed, is an earthly paradise for the bees and wasps. Its mighty growth of thistles and centauries draws them all to me from everywhere around. Never, in my insect hunting memories, have I seen so large a population at a single spot; all the trades have made it their rallying point. Here come hunters of every kind of game, builders in clay, weavers of cotton goods, collectors of pieces cut from a leaf or the petals of a flower, architects in pasteboard, plasterers mixing mortar, carpenters boring wood, miners digging underground galleries, workers handling goldbeater's skin and many more.

Who is this one? An Anthidium [a tailor bee]. She scrapes the cobwebby stalk of the yellow-flowered centaury and gathers a ball of wadding which she carries off proudly in the tips of her mandibles. She will turn it, under ground, into cotton felt satchels to hold the store of honey and the egg. And these others, so eager for plunder? They are Megachiles [leaf-cutting bees], carrying under their bellies their black, white or blood red reaping brushes. They will leave the thistles to visit the neighboring shrubs and there cut from the leaves oval pieces which will be made into a fit receptacle to contain the harvest. And these, clad in black velvet? They are Chalicodomae [mason bees], who work with cement and gravel. We could easily find their masonry on the stones in the harmas. And these noisily buzzing with a sudden flight? They are the Anthophorae [wild bees], who live in the old walls and the sunny banks of the neighborhood.

Now come the Osmiae. One stacks her cells in the spiral staircase of an empty snail shell; another, attacking the pith

of a dry bit of bramble, obtains for her grubs a cylindrical lodging and divides it into floors by means of partition walls; a third employs the natural channel of a cut reed; a fourth is a rent-free tenant of the vacant galleries of some mason bee. Here are the Macrocerae and the Eucerae, whose males are proudly horned; the Dasypodae, who carry an ample brush of bristles on their hind legs for a reaping implement; the Andrenae, so manifold in species; the slender-bellied Halicti [all wild bees]. I omit a host of others. If I tried to continue this record of the guests of my thistles, it would muster almost the whole of the honey yielding tribe. A learned entomologist of Bordeaux, Professor Perez, to whom I submit the naming of my prizes, once asked me if I had any special means of hunting, to send him so many rarities and even novelties. I am not at all an experienced and, still less, a zealous hunter, for the insect interests me much more when engaged in its work than when struck on a pin in a cabinet. The whole secret of my hunting is reduced to my dense nursery of thistles and centauries.

By a most fortunate chance, with this populous family of honey gatherers was allied the whole hunting tribe. The builders' men had distributed here and there in the harmas great mounds of sand and heaps of stones, with a view to running up some surrounding walls. The work dragged on slowly; and the materials found occupants from the first year. The mason bees had chosen the interstices between the stones as a dormitory where to pass the night, in serried groups. The powerful eyed lizard, who, when close pressed, attacks both man and dog, wide mouthed, had selected a cave wherein to lie in wait for the passing scarab [a dung

beetle also known as the sacred beetle]; the black-eared chat, garbed like a Dominican, white-frocked with black wings, sat on the top stone, singing his short rustic lay: his nest, with its sky blue eggs, must be somewhere in the heap. The little Dominican disappeared with the loads of stones. I regret him: he would have been a charming neighbor. The eyed lizard I do not regret at all.

The sand sheltered a different colony. Here, the Bembeces [digger wasps] were sweeping the threshold of their burrows, flinging a curve of dust behind them; the Languedocian Sphex was dragging her Ephippigera [a green grasshopper] by the antennae; a Stizus [a hunting wasp] was storing her preserves of Cicadellae [froghoppers]. To my sorrow, the masons ended by evicting the sporting tribe; but, should I ever wish to recall it, I have but to renew the mounds of sand: they will soon all be there.

Hunters that have not disappeared, their homes being different, are the Ammophilae, whom I see fluttering, one in spring, the others in autumn, along the garden walks and over the lawns, in search of a caterpillar; the Pompili [digger or hunting wasp], who travel alertly, beating their wings and rummaging in every corner in quest of a spider. The largest of them waylays the Narbonne Lycosa [known also as the black-bellied tarantula], whose burrow is not infrequent in the harmas. This burrow is a vertical well, with a curb of fescue grass intertwined with silk. You can see the eyes of the mighty Spider gleam at the bottom of the den like little diamonds, an object of terror to most. What a prey and what dangerous hunting for the Pompilus! And here, on a hot summer afternoon, is the Amazon ant, who leaves her

barrack rooms in long battalions and marches far afield to hunt for slaves. We will follow her in her raids when we find time. Here again, around a heap of grasses turned to mould, are Scoliae [large hunting wasps] an inch and a half long, who fly gracefully and dive into the heap, attracted by a rich prey, the grubs of Lamellicorns, Orycotes and Ceotoniae [various beetles].

What subjects for study! And there are more to come. The house was as utterly deserted as the ground. When man was gone and peace assured, the animal hastily seized on everything. The warbler took up his abode in the lilac shrubs; the greenfinch settled in the thick shelter of the cypresses; the sparrow carted rags and straw under every slate; the Serin finch, whose downy nest is no bigger than half an apricot, came and chirped in the plane tree tops; the Scops made a habit of uttering his monotonous, piping note here, of an evening; the bird of Pallas Athene, the owl, came hurrying along to hoot and hiss.

In front of the house is a large pond, fed by the aqueduct that supplies the village pumps with water. Here, from half a mile and more around, come the frogs and Toads in the lovers' season. The natterjack, sometimes as large as a plate, with a narrow stripe of yellow down his back, makes his appointments here to take his bath; when the evening twilight falls, we see hopping along the edge the midwife toad, the male, who carries a cluster of eggs, the size of peppercorns, wrapped round his hindlegs: the genial paterfamilias has brought his precious packet from afar, to leave it in the water and afterwards retire under some flat stone, whence he will emit a sound like a tinkling bell.

Lastly, when not croaking amid the foliage, the tree frogs indulge in the most graceful dives. And so, in May, as soon as it is dark, the pond becomes a deafening orchestra: it is impossible to talk at table, impossible to sleep. We had to remedy this by means perhaps a little too rigorous. What could we do? He who tries to sleep and cannot needs becomes ruthless.

Bolder still, the wasp has taken possession of the dwelling house. On my door sill, in a soil of rubbish, nestles the white-banded Sphex: when I go indoors, I must be careful not to damage her burrows, not to tread upon the miner absorbed in her work. It is quite a quarter of a century since I last saw the saucy cricket hunter. When I made her acquaintance, I used to visit her at a few miles' distance: each time, it meant an expedition under the blazing August sun. Today, I find her at my door; we are intimate neighbors. The embrasure of the closed window provides an apartment of a mild temperature for the Pelopaeus [a mason wasp]. The earth-built nest is fixed against the freestone wall. To enter her home, the spider huntress uses a little hole left open by accident in the shutters. On the moldings of the Venetian blinds, a few stray mason bees build their group of cells; inside the outer shutters, left ajar, a Eumenes [a mason wasp] constructs her little earthen dome, surmounted by a short, bell-mouthed neck. The common wasp and the Polistes [a solitary wasp] are my dinner guests: they visit my table to see if the grapes served are as ripe as they look.

Here, surely—and the list is far from complete—is a company both numerous and select, whose conversation

will not fail to charm my solitude, if I succeed in drawing it out. My dear beasts of former days, my old friends, and others, more recent acquaintances, all are here, hunting, foraging, building in close proximity. Besides, should we wish to vary the scene of observation, the mountain [Ventoux] is but a few hundred steps away, with its tangle of arbutus, rock roses and arborescent heather; with its sandy spaces dear to the Bembeces; with its marly slopes exploited by different wasps and bees. And that is why, foreseeing these riches, I have abandoned the town for the village and come to Serignan to weed my turnips and water my lettuces.

Laboratories are being founded, at great expense, on our Atlantic and Mediterranean coasts, where people cut up small sea animals, of but meager interest to us; they spend a fortune on powerful microscopes, delicate dissecting instruments, engines of capture, boats, fishing crews, aquariums, to find out how the yolk of an Annelid's egg is constructed, a question whereof I have never yet been able to grasp the full importance; and they scorn the little land animal, which lives in constant touch with us, which provides universal psychology with documents of inestimable value, which too often threatens the public wealth by destroying our crops. When shall we have an entomological laboratory for the study not of the dead insect, steeped in alcohol, but of the living insect; a laboratory having for its object the instinct, the habits, the manner of living, the work, the struggles, the propagation of that little world, with which agriculture and philosophy have most seriously to reckon?

To know thoroughly the history of the destroyer of our vines might perhaps be more important than to know how this or that nerve fiber of a Cirriped [sea animals with hair-like legs, including the barnacles and acorn shells] ends; to establish by experiment the line of demarcation between intellect and instinct; to prove, by comparing facts in the zoological progression, whether human reason be an irreducible faculty or not: all this ought surely to take precedence of the number of joints in a Crustacean's antenna. These enormous questions would need an army of workers; and we have not one. The fashion is all for the Mollusk and the Zoophytes [plant-like sea animals, including starfishes, jellyfishes, sea anemones and sponges]. The depths of the sea are explored with many drag nets; the soil which we tread is consistently disregarded. While waiting for the fashion to change, I open my harmas laboratory of living entomology; and this laboratory shall not cost the ratepayers one farthing.

CHAPTER II. THE ANTHRAX

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I made the acquaintance of the Anthrax in 1855 at Carpentras, at the time when the life history of the oil beetles was causing me to search the tall slopes beloved of the Anthophora bees [mason bees]. Her curious pupae, so powerfully equipped to force an outlet for the perfect insect incapable of the least effort, those pupae armed with a multiple plowshare at the fore, a trident at the rear and rows of harpoons on the back wherewith to rip open the Osmia bee's cocoon and break through the hard crust of the hillside, betokened a field that was worth cultivating. The little that I said about her at the time brought me urgent entreaties: I was asked for a circumstantial chapter on the strange fly. The stern necessities of life postponed to an ever retreating future my beloved investigations, so miserably stifled. Thirty years have passed; at last, a little leisure is at hand; and here, in the harmas of my village, with an ardor that has in no wise grown old, I have resumed my plans of yore, still alive like the coal smoldering under the ashes. The Anthrax has told me her secrets, which I in my turn am going to divulge. Would that I could address all those who cheered me on this path, including first and foremost the revered Master of the Landes [Leon Dufour]. But the ranks have thinned, many have been promoted to another world and their disciple lagging behind them can but record, in memory of those who are no more, the story of the insect clad in deepest mourning.

In the course of July, let us give a few sideward knocks to the bracing pebbles and detach the nests of the Chalicodoma of the Walls [a mason bee] from their supports. Loosened by the shock, the dome comes off cleanly, all in one piece. Moreover—and this is a great advantage—the cells come into view wide open on the base of the exposed nest, for at this point they have no other wall than the surface of the pebble. In this way, without any scraping, which would be wearisome work for the operator and dangerous to the inhabitants of the dome, we have all the cells before our eyes, together with their contents, consisting of a silky, amber-yellow cocoon, as delicate and translucent as an onion peeling. Let us split the dainty wrapper with the scissors, chamber by chamber, nest by nest. If fortune be at all propitious, as it always is to the persevering, we shall end by finding that the cocoons harbor two larvae together, one more or less faded in appearance, the other fresh and plump. We shall also find some, no less plentiful, in which the withered larva is accompanied by a family of little grubs wriggling uneasily around it.

Examination at once reveals the tragedy that is happening under the cover of the cocoon. The flacid and faded larva is the mason bee's. A month ago, in June, having finished its mess of honey, it wove its silken sheath for a bedchamber wherein to take the long sleep which is the prelude to the metamorphosis. Bulging with fat, it is a rich and defenseless morsel for whoever is able to reach it. Then, in spite of apparently insurmountable obstacles, the mortar wall and the tent without an opening, the flesh-eating larvae appeared in the secret retreat and are now

glutting themselves on the sleeper. Three different species take part in the carnage, often in the same nest, in adjoining cells. The diversity of shapes informs us of the presence of more than one enemy; the final stage of the creatures will tell us the names and qualities of the three invaders.

Forestalling the secrets of the future for the sake of greater clearness, I will anticipate the actual facts and come at once to the results produced. When it is by itself on the body of the mason bee's larva, the murderous grub belongs either to Anthrax trifasciata, MEIGEN, or to Leucospis gigas, FAB. But, if numerous little worms, often a score and more, swarm around the victim, then it is a Chalcidid's family which we have before us. Each of these ravagers shall have its biography. Let us begin with the Anthrax.

And first the grub, as it is after consuming its victim, when it remains the sole occupant of the mason bee's cocoon. It is a naked worm, smooth, legless and blind, of a creamy dead white, each segment a perfect ring, very much curved when at rest, but with the tendency to become almost straight when disturbed. Through the diaphanous skin, the lens distinguishes patches of fat, which are the cause of its characteristic coloring. When younger, as a tiny grub a few millimeters long, it is streaked with two different kinds of stains, some white, opaque and of a creamy tint, others translucent and of the palest amber. The former come from adipose masses in course of formation; the second from the nourishing fluid or from the blood which laves those masses.

Including the head, I count thirteen segments. In the middle of the body these segments are well marked, being

separated by a slight groove; but in the forepart they are difficult to count. The head is small and is soft, like the rest of the body, with no sign of any mouth parts even under the close scrutiny of the lens. It is a white globule, the size of a tiny pin's head and continued at the back by a pad a little larger, from which it is separated by a scarcely appreciable crease. The whole is a sort of nipple swelling slightly on the upper surface; and its double structure is so difficult to perceive that at first we take it for the animal's head alone, though it includes both the head and the prothorax, or first segment of the thorax.

The mesothorax, or middle segment of the thorax, which is two or three times larger in diameter, is flattened in front and separated from the nipple formed by the prothorax and the head by a deep, narrow, curved fissure. On its front surface are two pale red stigmata, or respiratory orifices, placed pretty close together. The metathorax, or last segment of the thorax, is a little larger still in diameter and protrudes. These abrupt increases in circumference result in a marked hump, sloping sharply towards the front. The nipple of which the head forms part is set at the bottom of this hump.

After the metathorax, the shape becomes regular and cylindrical, while decreasing slightly in girth in the last two or three segments. Close to the line of separation of the last two rings, I am able to distinguish, not without difficulty, two very small stigmata, just a little darker in color. They belong to the last segment. In all, four respiratory orifices, two in front and two behind, as is the rule among Flies. The length

of the full sized larva is 15 to 20 millimeters and its breadth 5 to 6.

Remarkable in the first place by the protuberance of its thorax and the smallness of its head, the grub of the Anthrax acquires exceptional interest by its manner of feeding. Let us begin by observing that, deprived of all, even the most rudimentary walking apparatus, the animal is absolutely incapable of shifting its position. If I disturb its rest, it curves and straightens itself in turns by a series of contractions, it tosses about violently where it lies, but does not manage to progress. It fidgets and gets no farther. We shall see later the magnificent problem raised by this inertness.

For the moment, a most unexpected fact claims all our attention. I refer to the extreme readiness with which the Anthrax' larva quits and returns to the Chalicodoma grub on which it is feeding. After witnessing flesh eating larvae at hundreds and hundreds of meals, I suddenly find myself confronted with a manner of eating that bears no relation to anything which I have seen before. I feel myself in a world that baffles my old experience. Let us recall the table manners of a larva living on prey, the Ammophila's for instance, when devouring its caterpillar. A hole is made in the victim's side; and the head and neck of the nursling dive deep into the wound, to root luxuriously among the entrails. There is never a withdrawal from the gnawed belly, never a recoil to interrupt the feast and to take breath awhile. The vivacious animal always goes forward, chewing, swallowing, digesting, until the caterpillar's skin is emptied of its contents. Once seated at table, it does not budge as long as

the victuals last. To tease it with a straw is not always enough to induce it to withdraw its head outside the wound; I have to use violence. When removed by force and then left to its own devices, the creature hesitates for a long time, stretches itself and mouths around, without trying to open a passage through a new wound. It needs the attacking point that has just been abandoned. If it finds the spot, it makes its way in and resumes the work of eating; but its future is jeopardized from this time forward, for the game, now perhaps tackled at inopportune points, is liable to go bad.

With the Anthrax' grub, there is none of this mangling, none of this persistent clinging to the entrance wound. I have but to tease it with the tip of a hair pencil and forthwith it retires; and the lens reveals no wound at the abandoned spot, no such effusion of blood as there would be if the skin were perforated. When its sense of security is restored, the grub once more applies its pimple head to the fostering larva, at any point, no matter where; and, so long as my curiosity does not prevent it, keeps itself fixed there, without the least effort, or the least perceptible movement that could account for the adhesion. If I repeat the touch with the pencil, I see the same sudden retreat and, soon after, the same contact just as readily renewed.

This facility for gripping, quitting and regripping, now here, now there and always without a wound, the part of the victim whence the nourishment is drawn tells us of itself that the mouth of the Anthrax is not armed with mandibular fangs capable of digging into the skin and tearing it. If the flesh were gashed by any such pincers, one or two attempts would be necessary before they could be released or

reapplied; besides, each point bitten would display a lesion. Well, there is nothing of the kind: a conscientious examination through the magnifying glass shows conclusively that the skin is intact; the grub glues its mouth to its prey or withdraws it with an ease that can only be explained by a process of simple contact. This being so, the Anthrax does not chew its food as do the other carnivorous grubs; it does not eat, it inhales.

This method of taking nourishment implies an exceptional apparatus of the mouth, into which it behooves us to inquire before continuing. My most powerful magnifying glass at last discovers, at the center of the pimple head, a small spot of an amber-russet color; and that is all. For a more exhaustive examination we will employ the microscope. I cut off the strange pimple with the scissors, wash it in a drop of water and place it on the object slide. The mouth now stands revealed as a round spot which, for hue and for the smallness of its size, may be compared with the front stigmata. It is a small conical crater, with sides of a pale yellowish-red and with faint, more or less concentric lines. At the bottom of this funnel is the opening of the gullet, itself tinted red in front and promptly spreading into a cone at the back. There is not the slightest trace of mandibular fangs, of jaws, of mouth parts for seizing and grinding. Everything is reduced to the bowl shaped opening, with a delicate lining of horny texture, as is shown by the amber hue and the concentric streaks. When I look for some term to designate this digestive entrance, of which so far I know no other example, I can find only that of a sucker or

cupping glass. Its attack is a mere kiss, but what a perfidious kiss!

We know the machine; now let us see the working. To facilitate observation, I shifted the newborn Anthrax grub, together with the Chalicodoma grub, its wet nurse, from the natal cell into a glass tube. I was thus able, by employing as many tubes as I wanted, to follow from start to finish, in all its most intimate details, the strange repast which I am going to describe.

The worm is fixed by its sucker to any convenient part of the nurse, plump and fat as butter. It is ready to break off its kiss suddenly, should anything disquiet it, and to resume it as easily when tranquillity is restored. No Lamb enjoys greater liberty with its mother's teat. After three or four days of this contact of the nurse and nursling, the former, at first replete and endowed with the glossy skin that is a sign of health, begins to assume a withered aspect. Her sides fall in, her fresh color fades, her skin becomes covered with little folds and gives evidence of an appreciable shrinking in this breast which, instead of milk, yields fat and blood. A week is hardly past before the progress of the exhaustion becomes startlingly rapid. The nurse is flabby and wrinkled, as though borne down by her own weight, like a very slack object. If I move her from her place, she flops and sprawls like a half-filled water bottle over the new supporting plane. But the Anthrax' kiss goes on emptying her: soon she is but a sort of shriveled lard bag, decreasing from hour to hour, from which the sucker draws a few last oily drains. At length, between the twelfth and the fifteenth day, all that

remains of the larva of the mason bee is a white granule, hardly as large as a pin's head.

This granule is the water bottle drained to the last drop, is the nurse's breast emptied of all its contents. I soften the meager remnant in water; then, keeping it still immersed, I blow into it through an extremely attenuated glass tube. The skin fills out, distends and resumes the shape of the larva, without there being an outlet anywhere for the compressed air. It is intact, therefore; it is free of any perforation, which would be forthwith revealed under the water by an escape of gas. And so, under the Anthrax' cupping glass, the oily bottle has been drained by a simple transpiration through the membrane; the substance of the nurse grub has been transfused into the body of the nursling by a process akin to that known in physics as endosmosis. What should we say to a method of being suckled by the mere application of the mouth to a teatless breast? What we see here may be compared with that: without any outlet, the milk of the Chalicodoma grub passes into the stomach of the Anthrax' larva.

Is it really an instance of endosmosis? Might it not rather be atmospheric pressure that stimulates the flow of nourishing fluids and distils them into the Anthrax' cup-shaped mouth, working, in order to create a vacuum, almost like the suckers of the Cuttlefish? All this is possible, but I shall refrain from deciding, preferring to assign a large share to the unknown in this extraordinary method of nutrition. It ought, I think, to provide physiologists with a field of research in which new views on the hydrodynamics of live fluids might well be gleaned; and this field trenches upon

others that would also yield rich harvests. The brief span of my days compels me to set the problem without seeking to solve it.

And the second problem is this: the Chalicodoma grub destined to feed the Anthrax is without a wound of any kind. The mother of the tiny larva is a feeble Fly deprived of whatsoever weapon capable of injuring her offspring's prey. Moreover, she is absolutely powerless to penetrate the mason bee's fortress, powerless as a fluff of down against a rock. On this point there is no doubt: the future wet nurse of the Anthrax has not been paralyzed as are the live provisions collected by the Hunting Wasps; she has received no bite nor scratch nor contusion of any sort; she has experienced nothing out of the common: in short, she is in her normal state. The billeted nursling arrives, we shall presently see how; he arrives, scarcely visible, almost defying the scrutiny of the lens; and, having made his preparations, he installs himself, he, the atom, upon the monstrous nurse, whom he is to drain to the very husk. And she, not paralyzed by a preliminary vivisection, endowed with all her normal vitality, lets him have his way, lets herself be sucked dry, with the utmost apathy. Not a tremor in her outraged flesh, not a quiver of resistance. No corpse could show greater indifference to the bite which it receives.

Ah, but the maggot has chosen the hour of attack with traitorous cunning! Had it appeared upon the scene earlier, when the larva was consuming its store of honey, things of a surety would have gone badly with it. The assaulted one, feeling herself bled to death by that ravenous kiss, would have protested with much wriggling of body and grinding of

mandibles. The position would have ceased to be tenable and the intruder would have perished. But at this hour all danger has disappeared. Enclosed in its silken tent, the larva is seized with the lethargy that precedes the metamorphosis. Its condition is not death, but neither is it life. It is an intermediary condition; it is almost the latent vitality of grain or egg. Therefore there is no sign of irritation on the larva's part under the needle with which I stir it and still less under the sucker of the Anthrax grub, which is able to drain the affluent breast in perfect safety.

This lack of resistance, induced by the torpor of the transformation, appears to me necessary, in view of the weakness of the nursling as it leaves the egg, whenever the mother is herself incapable of depriving the victim of the power of self defense. And so the nonparalyzed larvae are attacked during the period of the nymphosis. We shall soon see other instances of this.

Motionless though it be, the Chalicodoma grub is none the less alive. The primrose tint and the glossy skin are unequivocal signs of health: Were it really dead, it would, in less than twenty-four hours, turn a dirty brown and, soon after, decompose into a fluid putrescence. Now here is the marvelous thing: during the fortnight, roughly, that the Anthrax' meal lasts, the butter color of the larva, an unfailing symptom of the presence of life, continues unaltered and does not change into brown, the sign of putrefaction, until hardly anything remains; and even then the brown hue is often absent. As a rule, the look of live flesh is preserved until the final pellet, formed of the skin, the sole residue, makes its appearance. This pellet is white,

with not a speck of tainted matter, proving that life persists until the body is reduced to nothing.

We here witness the transfusion of one animal into another, the change of Chalicodoma substance into Anthrax substance; and, as long as the transfusion is not complete, as long as the eaten has not disappeared altogether and become the eater, the ruined organism fights against destruction. What manner of life is this, which may be compared with the life of a night light whose extinction is not accomplished until the last drop of oil has burnt away? How is any creature able to fight against the final tragedy of corruption up to the last moment in which a nucleus of matter remains as the seat of vital energy? The forces of the living creature are here dissipated not through any disturbance of the equilibrium of those forces, but for the want of any point of application for them: the larva dies because materially there is no more of it.

Can we be in the presence of the diffusive life of the plant, a life which persists in a fragment? By no means: the grub is a more delicate organic structure. There is unity between the several parts; and none of them can be jeopardized without involving the ruin of the others. If I myself give the larva a wound, if I bruise it, the whole body very soon turns brown and begins to rot. It dies and decomposes by the mere prick of a needle; it keeps alive, or at least preserves the freshness of the live tissues, so long as it is not entirely emptied by the Anthrax' sucker. A nothing kills it; an atrocious wasting does not. No, I fail to understand the problem; and I bequeath it to others.

All that I can see by way of a glimpse—and even then I put forward my suspicions with extreme reserve—all that I am permitted to surmise is reduced to this: the substance of the sleeping larva as yet has no very definite static existence; it is like the raw materials collected for a building; it is waiting for the elaboration that is to make a bee of it. To mould those shapeless lumps of the future insect, the air, that prime adjuster of living things, circulates among them, passing through a network of ducts. To organize them, to direct the placing of them, the nervous system, the embryo of the animal, distributes its ramifications over them. Nerve and air duct, therefore, are the essentials; the rest is so much material in reserve for the process of the metamorphosis. As long as that material is not employed, as long as it has not acquired its final equilibrium, it can grow less and less; and life, though languishing, will continue all the same on the express condition that the respiratory organs and the nervous filaments be respected. It is as it were the flame of the lamp, which, whether full or empty, continues to give light so long as the wick is soaked in oil. Nothing but fluids, the plastic materials held in reserve, can be distilled by the Anthrax' sucker through the unpierced skin of the grub; no part of the respiratory and nervous systems passes. As the two essential functions remain unscathed, life goes on until exhaustion is completed. On the other hand, if I myself injure the larva, I disturb the nervous or air conducting filaments; and the bruised part spreads a taint, followed by putrefaction, all over the body.

I have elsewhere, speaking of the Scolia [a digger wasp] devouring the Cetonia grub, enlarged upon this refined art

of eating which consists in consuming the prey while killing it only at the last mouthfuls. The Anthrax has the same requirements as his competitors who dine off fresh viands. He needs meat of that day, taken from a single joint that has to last a fortnight without going bad. His method of consuming reaches the highest level of art: he does not cut into his prey, he sips it little by little through his sucker. In this way, any dangerous risk is averted. Whether he imbibe at this spot or at that, even if he abandon the sucking process and resume it later, by no accident can he ever attack that which it is incumbent upon him to respect lest corruption supervene. The others have a fixed position on the victim, a place at which their mandibles have to bite and enter. If they move away from it, if they miss the appointed path, they imperil their existence. The Anthrax, more highly favored, puts his mouth where it suits him; he leaves off when he pleases and when he pleases starts again.

Unless I labor under a delusion, I think that I see the necessity for this privilege. The egg of the carnivorous burrower is firmly fixed on the victim at a point which varies considerably, it is true, according to the nature of the prey, but which is uniform for the same species of prey; moreover —and this is an important condition—the point of adhesion of that egg is always the head, whereas the egg of a bee, of the Osmia, for instance, is fixed to the mess of honey by the hinder end. When hatched, the new born Wasp grub has not to choose for itself, at its risk and peril, the suitable point at which to take the first cut in the quarry without fear of killing it too quickly: all that it need do is to bite at the spot where it has just been born. The mother, with her unfailing

instinct, has already made the dangerous choice; she has stuck her egg on the propitious spot and, by the very act of doing so, marked out the course for the inexperienced grub to follow. The tact of ripe age here guides the young larva's behavior at table.

The conditions are very different in the Anthrax' case. The egg is not placed upon the victuals, it is not even laid in the mason bee's cell. This is the natural consequence of the mother's feeble frame and of her lack of any instrument, such as a probe or auger, capable of piercing the mortar wall. It is for the newly hatched grub to make its own way into the dwelling. It enters, finds itself in the presence of ample provisions, the larva of the mason bee. Free of its actions, it is at liberty to attack the prey where it chooses; or rather the attacking point will be decided at haphazard by the first contact of the mouth in quest of food. Grant this mouth a set of carving tools, jaws and mandibles; in short, suppose the grub of the Fly to possess a manner of eating similar to that of the other carnivorous larvae; and the nursling is at once threatened with a speedy death. He will split open his nurse's belly, he will dig without any rule to guide him, he will bite at random, essentials as well as accessories; and, from one day to the next, he will set up gangrene in the violated mass, even as I myself do when I give it a wound. For the lack of an attacking point prescribed for him at birth, he will perish on the damaged provisions. His freedom of action will have killed him.

Certainly, liberty is a noble attribute, even in an insignificant grub; but it also has its dangers everywhere. The Anthrax escapes the peril only on the condition of