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The Life of the Caterpillar

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CHAPTER I

THE PINE PROCESSIONARY: THE EGGS AND THE HATCHING

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This caterpillar has already had his story told by Réaumur,1 but it was a story marked by gaps. These were inevitable in the conditions under which the great man worked, for he had to receive all his materials by barge from the distant Bordeaux Landes. The transplanted insect could not be expected to furnish its biographer with other than fragmentary evidence, very weak in those biological details which form the principal charm of entomology. To study the habits of insects one must observe them long and closely on their native heath, so to speak, in the place where their instincts have full and natural play.

With caterpillars foreign to the Paris climate and brought from the other end of France, Réaumur therefore ran the risk of [10]missing many most interesting facts. This is what actually happened, just as it did on a later occasion in the case of another alien, the Cicada.2 Nevertheless, the information which he was able to extract from a few nests sent to him from the Landes is of the highest value.

Better served than he by circumstances, I will take up afresh the story of the Processionary Caterpillar of the Pine. If the subject does not come up to my hopes, it will certainly not be for lack of materials. In my *harmas*3 laboratory, now stocked with a few trees in addition to its bushes, stand some vigorous fir-trees, the Aleppo pine and the black Austrian pine, a substitute for that of the Landes. Every year the caterpillar takes possession of them and spins his great purses in their branches. In the interest of the leaves, which are horribly ravaged, as though there had been a fire, I am obliged each winter to make [11]a strict survey and to extirpate the nests with a long forked batten.

You voracious little creatures, if I let you have your way, I should soon be robbed of the murmur of my once so leafy pines! Today I will seek compensation for all the trouble I have taken. Let us make a compact. You have a story to tell. Tell it me; and for a year, for two years or longer, until I know more or less all about it, I shall leave you undisturbed, even at the cost of lamentable suffering to the pines.

Having concluded the treaty and left the caterpillars in peace, I soon have abundant material for my observations. In return for my indulgence I get some thirty nests within a few steps of my door. If the collection were not large enough, the pine-trees in the neighbourhood would supply me with any

necessary additions. But I have a preference and a decided preference for the population of my own enclosure, whose nocturnal habits are much easier to observe by lantern-light. With such treasures daily before my eyes, at any time that I wish and under natural conditions, I cannot fail to see the Processionary's story unfolded at full length. Let us try. [12]

And first of all the egg, which Réaumur did not see. In the first fortnight of August, let us inspect the lower branches of the pines, on a level with our eyes. If we pay the least attention, we soon discover, here and there, on the foliage, certain little whitish cylinders spotting the dark green. These are the Bombyx' eggs: each cylinder is the cluster laid by one mother.

The pine-needles are grouped in twos. Each pair is wrapped at its base in a cylindrical muff which measures about an inch long by a fifth or sixth of an inch wide. This muff, which has a silky appearance and is white slightly tinted with russet, is covered with scales that overlap after the manner of the tiles on a roof; and yet their arrangement, though fairly regular, is by no means geometrical. The general aspect is more or less that of an immature walnut-catkin.

The scales are almost oval in form, semitransparent and white, with a touch of brown at the base and of russet at the tip. They are free at the lower end, which tapers slightly, but firmly fixed at the upper end, which is wider and blunter. You cannot detach them either by blowing on them or by [13]rubbing them repeatedly with a hair-pencil. They stand up, like a fleece stroked the wrong way, if the sheath is rubbed gently upwards, and retain this bristling position indefinitely; they resume their original arrangement when the friction is in the opposite direction. At the same time, they are as soft as velvet to the touch. Carefully laid one upon the other, they form a roof that protects the eggs. It is impossible for a drop of rain or dew to penetrate under this shelter of soft tiles.

The origin of this defensive covering is self-evident: the mother has stripped a part of her body to protect her eggs. Like the Eider-duck, she has made a warm overcoat for them out of her own down. Réaumur had already suspected as much from a very curious peculiarity of the Moth. Let me quote the passage:

> "The females," he says, "have a shiny patch on the upper part of their body, near the hind-quarters. The shape and gloss of this disk attracted my attention the first time that I saw it. I was holding a pin, with which I touched it, to examine its structure. The [14]contact of the pin produced a little spectacle that surprised me: I saw a cloud of tiny spangles at once detach themselves. These spangles scattered in every direction: some seemed to be shot into the air, others to the sides; but the greater part of the cloud fell softly to the ground.

> “Each of those bodies which I am calling spangles is an extremely slender lamina, bearing some resemblance to the atoms of dust on the Moths’ wings, but of course much bigger.... The disk that is so noticeable on the hind-quarters of these Moths is therefore a heap—and an enormous heap—of these scales.... The females seem to use them to wrap their eggs in; but the Moths of the Pine Caterpillar refused to lay while in my charge and consequently did not enlighten me as to whether they use the scales to cover their eggs or as to what they are doing with all those scales gathered round their hinder part, which were not given them and placed in that position to serve no purpose.”

You were right, my learned master: that dense and regular crop of spangles did not grow on the Moth’s tail for nothing. Is [15]there anything that has no object? You did not think so; I do not think so either. Everything has its reason for existing. Yes, you were well-inspired when you foresaw that the cloud of scales which flew out under the point of your pin must serve to protect the eggs.

I remove the scaly fleece with my pincers and, as I expected, the eggs appear, looking like little white-enamel beads. Clustering closely together, they make nine longitudinal rows. In one of these rows I count thirty-five eggs. As the nine rows are very nearly alike, the contents of the cylinder amount in all to about three hundred eggs, a respectable family for one mother!

The eggs of one row or file alternate exactly with those in the two adjoining files, so as to leave no empty spaces. They suggest a piece of bead-work produced with exquisite dexterity by patient fingers. It would be more correct still to compare them with a cob of Indian corn, with its neat rows of seeds, but a greatly reduced cob, the tininess of whose dimensions makes its mathematical precision all the more remarkable. The grains of the Moth’s spike have a slight tendency to be hexagonal, because of their mutual [16]pressure; they are stuck close together, so much so that they cannot be separated. If force is used, the layer comes off the leaf in fragments, in small cakes always consisting of several eggs apiece. The beads laid are therefore fastened together by a glutinous varnish; and it is on this varnish that the broad base of the defensive scales is fixed.

It would be interesting, if a favourable opportunity occurred, to see how the mother achieves that beautifully regular arrangement of the eggs and also how, as soon as she has laid one, all sticky with varnish, she makes a roof for it with a few scales removed one by one from her hind-quarters. For the moment, the very structure of the finished work tells us the course of the procedure. It is evident that the eggs are not laid in longitudinal files, but in circular rows, in rings, which lie one above the other, alternating their grains. The laying begins at the bottom, near the lower end of the double pine-leaf; it finishes at the top.

The first eggs in order of date are those of the bottom ring; the last are those of the top ring. The arrangement of the scales, all in a longitudinal direction and attached by the end facing the [17]top of the leaf, makes any other method of progression inadmissible.

Let us consider in the light of reflection the elegant edifice now before our eyes. Young or old, cultured or ignorant, we shall all, on seeing the Bombyx' pretty little spike, exclaim:

"How handsome!"

And what will strike us most will be not the beautiful enamel pearls, but the way in which they are put together with such geometrical regularity. Whence we can draw a great moral, to wit, that an exquisite order governs the work of a creature without consciousness, one of the humblest of the humble. A paltry Moth follows the harmonious laws of order.

If Micromégas4 took it into his head to leave Sirius once more and visit our planet, would he find anything to admire among us? Voltaire shows him to us using one of the diamonds of his necklace as a magnifying-glass in order to obtain some sort of view of the three-master which has run aground on his thumb-nail. He enters into conversation [18]with the crew. A nail-paring, curved like a horn, encompasses the ship and serves as a speaking-trumpet; a tooth-pick, which touches the vessel with its tapering end and the lips of the giant, some thousand fathoms above, with the other, serves as a telephone. The outcome of the famous dialogue is that, if we would form a sound judgment of things and see them under fresh aspects, there is nothing like changing one's planet.

The probability then is that the Sirian would have had a rather poor notion of our artistic beauties. To him our masterpieces of statuary, even though sprung from the chisel of a Phidias, would be mere dolls of marble or bronze, hardly more worthy of interest than the children's rubber dolls are to us; our landscape-paintings would be regarded as dishes of spinach smelling unpleasantly of oil; our opera-scores would be described as very expensive noises.

These things, belonging to the domain of the senses, possess a relative æsthetic value, subordinated to the organism that judges them. Certainly the Venus of Melos and the Apollo Belvedere are superb works; but even so it takes a special eye to appreciate them. [19]Micromégas, if he saw them, would be full of pity for the leanness of human forms. To him the beautiful calls for something other than our sorry, frog-like anatomy.

Show him, on the other hand, that sort of abortive windmill by means of which Pythagoras, echoing the wise men of Egypt, teaches us the fundamental properties of the right-angled triangle. Should the good giant, contrary to our expectation, happen not to know about it, explain to him what the windmill means. Once the light has entered his mind, he will find, just as we do, that

there is beauty there, real beauty, not certainly in that horrible hieroglyphic, the figure, but in the unchangeable relation between the lengths of the three sides; he will admire as much as we do geometry the eternal balancer of space.

There is, therefore, a severe beauty, belonging to the domain of reason, the same in every world, the same under every sun, whether the suns be single or many, white or red, blue or yellow. This universal beauty is order. Everything is done by weight and measure, a great statement whose truth breaks upon us all the more vividly as we probe more deeply into the mystery of things. [20]

Is this order, upon which the equilibrium of the universe is based, the predestined result of a blind mechanism? Does it enter into the plans of an Eternal Geometer, as Plato had it? Is it the ideal of a supreme lover of beauty, which would explain everything?

Why all this regularity in the curve of the petals of a flower, why all this elegance in the chasings on a Beetle's wing-cases? Is that infinite grace, even in the tiniest details, compatible with the brutality of uncontrolled forces? One might as well attribute the artist's exquisite medallion to the steam-hammer which makes the slag sweat in the melting.

These are very lofty thoughts concerning a miserable cylinder which will bear a crop of caterpillars. It cannot be helped. The moment one tries to dig out the least detail of things, up starts a why which scientific investigation is unable to answer. The riddle of the world has certainly its explanation otherwhere than in the little truths of our laboratories. But let us leave Micromégas to philosophize and return to the commonplaces of observation.

The Pine Bombyx has rivals in the art of [21]gracefully grouping her egg-beads. Among their number is the Neustrian Bombyx, whose caterpillar is known by the name of "Livery," because of his costume. Her eggs are assembled in bracelets around little branches varying greatly in nature, apple- and pear-branches chiefly. Any one seeing this elegant work for the first time would be ready to attribute it to the fingers of a skilled stringer of beads. My small son Paul opens eyes wide with surprise and utters an astonished "Oh!" each time that he comes upon the dear little bracelet. The beauty of order forces itself upon his dawning attention.

Though not so long and marked above all by the absence of any wrapper, the ring of the Neustrian Bombyx reminds one of the other's cylinder, stripped of its scaly covering. It would be easy to multiply these instances of elegant grouping, contrived now in one way, now in another, but always with consummate art. It would take up too much time, however. Let us keep to the Pine Bombyx.

The hatching takes place in September, a little earlier in one case, a little later in another. So that I may easily watch the new-born caterpillars in their first labours, I have [22]placed a few egg-laden branches in the window of my study.

They are standing in a glass of water which will keep them properly fresh for some time.

The little caterpillars leave the egg in the morning, at about eight o’clock. If I just lift the scales of the cylinder in process of hatching, I see black heads appear, which nibble and burst and push back the torn ceilings. The tiny creatures emerge slowly, some here and some there, all over the surface.

After the hatching, the scaly cylinder is as regular and as fresh in appearance as if it were still inhabited. We do not perceive that it is deserted until we raise the spangles. The eggs, still arranged in regular rows, are now so many yawning goblets of a slightly translucent white; they lack the cap-shaped lid, which has been rent and destroyed by the new-born grubs.

The puny creatures measure a millimetre[5] at most in length. Devoid as yet of the bright red that will soon be their adornment, they are pale-yellow, bristling with hairs, some shortish and black, others rather longer and white. The head, of a glossy black, is big [23]in proportion. Its diameter is twice that of the body. This exaggerated size of the head implies a corresponding strength of jaw, capable of attacking tough food from the start. A huge head, stoutly clad in horn, is the predominant feature of the budding caterpillar.

These macrocephalous ones are, as we see, well-armed against the hardness of the pine-needles, so well-armed in fact that the meal begins almost immediately. After roaming for a few moments at random among the scales of the common cradle, most of the young caterpillars make for the double leaf that served as an axis for the native cylinder and spread themselves over it at length. Others go to the adjacent leaves. Here as well as there they fall to; and the gnawed leaf is hollowed into faint and very narrow grooves, bounded by the veins, which are left intact.

From time to time, three or four who have eaten their fill fall into line and walk in step, but soon separate, each going his own way. This is practice for the coming processions. If I disturb them ever so little, they sway the front half of their bodies and wag their [24]heads with a jerky movement similar to the action of an intermittent spring.

But the sun reaches the corner of the window where the careful rearing is in progress. Then, sufficiently refreshed, the little family retreats to its native soil, the base of the double leaf, gathers into an irregular group and begins to spin. Its work is a gauze globule of extreme delicacy, supported on some of the neighbouring leaves. Under this tent, a very wide-meshed net, a siesta is taken during the hottest and brightest part of the day. In the afternoon, when the sun has gone from the window, the flock leaves its shelter, disperses around, sometimes forming a little procession within a radius of an inch, and starts browsing again.

Thus the very moment of hatching proclaims talents which age will develop without adding to their number. In less than an hour from the bursting of the egg, the caterpillar is both a processionary and a spinner. He also flees the light when taking refreshment. We shall soon find him visiting his grazing-grounds only at night.

The spinner is very feeble, but so active that in twenty-four hours the silken globe attains [25]the bulk of a hazel-nut and in a couple of weeks that of an apple. Nevertheless, it is not the nucleus of the great establishment in which the winter is to be spent. It is a provisional shelter, very light and inexpensive in materials. The mildness of the season makes anything else unnecessary. The young caterpillars freely gnaw the logs, the poles between which the threads are stretched, that is to say, the leaves contained within the silken tent. Their house supplies them at the same time with board and lodging. This excellent arrangement saves them from having to go out, a dangerous proceeding at their age. For these puny ones, the hammock is also the larder.

Nibbled down to their veins, the supporting leaves wither and easily come unfastened from the branches; and the silken globe becomes a hovel that crumbles with the first gust of wind. The family then moves on and goes elsewhere to erect a new tent, lasting no longer than the first. Even so does the Arab move on, as the pastures around his camel-hide dwelling become exhausted. These temporary establishments are renewed several times over, always at greater heights than the last, so much so that the tribe, which was hatched on [26]the lower branches trailing on the ground, gradually reaches the higher boughs and sometimes the very summit of the pine-tree.

In a few weeks' time, a first moult replaces the humble fleece of the start, which is pale-coloured, shaggy and ugly, by another which lacks neither richness nor elegance. On the dorsal surface, the various segments, excepting the first three, are adorned with a mosaic of six little bare patches, of a bright red, which stand out a little above the dark background of the skin. Two, the largest, are in front, two behind and one, almost dot-shaped, on either side of the quadrilateral. The whole is surrounded by a palisade of scarlet bristles, divergent and lying almost flat. The other hairs, those of the belly and sides, are longer and whitish.

In the centre of this crimson marquetry stand two clusters of very short bristles, gathered into flattened tufts which gleam in the sun like specks of gold. The length of the caterpillar is now about two centimetres6 and his width three or four millimetres.7 Such is the costume of middle age, which, like the earlier one, was unknown to Réaumur. [27]

1 René Antoine Ferchault de Réaumur (1683–1757), inventor of the Réaumur thermometer and author of *Mémoires pour servir à l'histoire naturelle des insectes*.—*Translator's Note.*↑

2 For the Cicada or *Cigale*, an insect remotely akin to the Grasshopper and found more particularly in the south of France, cf. *Social Life in the Insect World*, by J.H. Fabre, translated by Bernard Miall: chaps. i to iv.—*Translator's Note.*↑

3 The *harmas* was the enclosed piece of waste ground in which the author used to study his insects in their natural state.—*Translator's Note.*↑

4 The eponymous hero of Voltaire's story of "the little great man," published in 1752 in imitation of *Gulliver's Travels*.—*Translator's Note.*↑

5 .039 inch.—*Translator's Note.*↑

6 About three-quarters of an inch.—*Translator's Note.*↑

7 .117 to .156 inch.—*Translator's Note.*↑

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CHAPTER II

THE PINE PROCESSIONARY: THE NEST; THE COMMUNITY

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November arrives, however, bringing cold weather; the time has come to build the stout winter tabernacle. High up in the pine the tip of a bough is chosen, with suitably close-packed and convergent leaves. The spinners surround it with a spreading network, which bends the adjacent leaves a little nearer and ends by incorporating them into the fabric. In this way they obtain an enclosure half silk, half leaves, capable of withstanding the inclemencies of the weather.

Early in December the work has increased to the size of a man's two fists or more. In its ultimate perfection, it attains a volume of nearly half a gallon by the end of winter.

It is roughly egg-shaped, tapering to a certain length below and extended into a sheath which envelops the supporting branch. The origin of this silky extension is as follows: every evening between seven and nine o'clock, [28]weather permitting, the caterpillars leave the nest and go down the bare part of the bough which forms the pole of the tent. The road is broad, for this axis is sometimes as wide as the neck of a claret-bottle. The descent is accomplished without any attempt at order and

always slowly, so much so that the first caterpillars to come out have not yet dispersed before they are caught up by the others. The branch is thus covered by a continuous bark of caterpillars, made up of the whole community, which gradually divides into squads and disperses to this side and that on the nearest branches to crop their leaves. Now not one of the caterpillars moves a step without working his spinneret. Therefore the broad downward path, which on the way back will be the ascending path, is covered, as the result of constant traffic, with a multitude of threads forming an unbroken sheath.

It is obvious that this sheath, in which each caterpillar, passing backwards and forwards on his nocturnal rambles, leaves a double thread, is not an indicator laid down with the sole object of simplifying the journey back to the nest: a mere ribbon would be enough for that. Its use might well be to strengthen the [29]edifice, to give it deeper foundations and to join it by a multitude of cables to the steady branch.

The whole thing thus consists, above, of the home distended into an ovoid and, below, of the stalk, the sheath surrounding the support and adding its resistance to that of the numerous other fastenings.

Each nest that has not yet had its shape altered by the prolonged residence of the caterpillars shows in the centre a bulky, milk-white shell, with around it a wrapper of diaphanous gauze. The central mass, formed of thickly-woven threads, has for a wall a thick quilt into which are absorbed, as supports,

numbers of leaves, green and intact. The thickness of this wall may be anything up to three-quarters of an inch.

At the top of the dome are round openings, varying greatly in number and distribution, as wide across as an ordinary lead-pencil. These are the doors of the house, through which the caterpillars go in and out. All around the shell are projecting leaves, which the insects' teeth have respected. From the tip of each leaf there radiate, in graceful, undulating curves, threads which, loosely interlaced, form [30]a light tent, a spacious verandah of careful workmanship, especially in the upper part. Here we find a broad terrace on which, in the daytime, the caterpillars come and doze in the sun, heaped one upon the other, with rounded backs. The network stretching overhead does duty as an awning: it moderates the heat of the sun's rays; it also saves the sleepers from a fall when the bough rocks in the wind.

Let us take our scissors and rip open the nest from end to end longitudinally. A wide window opens and allows us to see the arrangement of the inside. The first thing to strike us is that the leaves contained in the enclosure are intact and quite sound. The young caterpillars in their temporary establishments gnaw the leaves within the silken wrapper to death; they thus have their larder stocked for a few days without having to quit their shelter in bad weather, a condition made necessary by their weakness. When

they grow stronger and start working on their winter home, they are very careful not to touch the leaves. Why these new scruples?

The reason is evident. If bruised, those leaves, the framework of the house, would [31]very soon wither and then be blown off with the first breath of wind. The silken purse, torn from its base, would collapse. On the other hand, if the leaves are respected, they remain vigorous and furnish a stout support against the assaults of winter. A solid fastening is superfluous for the summer tent, which lasts but a day; it is indispensable to the permanent shelter which will have to bear the burden of heavy snows and the buffeting of icy winds. Fully alive to these perils, the spinner of the pine-tree considers himself bound, however importunate his hunger, not to saw through the rafters of his house.

Inside the nest, therefore, opened by my scissors I see a thick arcade of green leaves, more or less closely wrapped in a silky sheath whence dangle shreds of cast skin and strings of dried droppings. In short, this interior is an extremely unpleasant place, a rag-shop and a sewage-farm in one, and corresponds in no way with the imposing exterior. All around is a solid wall of quilting and of closely-woven leaves. There are no chambers, no compartments marked off by partition-walls. It is a single room, turned into a [32]labyrinth by the colonnade of green leaves placed in rows one above the other throughout the oval hall. Here the caterpillars stay

when resting, gathered on the columns, heaped in confused masses.

When we remove the hopeless tangle at the top, we see the light filtering in at certain points of the roof. These luminous points correspond with the openings that communicate with the outer air. The network that forms a wrapper to the nest has no special exits. To pass through it in either direction, the caterpillars have only to push the sparse threads aside slightly. The inner wall, a compact rampart, has its doors; the flimsy outer veil has none.

It is in the morning, at about ten o'clock, that the caterpillars leave their night-apartment and come to take the sun on their terrace, under the awning which the points of the leaves hold up at a distance. They spend the whole day there dozing. Motionless, heaped together, they steep themselves deliciously in warmth and from time to time betray their bliss by nodding and wagging their heads. At six or seven o'clock, when it grows dark, the sleepers awake, bestir themselves, [33]separate and go their several ways over the surface of the nest.

We now behold an indeed delightful spectacle. Bright-red stripes meander in every direction over the white sheet of silk. One goes up, another comes down, a third moves aslant; others form a short procession. And, as they solemnly walk about in a splendid disorder, each glues to the ground which it covers the thread that constantly hangs from its lip.

Thus is the thickness of the shelter increased by a fine layer added immediately above the previous structure; thus is the dwelling strengthened by fresh supports. The adjoining green leaves are taken into the network and absorbed in the building. If the tiniest bit of them remains free, curves radiate from that point, increasing the size of the veil and fastening it at a greater distance. Every evening, therefore, for an hour or two, great animation reigns on the surface of the nest, if the weather permits; and the work of consolidating and thickening the structure is carried on with indefatigable zeal.

Do they foresee the future, these wary ones who take such precautions against the rigours of winter? Obviously not. Their few [34]months' experience—if indeed experience can be mentioned in connection with a caterpillar—tells them of savoury bellyfuls of green stuff, of gentle slumbers in the sun on the terrace of the nest; but nothing hitherto has made them acquainted with cold, steady rain, with frost, snow and furious blasts of wind. And these creatures, knowing naught of winter's woes, take the same precautions as if they were thoroughly aware of all that the inclement season holds in store for them. They work away at their house with an ardour that seems to say:

"Oh, how nice and warm we shall be in our beds here, nestling one against the other, when the pine-tree swings aloft its frosted candelabra! Let us work with a will! *Laboremus!*"

Yes, caterpillars, my friends, let us work with a will, great and small, men and grubs alike, so that we may fall asleep peacefully; you with the torpor that makes way for your transformation into Moths, we with that last sleep which breaks off life only to renew it. *Laboremus!*

Anxious to watch my caterpillars' habits in detail, without having to sally forth by lantern-light, [35]often in bad weather, to see what happens in the pine-trees at the end of the enclosure, I have installed half-a-dozen nests in a greenhouse, a modest, glazed shelter which, though hardly any warmer than the air outside, at least affords protection from the wind and rain. Fixed in the sand, at a height of about eighteen inches, by the base of the bough that serves as both an axis and a framework, each nest receives for rations a bundle of little pine-branches, which are renewed as soon as they are consumed. I take my lantern every evening and pay my boarders a visit. This is the way in which most of my facts are obtained.

After the day's work comes the evening meal. The caterpillars descend from the nest, adding a few more threads to the silvery sheath of the support, and reach the posy of fresh green stuff which is lying quite near. It is a magnificent sight to see the red-coated band lined up in twos and threes on each needle and in ranks so closely formed that the green sprigs of the bunch bend under the load.

The diners, all motionless, all poking their heads forward, nibble in silence, placidly. Their broad black foreheads gleam in the [36]rays of the lantern. A shower of granules drops on the sand below. These are the residues of easy-going stomachs, only too ready to digest their food. By to-morrow morning the soil will have disappeared under a greenish layer of this intestinal hail. Yes, indeed, it is a sight to see, one far more stimulating than that of the Silk-worms' mess-room. Young and old, we are all so much interested in it that our evenings almost invariably end in a visit to the greenhouse caterpillars.

The meal is prolonged far into the night. Satisfied at last, some sooner, some later, they go back to the nest, where for a little longer, feeling their silk-glands filled, they continue spinning on the surface. These hard workers would scruple to cross the white carpet without contributing a few threads. It is getting on for one or even two o'clock in the morning when the last of the band goes indoors.

My duty as a foster-father is daily to renew the bunch of sprigs, which are shorn to the last leaf; on the other hand, my duty as an historian is to enquire to what extent the diet can be varied. The district supplies me with Processionaries on the Scotch pine, the maritime pine and the Aleppo pine indifferently, [37]but never on the other Coniferæ. Yet one would think that any resin-scented leaf ought to suit. So says chemical analysis.

We must mistrust the chemist's retort when it pokes its nose into the kitchen. It may succeed in making butter out of tallow-candles and brandy out of potatoes; but, when it tells us that the products are identical, we shall do well to refuse these abominations. Science, astonishingly rich as it is in poison, will never provide us with anything fit to eat, because, though the raw substance falls to a large extent within its domain, that same substance escapes its methods the moment that it is wanted organized, divided and subdivided indefinitely by the process of life, as needed by the stomach, whose requirements are not to be met by measured doses of our reagents. The raw material of cell and fibre may perhaps be artificially obtained, some day; cell and fibre themselves, never. There's the rub with your chemical feeding.

The caterpillars loudly proclaim the insurmountable difficulty of the problem. Relying on my chemical data, I offer them the different substitutes for the pine growing in my enclosure: the spruce, the yew, the thuja, the [38]juniper, the cypress. What! Am I asking them, Pine Caterpillars, to bite into that? They will take good care not to, despite the tempting resinous smell! They would die of hunger rather than touch it! One conifer and one only is excepted: the cedar. My charges browse upon its leaves with no appreciable repugnance. Why the cedar and not the others? I do not know. The

caterpillar’s stomach, fastidious as our own, has its secrets.

Let us pass to other tests. I have just slit open longitudinally a nest whose internal structure I want to explore. Owing to the natural shrinkage of the split swan’s-down, the cleft reaches two fingers’ breadth in the centre and tapers at the top and bottom. What will the spinners do in the presence of such a disaster? The operation is performed by day, while the caterpillars are slumbering in heaps upon the dome. As the living-room is deserted at this time, I can cut boldly with the scissors without risk of damaging any part of the population.

My ravages do not wake the sleepers: all day long not one appears upon the breach. This indifference looks as though it were due [39]to the fact that the danger is not yet known. Things will be different to-night, when the busy work begins again. However dull they may be, the caterpillars will certainly notice that huge window which freely admits the deadly draughts of winter; and, possessing any amount of padding, they will crowd round the dangerous gap and stop it up in a trice. Thus do we argue, forgetting the animal’s intellectual darkness.

What really happens is that, when night falls, the indifference of the caterpillars remains as great as ever. The breach in the tent provokes not a sign of excitement. They move to and fro on the surface of the nest; they work, they spin as usual. There is no change, absolutely none, in their behaviour. When

the road covered chances to bring some of them to the brink of the ravine, we see no alacrity on their part, no sign of anxiety, no attempt to close up the two edges of the slit. They simply strive to accomplish the difficult crossing and to continue their stroll as though they were walking on a perfect web. And they manage it somehow or other, by fixing the thread as far as the length of their body permits. [40]

Having once crossed the gulf, they pursue their way imperturbably, without stopping any more at the breach. Others come upon the scene and, using the threads already laid as foot-bridges, pass over the rent and walk on, leaving their own thread as they go. Thus the first night's work results in the laying over the cleft of a filmy gauze, hardly perceptible, but just sufficient for the traffic of the colony. The same thing is repeated on the nights that follow; and the crevice ends by being closed with a scanty sort of Spider's web. And that is all.

There is no improvement by the end of the winter. The window made by my scissors is still wide open, though thinly veiled; its black spindle shape shows from the top of the nest to the bottom. There is no darn in the split texture, no piece of swan's-down let in between the two edges to restore the roof to its original state. If the accident had happened in the open air and not under glass, the foolish spinners would probably have died of cold in their cracked house.

Twice renewed with the same results, this test proves that the Pine Caterpillars are not alive to the danger of their split dwelling. [41]Expert spinners though they be, they seem as unconscious of the ruin of their work as the spools in a factory are of a broken thread. They could easily make good the damage by stopping up the breach with the silk that is lavished elsewhere without urgent need; they could weave upon it a material as thick and solid as the rest of the walls. But no, they placidly continue their habitual task; they spin as they spun yesterday and as they will spin to-morrow, strengthening the parts that are already strong, thickening what is already thick enough; and not one thinks of stopping the disastrous gap. To let a piece into that hole would mean weaving the tent all over again from the beginning; and no insect, however industrious, goes back to what it has already done.

I have often called attention to this feature in animal psychology; notably I have described the ineptitude of the caterpillar of the Great Peacock Moth.1 When the experimenter lops the top off the complicated eel-trap which forms the pointed end of the cocoon, this caterpillar spends the silk remaining [42]to him in work of secondary importance, instead of making good the series of cones, each fitting into the other, which are so essential to the hermit's protection. He continues his normal task imperturbably, as though nothing out of the way had

taken place. Even so does the spinner in the pine-tree act with his burst tent.

Your foster-parent must perpetrate yet another piece of mischief, O my Processionary; but this time it shall be to your advantage! It does not take me long to perceive that the nests intended to last through the winter often contain a population much greater than that of the temporary shelters woven by the very young caterpillars. I also notice that, when they have attained their ultimate dimensions, these nests differ very considerably in size. The largest of them are equal to five or six of the smallest. What is the cause of these variations?

Certainly, if all the eggs turned out well, the scaly cylinder containing the laying of a single mother would be enough to fill a splendid purse: there are three hundred enamelled beads here for hatching. But in families which swarm unduly an enormous waste always [43]takes places and restores the balance of things; if the called are legion, the chosen are a well thinned-out troop, as is proved by the Cicada, the Praying Mantis2 and the Cricket.

The Pine Processionary, another crucible of organic matter of which various devourers take advantage, is also reduced in numbers immediately after the hatching. The delicate mouthful has shrunk to a few dozens of survivors around the light globular network in which the family passes the sunny autumn days. Soon they will have to be thinking of the stoutly-built winter tent. At such a time, it would

be a boon if they could be many, for from union springs strength.

I suspect an easy method of fusion among a few families. To serve them as a guide in their peregrinations about the tree, the caterpillars have their silk ribbon, which they follow on their return, after describing a bend. They may also miss it and strike another, one differing in no respect from their own. This new ribbon marks the way to some nest situated in the neighbourhood. The strayed [44]caterpillars, failing to distinguish it from their own ribbon, follow it conscientiously and in this manner end by reaching a strange dwelling. Suppose them to be peacefully received: what will happen?

Once fused, the several groups assembled by the accident of the path will form a powerful city, fitted to produce great works; the concerted weaklings will give rise to a strong, united body. This would explain the thickly-populated, bulky nests situated so near to others that have remained puny. The former would be the work of a syndicate incorporating the interests of spinners collected from different parts; the latter would belong to families left in isolation by the luck of the road.

It remains to be seen whether the chance-comers, guided by a strange ribbon, meet with a good reception in the new abode. The experiment is easily made upon the nests in the greenhouse. In the evening, at the hours devoted to grazing, I remove with a pruning-shears the different little branches

covered with the population of one nest and lay them on the provisions of the neighbouring nest, which provisions are also overrun with caterpillars. [45]Or I can make shorter work of it by taking the whole bunch, well covered with the troop, of the first pouch and planting it right beside the bunch of the second, so that the leaves of the two mingle a little at the edges.

There is not the least quarrelling between the real proprietors and the new arrivals. Both go on peacefully browsing, as though nothing had happened. And all without hesitation, when bed-time comes, make for the nest, like brothers who have always lived together; all do some spinning before retiring to rest, thicken the blanket a little and are then swallowed up in the dormitory. By repeating the same operation next day and, if necessary, the day after, in order to collect the laggards, I succeed without the slightest difficulty in wholly depopulating the first nest and transferring all its caterpillars to the second.

I venture to do something better still. The same method of transportation allows me to quadruple the output of a spinning-mill by adding to it the workers of three similar establishments. And, if I limit myself to this increase, the reason is not that any confusion [46]manifests itself in this shifting of quarters, but that I see no bounds to my experiment, so cheerfully do the caterpillars accept any addition to their

number. The more spinners, the more spinning: a very judicious rule of conduct.

Let us add that the caterpillars which have been transported cherish no regrets for their old house. They are quite at home with the others and make no attempt to regain the nest whence they were banished by my artifices. It is not the distance that discourages them, for the empty dwelling is only half a yard away at most. If, for the purpose of my studies, I wish to restock the deserted nest, I am obliged once more to resort to transportation, which invariably proves successful.

Later, in February, when an occasional fine day allows of long processions on the walls and the sand-covered shelf of the greenhouse, I am able to watch the fusing of two groups without personally intervening. All that I have to do is patiently to follow the evolutions of a file on the march. I see it sometimes, after leaving one nest, enter a different one, guided by some fortuitous [47]change of route. Thenceforward the strangers form part of the community on the same footing as the others. In a like fashion, when the caterpillars walk abroad upon the tree at night, the scanty groups of the outset must increase and gather the number of spinners which an extensive building requires.

Everything for everybody. So says the Pine Processionary, nibbling his leaves without quarrelling in the least over his neighbours' mouthfuls, or else entering—and being always peacefully received—

another's home precisely as he would his own. Whether a member of the tribe or a stranger, he finds room in the refectory and room in the dormitory. The others' nest is his nest. The others' grazing-ground is his grazing-ground, in which he is entitled to his fair share, one neither greater nor smaller than the share of his habitual or casual companions.

Each for all and all for each. So says the Processionary, who every evening spends his little capital of silk on enlarging a shelter that is often new to him. What would he do with his puny skein, if alone? Hardly anything. But there are hundreds and hundreds of them in the spinning-mill; and the result [48]of their infinitesimal contributions, woven into a common stuff, is a thick blanket capable of resisting the winter. In working for himself, each works for the others; and these on their side work as zealously for each. O lucky animals that know nothing of property, the mother of strife! O enviable cenobites, who practise the strictest communism!

These habits of the caterpillars invite a few reflections. Generous minds, richer in illusions than in logic, set communism before us as the sovran cure for human ills. Is it practicable among mankind? At all times there have been, there still are and there always will be, fortunately, associations in which it is possible to forget in common some small part of the hardships of life; but is it possible to generalize?

The caterpillars of the pine can give us much valuable information in this respect. Let us have no