

H. TRACY,

SCENES OF INDUSTRY

DISPLAYED

In the

BEEHIVE AND THE ANT-HILL.



LONDON:

JOHN HARRIS,

CORNER OF ST. PAUL'S CHURCH-YARD.

J. F. Tracy

G. F. Herbert.
Tracy.

1883.

~~Lucy F. William~~
~~to her little cousins~~
~~Fred^k Augustus and~~
~~Charlotte Tracy~~

1844

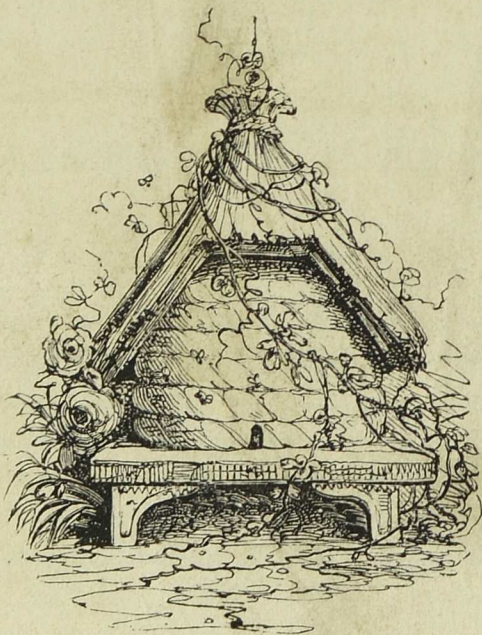
Lucy F. S. William
to her little cousins
Fred^k Augustus and
Charlotte Tracy."

1844.
Fred^k (my father) was born
2nd Feb. 1829. Theo. F. Tracy

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(FRONTIS)
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SCENES OF INDUSTRY
DISPLAYED
In the
BEE-HIVE AND THE ANT-HILL.

BY THE AUTHOR OF "WARS OF THE JEWS," "THE STUDENTS," &c.



"Go to the ant, thou sluggard;
Consider her ways, and be wise."—Prov.

LONDON:
JOHN HARRIS,
CORNER OF ST. PAUL'S CHURCH-YARD.

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SCENES OF INDUSTRY.

HISTORY OF BEES.

CHAPTER I.

ONE Saturday afternoon, I had taken a longer stroll than usual from my cottage at Long Hampton, which I had made my abode for the summer months. It was May, and one of the pleasantest days of that delightful month. I had reached a little hill, and sat myself down under the shade of the stunted furs that crowned its summit : the prospect was not extensive, but it was peculiarly interesting, the varied objects were strikingly contrasted. On the left, the ——shire hills were dimly seen, and their gentle slopes formed a contrast with the bold outline of the range which spread round to the front of the landscape. A thick wood co-

vered the slope of this little chain of hills, and overhung the river which ran in a gentle stream below. On this side of the river lay large fields of grass just ready to be cut; and between my hill and these fields, was situated, though scarcely visible for the trees, the village of Bray. The bird's-eye view, which my elevated situation gave me, shewed the tower of the pretty grey church, here and there a cottage chimney, a peep at the parsonage, and a full view of the bridge which crossed the river, and formed the high road to the county-town. Over this bridge, my eye wandered to the right, and followed the river through the golden meadows till I lost it in the park, when, looking up, I was delighted to behold in the distance, the bold towers which flank the court of the castle.

I was soon tired of straining my eyes to catch the distant objects, and again I looked straight forward to the village. There I discovered a large white house, the back of which was opposite to me, and it opened into a garden, walled round, and intersected with broad gravel walks. I fancied I heard the tinkling of a little bell; and, almost at the same moment, the glass door which led into the garden, opened, and out issued an innumerable swarm of girls, clad in white, with green ribbands. "Well," said I to myself, "here is a swarm of

larger bees than I have been lately in the habit of observing. Let me see if their movements are equally orderly with those of my friends." For a little while, there was, indeed, a great flutter, especially when a lady appeared, whom I soon made out to be a governess, and these little girls were her scholars. After a few minutes, they ranged themselves into something like order, and in groups of two or three, linked arm in arm, left the garden, and I lost sight of them.

Once more I ceased to think of all living beings, save the musical inhabitants of the grove, and I gave myself up to the enjoyment of their various notes; among which, to my surprise as well as pleasure, I plainly distinguished those of the nightingale, generally represented as so unsocial a bird as to warble only in the hours of darkness and repose.

Just at this moment I heard a loud peal of laughter, as if from a number of merry little beings. I looked about, and to my right, in one of the fields, below the hill on which I sat, I again espied the white and green nymphs who had issued from the white house. I was near enough to see what they were about, without being myself observed. Some, and among these the elder lady, were seated upon the gate or palings which were between them and the next field; but most of them

were in a cluster busily examining something in the ground. The peal of laughter was succeeded by one or two others; but soon a sound of a different kind was heard, which evidently disturbed the studies of the elder lady; for she shut the book she had been reading, and joined the group.

I then saw them throng round a very little girl, who seemed to be much and suddenly hurt; and, being unable to walk, two of the elder girls, at the suggestion of their governess, put their hands together and carried her upon their arms. They proceeded through the gate homewards; but some of the others lingered behind, looking at this same spot on the ground. It seemed, however, they had reason to repent of their curiosity; for I heard two or three more screams, and another girl was obliged to be conveyed home, in the same way as the first; and two or three more evidently limped, or seemed to be rubbing or tying up their arms.

Slowly they returned homewards, and I watched them till I saw them re-enter the garden. Some carried the lame ones in, others strolled about the broad gravel walks, while the little ones betook them to their little gardens; busily, as I fancied, setting the roots of wild flowers which they had collected in their afternoon's excursion.

I felt a strong curiosity to know what could be on that spot of ground to cause such a commotion in the group ; and, accordingly, I strolled down the little hill into the field. I had my conjectures, indeed ; and was in hopes the discovery might be of use to me in my studies ; for I had come into the neighbourhood on purpose to gain all the information I could, by actual observation, on the history of bees. I was not disappointed ; it was a bees' nest which had disturbed the girls, who, I suppose, before they perceived it, had put their feet too near, and irritated its inhabitants, who avenged themselves by stinging the limbs of the intruders.

The dusk was approaching, and the rising damp warned me to depart. I therefore postponed the examination of this nest for some other opportunity. In looking about to find some mark by which I could remember the spot, I observed a book lying in the grass : " Oh, ho !" thought I, " the poor wounded one forgot her book in her distress ; well, let me see what her name is." I took up the book, and saw on the outside in neat gilt letters, " Letitia Welbeck. Second prize. Reward for Good Conduct." On opening it, I found it to be the " Cabinet of Curiosities."—" This will be a terrible loss," said

I, "I must think, if I cannot find out the young lady, and restore it to her."

With this intention, I carried the book, and took the way to the village. But I could not make up my mind to knock at the door of the large white house. "It would be too formidable," thought I, "to have to encounter, perhaps, two or three grave governesses, and a whole host of girls; how should an old bachelor, like myself, know how to behave among them?"

While I was thus musing and sauntering, I reached the village, and was close to the garden gate of the vicarage.

I had never walked down the village before; and while pausing to look at the pretty little church, one side of which positively stood in the vicar's garden, I felt myself tapped upon the shoulder; and, on turning round, found it to be the curate of the village in which I was for the time residing.

He was accompanied by a grave-looking elderly man, whom he introduced to me as the vicar, whose house and church I was admiring. "Why, my bee-hunter!" said my lively friend, Wellingford, "what are you doing here, so far from your hives; have you borrowed the wings of one of your little companions and flown across the fields?"

The grave-looking clergyman glanced his eye upon the book I was carrying in my hand. "A lady's name!" said he, in a very quizzical tone; "Your friend has been conning a favourite lesson, Wellingford."

Being little disposed to be the butt of a joke, I hastened to tell my story, and my anxiety to restore to the little girl her lost prize.

"Oh, if that be all," said the vicar, who had exchanged his solemn look for one of great drollery; "if that be all, I will put you under my wing, and introduce you to these '*grave ladies*.'" So saying, we walked along, and, turning the corner which led out of the village, were almost directly in front of the white house. The front was far prettier than the back, being something like an Italian villa in miniature; a semicircular plot of grass, flanked by shrubberies and groves, led up, on each side, to the entrance. As we entered, the gate shut upon us, and we were soon at the steps. These were covered with geraniums in full bloom, and other plants apparently fresh from the green-house; the windows on each side of the steps reached the ground, and were enveloped with monthly and Austrian roses, mignonette, and French honeysuckle.

I am such a lover of nature, that I was put into

good humour by these tasty decorations, and prepared even to encounter the “grave” looks of the governess; but, when I followed the vicar into a small but elegant pink-coloured drawing-room, and saw myself approaching a graceful and handsome female, neither grave nor formal, but gentle and almost sprightly in her manner, I felt quite perplexed. Near the window, sat a blooming and merry-faced young lady, with her drawing apparatus before her; and at the harp sat another female, whose features were of a graver cast, but whose tall and commanding figure looked exceedingly graceful, when bending over the harp, which she was in the act of tuning.

I was introduced to all these severally by the vicar, in a half-serious, half-humorous manner; and I soon made out, by the smile which appeared upon the face of all the ladies, that they were accustomed to consider him as a regular wit.

He took the book out of my hand, telling the ladies how anxious I was to shew a due sense of honesty, and related my tale in so droll a manner, that we all had a hearty laugh; after which, I felt myself very much at home.

Miss R. the elder governess, said she believed the little girls were in the garden; and that if I liked to take a stroll round the grounds, I might

have the privilege of restoring the book myself to its right owner.

We formed a party immediately; and, after visiting the green-house, &c. entered the garden behind. At the bottom of a broad gravel walk, in a kind of stone arbour, with her foot on a cushion, and surrounded by young companions, I found the little girl, whose book I was in possession of. She was much pleased at seeing her book, and thanked me for bringing it. I told her, I was sorry that my friends, the bees, had proved such great enemies to her, but that I thought a sight of them in my hives at Long Hampton, would almost reconcile her to them.

We then pursued our walk, and after much agreeable conversation I began to think I must not intrude any longer. As we approached the gate, I found Wellingford making the two younger Miss R.'s laugh at my expense, by describing the furniture of my little garden at Long Hampton; the various shaped and various sized hives, the swarms of bees, &c.

To escape from his jokes, I took a hasty leave, but not till I had invited the ladies to come and see my bees, and to bring with them some of their pupils who had been stung, that I might endeavour to reconcile them to each other.

CHAPTER II.

A FEW days after this little adventure, I received a visit from my reverend neighbour Wellingford ; I was in the garden, among the hives, and watching the labours of my bees. With my head bent down to the windows of the hive, I was not aware that any one was passing the low paling that separates my garden from the lane, till I felt the tap of Wellingford's whip on my shoulder. He was booted and spurred, and had apparently just dismounted from his horse. "Prepare," said he, "prepare your hive, my good friend, for there are visitors for you on the road ; bid your bees trim their Sunday suits, and tune their merriest hum."

I was glad of this friendly warning, as it enabled me to make some few arrangements in my little domain. I ordered chairs to be brought out and placed in the pink hawthorn arbour, which, being now in full bloom, looked very gay ; and thither I had my glass hives transported, that we might make our observations unmolested by the sun.

The little group presently made their appearance, accompanied by the elder Miss R. and I

hastened to the garden gate to receive them. I soon spied the wounded Letitia among the number, and was glad to find that she was able to walk again; but I remarked that she trembled whenever a bee came buzzing near her. On this account, I led the party in a direction contrary to where most of the hives were, and introduced them into the arbour, in one corner of which stood my hive, which looked like a box with glass windows, and on a little table were placed my various-sized microscopes.

“ I am unwilling,” said I, “ to introduce you at once to all my hives, lest the bees that throng about them should occasion terror to the young ladies, who have so lately suffered from their stings; but I hope first to say something in their favour, which shall reconcile them to each other; for, though always armed, they use their weapons only in self-defence; for you must remember, Miss Letitia, that your foot planted upon their nest, must have appeared to them like an invasion from a terrible enemy.

“ When I shew you that these little beings unite together to make themselves houses and towns, and that all their labours are carried on in a most regular and clever manner; that they have a queen, whom they obey and guard; I think you

will agree with me that the bee is the most intelligent of all insects.

“The society in each hive is composed of a number of drones, a still greater number of workers, and one queen, besides the young brood, the object of care and attention to all the others.

“As there is as much difference between the form and appearance of these several members of our insect society, as between their duties in their little establishment, I will first make you *personally* acquainted with them. Do not be alarmed, however; I will not open the door of my hive, and suffer them to buzz around you; the recollection of her wounds would prevent one at least of my young listeners from a quiet examination of their bodies. No, you shall study them first from the contents of my portfolio, and learn to admire the various parts of their frames, so curiously adapted to assist their still more extraordinary instincts. I may then venture to open my cabinet of real, though not living insects, and I predict that before very long the curiosity even of my friend Letitia herself will so far overcome her fear, that she will assist me with her own hands to place a living bee under the glass of my microscope.”

I perceived my young friends all rather shuddered, and with a smile of doubt on their counte-

nances watched me as I entered my cottage to fetch my portfolio of drawings. "You must not," said I, as I displayed these upon the wide garden-table, "expect finished drawings; we naturalists do not aim at smooth lines or a pretty effect: all we want is a true though rough representation of nature.

"Those who have observed bees flitting from flower to flower in a garden, buzzing about with all the noise and bustle of labourers, have looked upon them with admiration perhaps for their golden rings glittering in the sun, mingled with terror of their invisible weapon; but, without a much nearer examination, they can have formed very little idea of the wonderful construction of their limbs.

"Here, then, is the bare outline of this insect, which did not however start into life with all its parts perfect as you behold them."

LETITIA. "I thought an *insect* meant merely a crawling thing, such as a worm or caterpillar. I find I must be ignorant of the exact meaning of the word *insect*."

"Your remark," I replied, "satisfies me that you are not a mere superficial inquirer into a subject which has occupied my attention so many years, and about which I shall be most happy to gratify

your curiosity to the utmost of my power. Insects, Miss Letitia, are all creatures furnished with a head, antennæ, and six or more feet. They breathe through holes, or pores, in the sides of their bodies. Their skin is hard, and supplies the place of bones, of which they have none. But their principal distinction consists in their antennæ, which differ from the horns of other animals, in being jointed and moveable.

“All insects make their first appearance in the world in the shape of eggs; they then go through three metamorphoses;—the *larva*, the *pupa*, and the *imago*.

“The egg I need not describe to you: the *larva* is the grub or worm state. It is a Latin word, signifying *mask*, since the insect appears to be masked while in this state. Some insects live only a few days or weeks in this state, while some remain in it for months or years. They then cease eating, and, fixing themselves in a safe place, cast off their outer skin, and disclose an oblong body. They are now in their third, or *pupa* state, in which each looks like a child wrapped in swaddling clothes, for they have a thin skin, which in the bee tribe covers each limb separately. They do not eat in this state, and are not able to move from place to place.

“ Thus the insect remains, in some kinds, a few hours, in others a few weeks, months, or years, and is gradually made perfect, when it bursts its case and enters the fourth or *imago* state. This word is used, because the insect, having laid aside its various masks, becomes now a perfect image of its kind, and means, in fact, the fly, the bee, or whatever insect you behold around you.

“ The bee is of the Hymenoptera tribe of insects, which includes all having four wings, and a sting in the tail. Now let me call your attention to this little drawing; and, that you may understand me, if I should at any time chance to use a scientific term, let me beg your most *serious* attention to this list of names, explanatory of my insect skeleton, the larger part of which represents the outer, and the smaller part, the inner surface of a bee.

Letter a—is the caput, or head.

b—the palpi, or feelers.

c—the antennæ, or horns.

d—the oculi, or eyes.

e—the thorax, or throat.

f—the scutulum, or escutcheon.

g—the pectus, or breast.

h—the sternum, or breast-bone.

i—the abdomen, or stomach.

Letter k—the tail

l—the electra, or shells.

m—the membranous wings.

n—the pedes, or feet.

“ You must forgive the trial of patience I have provided for you in this long list of names; we will now proceed with a particular examination of the body of the bee.

“ The bee is about three quarters of an inch long; its four curiously shaped wings have strong fibres round and across them, to add strength to the delicate texture of which they are composed. It has six legs, a large head, and thin neck. Its waist, or middle part, is likewise very slender.

“ The bee is provided with two instruments of defence, or war; for, besides its sting, it has teeth, placed within its fangs or mouth, which meet horizontally, not one over the other as our own. With these teeth the bee seizes any robber who dares to invade the general store of honey, and holds him prisoner until another comes and pierces the body of the enemy with his formidable sting.

“ To us, the wound occasioned by the sting of the bee is only painful, not dangerous; but to creatures of the same species, it brings certain death.”

LETITIA. "Is it true, that a bee never lives after it has lost its sting?"

"Yes," replied I: "their sting is fastened to their bowels, and when they leave it behind, which, if the person stung gives a sudden start or jerk, they are very liable to do, they leave their life with it. I really believe a bee would live longer if cut in half, than if deprived of its sting.

"This little sword of theirs is pointed, and very sharp; and the bee can make it penetrate through very hard and tough substances. Your stocking and glove, Miss Letitia, for instance, you would imagine to afford tolerable resistance against so minute a dart; especially, since it is in fact a hollow tube, containing the poison in the middle of it, as we will by and by ascertain by means of our glasses.

"The eyes of bees are large; but being protected or covered by a thick horny substance, they are very dim-sighted.

"To compensate for this imperfection, they are provided with antennæ, or horns, which project from above their eyes, and have each one joint in the middle, and another near the end, so that they can be pushed forwards or drawn in at pleasure. With these antennæ, which serve them

as hands and fingers, the bees can touch whatever object is too minute for them to see, and are enabled by them to be as expert in chasing away intruders by moonlight, as in cutting their way through the air in open day.

“ Look through this microscope, and you will discover the tongue of the bee: being too long for its tiny mouth, it is doubled over upon its breast, down which it spreads to a considerable distance.

“ This tongue is as curious in its construction, and as useful to our little insect, as any other of its members; for with it, the bee not only provides itself with food, but collects the stores of honey which it hoards in its combs. The shape and size of the tongue varies in every different kind of bee; sometimes it is composed of one single piece, and sometimes of three, five, or seven pieces. The outer parts of the tongue are protected by sheaths, of a horny kind of substance, folding over each other, whose little valves or doors are ranged in pairs on each side. The tongue itself is porous, and imbibes the juices of the flowers which the bees sip from the nectaries, and which are afterwards converted into honey.”

MISS R. “ Have you never observed, Letitia,

the bee, when he perches upon a full-blown flower, put out his little tongue, lengthen it and then shorten it, draw it in, and turn it about in all directions? Its movements are really quite entertaining."

Letitia, as I expected, acknowledged that she had never had the courage to stand near enough to examine all this; and I continued my description.

"You will observe too, for I am rather proud of my glasses, the innumerable fine hairs which cover every part of its body, like that of a fox; even its very eyes are covered with the finest hair, which, without a glass, you would never have suspected. In the hinder part of the bee we are examining, you may discover the bottle, or bag, in which it carries its honey, which, by the help of muscles curiously adapted for that purpose, it empties into the honeycomb. In this bag our little friends often fetch up water, to dilute their sandarach, or bread, the food they provide for their young.

"Are you satisfied with this general description of a bee? Or may I flatter myself that I have so far interested my young friends, that they are willing to listen while I describe the varieties which distinguish the *persons* of the queens, the drones, and the workers?"

My auditors expressed their willingness, nay, even their desire, to hear more; and it may be considered as a proof that we were all engrossed with one subject, that we had not before perceived that Wellingford had deserted the group, and was trotting down the hill, within sight, though already at some considerable distance from us.

“The queen bee then, or female, whom I think I may call the noblest of all insects, differs from all her subjects, in having a longer body, tapering off at the end. Her wings, however, are short, which shews that she was not intended by nature for long flights, or a life of labour. The hair on her back resembles a velvet or fur cape, and is of a rather lighter brown than the rest of her body. The end of her body is jet black, and glossy as polished marble; her two principal legs and stomach are of golden hue, in which respect she far outshines the other inhabitants of the hive. Virgil, the poet of the bees, describes her as—

——— Godlike to behold,
Her royal body shines with specks of gold
And ruddy scales.

“But we must remember, that the colours of the imagination are often more brilliant than those of

nature, and that Virgil in this instance painted with the former.

“ The drone, or male bee, is as large again as the workers, and is the reverse of the female, his body being short, thick, and clumsy, and very obtuse at each end. His eyes are large and very near together; between them, however, are situated the antennæ, which in the drone has as many as fourteen joints, some so small as to be nearly imperceptible. His wings are long, his legs short and thin, and his voice so loud and *dreadful* as to occasion much needless fear.”

LETITIA. “ Ah! how can you say needless? Think what I suffered from his terrible stings!”

“ True, Miss Letitia,” replied I, smiling at her almost indignant countenance, “ you found a cruel enemy in the bee, but it was not the drone; for, singular as it may appear to you, this member of the family of bees is not provided with a sting; and henceforward remember, that the deep-toned buzz, awful as it has hitherto been to your ears, need no longer convey any cause of alarm.

“ The drone is, likewise, incapable of assisting in the labours of the workers, from the shortness of its tongue, which is not long enough to reach the honey out of many kinds of flowers.

“ The workers differ little from the drones, ex-

cept in being much smaller, and in having a sting, and one additional joint to their antennæ."

I was about to begin describing the various duties of the several classes, when Miss R. interrupted me; and after thanking me, in much too grateful terms, for the instruction I had already given her young pupils—and, indeed, she modestly added, to herself,—observed that the time she had allotted for their visit was expired; and that her sister Jane, with another detachment of girls, would be already looking out for their approach to Oakly Wood, the rendezvous for that afternoon. A promise of another visit shortly, reconciled me to their departure; especially, since I had the satisfaction of observing, that one or two of my new acquaintance, and among them Letitia, cast a wistful look at my hives, as they retreated after Miss R. through the garden-wicket.

"I have excited your curiosity, at least, my little friends," said I to myself, as I replaced my portfolio in its customary nook, and inclosed my microscopes in their cases, and ranged them in due order on the chimney-piece.

CHAPTER III.

“CURIOUS, as I perceive you are become, to peep into the windows of my box-hive,” said I, addressing my new acquaintances, whom I had the pleasure of seeing, a few days afterwards, again seated round my garden-table, “I cannot gratify that curiosity, until I have given you some idea of the economy of a hive, and of the relative duties of the bees.

“You must prepare for the history of a laborious and indefatigable race, governed by their own laws, to which they are strictly obedient, full of foresight, and entirely devoted to the good of the public.

“The monarchy of the bees, in fact, has been thought worthy the attention and investigation of clever men from the most ancient times. Most of these have aimed at discovering a true knowledge of them; but, until of late, many points of their history have been wrapped up in great obscurity; and, strange to say, it is to a blind man of the present day, Mr. Huber of Geneva, that we are chiefly indebted for discoveries which throw light upon their proceedings.

“ I shall endeavour to avoid, as much as possible, the fables which have been so plentifully handed down to us from time immemorial, though I doubt not you will consider what I do relate as sometimes sufficiently marvellous.

“ The queen, or mother bee, is the only female in the hive who lays eggs. She generally lays between thirty and forty thousand in a year. Her existence is therefore most essential to the hive, and her subjects, whose instinct teaches them this fact, spare no pains to protect and cherish her. The queen is despotic in her hive, but the chain which unites her to her subjects, is linked by affection. Long habit endears even her person to them, and they resent any attempt to exchange her and put another queen into her place. The queen herself will admit of no rival, and fights any other queen who invades her kingdom, or aims at sharing its honours. Except on such an occasion as this, however, her disposition is truly queen-like ; and she behaves, as if conscious of the importance of her life, in a dignified and pacific manner, not asking it by giving way to every impulse of anger. The sting with which, as I have before told you, the queen is armed, inflicts a more painful and deeper wound, than that of the other bees, but she never makes use of this weapon unless she has

been severely provoked. I have handled, turned her about, and teased her in various ways, without having ever received the honour of a royal sting."

MISS R. "I must allow, that this disposition partakes of a truly royal character, which ought to be slow in inflicting vengeance; but when it does so, should let the punishment be sufficiently severe to deter others from offending in a similar manner."

No one being inclined to dispute the justness of this observation, I continued,—“As to the drones, those notorious idlers, whose very name is held in such contempt, that to call a person a *drone*, is quite an insult; they are, in fact, the many thousand husbands of the one queen. Their life is very short: they make their appearance in the hive early in May; they increase rapidly in number from that time; live a life of ease and luxury, without labour, and feed on honey, the most dainty fare the hive can afford. At length, weary of supporting this race of idlers, now no longer of any use to the community, towards the latter end of July the working-bees begin to chase them, and, hunting them down to the bottom of the hive, where they take refuge in great numbers, they put them to death with their stings.”

LETITIA. “I begin to fear these working bees, industrious as they may be, are not very amiable.”

“ This, perhaps,” I replied, “ is not the most pleasing trait in the characters of the workers ; but have patience, and this impression of their inhumanity, will, I am convinced, give way to admiration and astonishment. But how shall I begin my description of these extraordinary little beings ? Who, in fact, could explain to you the language by which they communicate with each other, arrange their plans, and give laws to their little kingdom ?

“ The working-bees have the whole management and care of the hive ; they clean it, and guard it from robbers ; they collect stores of honey and wax ; they build cells, which serve as nurseries for their young, whom they rear with the most tender care. The history of this active race has filled many a volume ; but I promise you more entertainment than any book can afford, if you will now venture to follow me to the hive, where we can study its history with our own eyes, from nature’s inexhaustible pages.”

Curiosity triumphed over fear in the minds of my auditors ; or rather, perhaps I ought to say, a laudable pride enabled them to summon up their fortitude, and prevented them from betraying any remains of fear, which might still be lurking in their minds. I stationed myself nearest the

door of my box-hive, and ranged my visitors at the glass windows all around. My hive was formed upon the most newly invented plan, and afforded every facility for making observations.

“Here is a city,” said I, “composed, probably, of eighteen or twenty thousand inhabitants; you already know that these consist of one queen, many nobles, and still more labourers; let us see what kind of houses they live in.”

“I see,” cried Letitia, who was anxious to shew her new-acquired courage, “rows of little cells, ranged one above another. Do the bees live in these?”

“These,” I replied, “are their houses; and between the rows of these, you observe in some parts space enough to admit two bees abreast; these we will call streets; and these still smaller subdivisions, courts and alleys, which cross and intersect the city in every direction. And now for the inhabitants of this busy world: can you make out at all what they are about?”

LETITIA. “I should say, that some of them seemed employed in building up again the broken or decayed walls of their houses. Pray what kind of brick and mortar do they make use of?”

“It is wax, with which they build their houses; but this curious substance will deserve more atten-

tion than we can give it at present; for I am anxious to explain to you the formation of their honeycomb, or, as I have named it, their city.

“This, as you have remarked, consists of a number of small cells, or houses, and is not the least wonderful proof of the skill of our little friends. Their grand aim in the construction of a city, would of course be to get as many houses into as small a space as possible.

“To effect this, and to form the cells upon one regular plan, they have done what the most scientific men, with all their reflection, have been unable to effect; and they have done it in such a manner as best to answer every purpose for which they wanted their houses, namely, the depositing of their eggs, rearing their young, and laying up stores of honey for winter use.

“Now, before we decide as to the excellence of their performance, let us first consider how we ourselves should set about building a habitation for bees. In the first place, what shape should the cells be?”

LETITIA. “I should say round, because that would be most suitable to the form of the bees themselves.”

“Very well, but just cast your eye upon this paper; I have drawn two or three round or

circular tubes; you see they do not join well, and there is considerable room lost in the spaces between them. This would not, I think, be approved of by our little economists."

LETITIA. "I perceive that objection; but what do you say to square or triangular houses; the sides of which being flat would fit into each other?"

"There is one objection to either of those; namely, that the bees would not fit in well, and that corners would therefore be all loss of room. Let us see what the bees themselves fixed upon, and then we shall with humility acknowledge their superior skill, or that rather of Him who gave them their instinct.

"The number of bees all collected and hovering about, will perplex us too much to allow of making our observations from the hive itself; we will therefore turn once again to the table, and examine this piece of dried comb, which I have purposely cut through the middle.

"Each cell has, you perceive, six sides, or is hexagonal, as it is called: this form unites the advantages of being flat sided, with that of being so nearly circular, as to leave very little unoccupied space when the body of the bee is within it."

MISS R. observed that this form spared wax

as well as ground ; since, if the cells were circular, there must be a separate wall to each, instead of which, one wall serves for two houses.

“ There are other equally skilful contrivances in this comb, which we should have attempted in vain. Each cell must, you know, have an opening at one end to admit its inhabitants ; the bees, therefore, with true economy, build a double comb, in which ranges of cells are placed back to back, one bottom serving for both sets of cells.

“ This method of building their cells unites to perfect neatness and economy, great strength and firmness, which you will find peculiarly necessary when you hear how delicately thin they build their waxen walls, and what a store of honey they pack up in each cell.

“ If we had been the architects, we should doubtless have fancied that flat bases would have served every purpose, would have required as little time, as little trouble, and as little wax, as any other kind. Not so our rival masons. To economize their wax, the hard earning of many and many a day's gleanings from many thousands of flowers, they have discovered the superior advantage of a pointed or pyramidal base, which enables one set of cells to fit into the opposite set.

“ Here you perceive a double row of hexagonal tubes united by one pyramidal base, but mark the

difficulty in the building of this remarkable fabric. Let us try one ourselves. Take this card, for instance; double it into three parts, and bend those again in the middle, cut each to form a vandyke; bend the card round your finger till it meets, and then you will find that you have a six-sided tube, whose base is formed by three hollow triangles. Now a double triangle is properly called a lozenge, for I will not offend you by not using scientific terms.

“Cut three lozenges, therefore, to fit in the three hollow triangles, and place them together thus, and you form a little cap, which serves as a base to one cell, and to the half of two of the opposite cells.”

Letitia declared she could not boast of much skill in geometry; but I perceived that she understood the terms I made use of; and her wish to enter fully into the subject, united to a tolerable share of penetration, made her at length understand me; and by means of a few cards, and a needle and thread, we had soon a tolerably exact set of cells upon the table before us.

“These,” said I, “serve as examples, though rude, if compared with the perfect angles and smooth surface of the waxen comb itself.”

“I see,” cried Letitia, “that we have made one set of cells, whose bases are pyramidal or

hollow, but the opposite set will surely be just the reverse?"

"Let us," said I, "turn the honeycomb to the other side, and we shall see how curiously yet simply the bees have obviated this difficulty.

"Observe, that the pyramidal points on this side, enter the hollow triangles of the other; so that the three lozenges which form the bottom of this cell, are each of them one of the lozenges belonging to the bottom of a separate cell on the other side. Stick a pin, for instance, into each lozenge which forms the base of this cell, and tell me where to find the points."

LETITIA. "Here they are, each in a separate cell. How very neat and curious! Look, dear Miss R. there is not an atom of wax or room wasted in this lovely fabric!"

"You are becoming a willing admirer of your enemies, Miss Letitia," said I, smiling at the rapture with which she held up the honeycomb to her governess: "they are indeed extraordinary architects, especially since they do not proceed mechanically with their work, but, like mortals, make occasional mistakes, in the correcting of which one would almost declare they employed reason and judgment.

"You observed them in the hive, apparently

plastering up holes, or repairing walls. In fact, they have often much to mend; and, accurate as the bees are, their six-sided habitations are sometimes very crooked and irregular. They often begin their work clumsily; and their cells, when they first begin, are ill formed, but they soon find out their error, and try to improve as they go on; so that the opening of the cell is almost always regular and symmetrical.

“ You would imagine that an irregularity in one cell, would cause all the others to be thrown out of place, but the bee is too sagacious for this; and if one cell be too large, you invariably find the next proportionably small.

“ Sometimes they make their pyramidal bases of four lozenges instead of three, and two of these have perhaps four sides, and the others more or less. They perceive how defective this is, and try to correct it, by patching it up with other pieces.

“ But the manner in which the bees adapt their houses to the situation they are at times forced to build in, is perhaps still more astonishing. They can give a gentle curve to the tubes of their cells in the most masterly style of architecture, still preserving the utmost regularity in their rows. In order to be sparing of their wax, which, both

in gathering and preparing, costs them much labour, they make the walls and bottoms of their cells thinner than the thinnest paper, so that it sometimes happens they are not strong enough to bear the weight of honey, or to resist the frequent pushes of the bees as they enter. The top of the cell, therefore, gives way first; but the bees take care to mend and guard it, by adding a string of wax around the entrance. And this, again, sometimes destroys its perfect hexagonal form.

“ Much time, and we might easily fancy, much thought, are expended before the completion even of a single cell. If, in building it, the bee began it as thin as it ought to be, that part would probably burst by the force of her body pushing against it as she went on. She therefore makes it at first very thick, and afterwards, when she begins to put the finishing stroke to it, cuts and pares away the walls to its proper delicate thinness, and makes use of the remaining wax to continue her work.

“ Here, as in every other part of their labours, they proceed with the utmost regularity; one set of masons doing the rough work, while another set finish and polish it off.

“ But let us go through the whole process of their building, and hear how methodically they

arrange their plans. The working bees are of two sorts—*nurse-bees* and *wax-makers*. The latter prepare their materials in the following curious manner:—they suspend themselves one to another, the claws of the fore-legs of the undermost, clinging to those of the hind-pair of the uppermost. Thus they cluster, and form a kind of curtain, consisting of continued festoons which cross each other in all directions: the backs of the bees only being in sight. Thus they remain without stirring for four-and-twenty hours, during which time the wax is forming beneath their bodies. One bee then moves to the top of the hive, and taking the wax from its body with its hinder legs, conveys it to its mouth, and works it up ready for the masons to make use of.

“The *foundress-bee*, or the one who begins a new comb, takes a little parcel of this prepared wax, and begins a wall. When she has placed the first heap, she flies away and another takes her place; and so on, till they have made a rough uneven wall, five or six inches long, fastened at one end to the top of the hive, and descending perpendicularly down the middle of it.

“The nurse-bees then take up the work, and polish and smooth what the wax-makers have begun. The wax-makers are therefore the la-

bourers, who carry and place the stones; the nurse-bees, the masons who work them up into form. One of these masons places itself with its head close to the middle of this wall, which is to serve as a base for two sets of cells, and with its mandibles, moving its head about rapidly, forms the hollow for one of the cells. It then flies off, and another takes its place, and with its teeth and fore-feet heaps up the wax on each side to begin the tube or cell. Twenty bees come one after another to this work.

“When a little bit of each cell is completed, they go to the other side of the wall, and begin the cells there, working at two at a time. The wax-makers continue to supply wax, and when one row of cells is quite finished, a new set of workmen polish and finish them off, while the former set are busy at the cells on the other side.

“Thus regularly and orderly the bees go on, finishing one set of cells to a certain height before they begin another. It is with their antennæ that they measure their work as they go on; this wonderful organ is so flexible that they can pass it over even the most delicate substance, so that, as well as serving them for compasses, it likewise enables them to go on with their work, even in the dark.

“It is at this work we shall now find them ; for at this most of them are employed the day through. Come, Miss Letitia, let us see now if we can make out what they are about.”

They all followed me eagerly to the hive, anxious to make their own observations.

“Ah !” cried Letitia, “here is one close to me ; she is planing the side of her house quite smooth.—See, see, how quickly she scrapes with her teeth ! Look at the tiny chips of wax she clears away !—She has stuck them together like a ball, about the size of a pin’s head. She has flown away, and carried the ball with her ! And, oh ! how curious ! another bee has taken her place, and is going on with her work, and she too has now flown away with her ball.”

“And now,” said I, “the best arithmetician of the party shall tell us how many cells there are in this comb.”

“If Miss Anne were but here !” they all exclaimed.

But presently they pulled forward a modest looking girl, with a singularly acute countenance, notwithstanding a slight cast in the eye, and declared that Elizabeth, for that was her name, was second only to Miss Anne, and was a capital accountant.

“ I shall not put her skill to the proof so much as I wished you to believe,” said I smiling; “ for my sum is not a difficult one. This is it:—

“ The comb contained in this hive is fifteen inches long and ten thick; and the diameter of each cell being two lines and two-fifths, there are twenty cells in every four inches; that is to say, five cells in every inch.”

A slate was produced, and Elizabeth, with some hesitation, and some diffidence, came forward, and suggested that it would be first necessary to multiply the length and the breadth by each other,—that is to say, the 15 by 10; the produce of that, 150, giving the number of square inches contained in the comb. As there are five cells in every inch, you must find the fives in 150. There are 30, with which you must multiply the 150. The produce of that, 4500, must be multiplied by 2, because every comb, you said, was double. So that it makes the number of cells in this comb to be 9000.

Our little party was loud in its admiration of the ready manner in which Elizabeth had performed her task, which I assured her was quite correct; I then continued:—

“ With regard to the depth of the cells, they

vary ; some being nearly half an inch in depth, others more, and others less. The deeper cells are turned into store-houses, if not wanted for the maggots : and when their honey harvest is so very plentiful, that they are in distress for room, they either lengthen out their old cells, or build others on a larger scale ; so that the surface of the comb is never perfectly even."

" And do the queen bees," asked Letitia, " live in the same small kind of houses as their subjects, the working bees ?"

" No," answered I ; " how would that be consistent with the notions of the bees, of the respect due to their sovereign ? But I shall be afraid of wearying you, if I go on with the subject at present. We will shut up the hive, and bid adieu to its industrious inhabitants ; and, if Miss R. will allow, shew for once that we have not profited by their example, but spend an idle evening in rowing down the river in my little boat."

Miss R. consenting, and the rest of the party making grateful speeches, I shewed them the way to the banks of the beautiful little river, at the bottom of the hill upon which my cottage was situated. We found it, in consequence of my previous directions, covered with a gay awning, and

well stored with every thing necessary for tea, which I had resolved to make for my young friends in a beautiful dell a few miles down the river.

With a song from one, a joke from another, and a determination on the part of every one to please and be pleased, we passed the time most agreeably; and at a late hour, when the moon from her silver horns shed a faint and partial light, I took leave of them at the gate of their own house, and slowly remounting the hill, returned to my cottage to resume my usual habits and grave meditations.

CHAPTER IV.

BUT adieu to "grave meditations."—"Put aside your book, my friend," said Wellingford; who, booted and spurred, but on foot, had stolen unperceived through my garden-gate. "To the bee-hive let's away, in the merry month of May; for yonder come your little pupils; and I too, meaning to have a peep to-day, have put my horse into your stable, and given my books a holiday."

The cheerful tone of his voice roused me from my studies; and who that passes his time alone from morn till night, has never felt the pleasure of such an interruption?

I bustled about to prepare for my visitors, though I affected all the time to look very solemn. "Wellingford," said I, "we will admit you of our party; but it is on condition only that you are sedate in your conduct, and do not interrupt by your jokes the gravity of my lecture."

The young party, who had just entered the gate, assured me that it was in vain to expect such good conduct from Wellingford, and that I had better expel him at once. But Wellingford entreated, and I yielded to his desire.

"Before I introduce you to the royal palace, I must give you some farther description of the city; that is to say, of the honeycomb when completed.

"You observe, that the combs all lie in an horizontal direction, and parallel to each other, so that there is a space left between each, large enough for two bees to go about at once; these I have called streets. Here, again, on the surface of the combs, are smaller openings, which serve

as means of communication to the different parts of the hive."

"Then those are the alleys and courts which you told us of, I suppose?" said Letitia.

"We may as well call them so. When the bees set about the building of a new city, after cleaning out the hive, which they do most carefully, they construct a few of the cells of the middle comb, as I have before fully explained to you; then they begin two others, at some little distance; and, by carrying on several buildings at once, set as many of their masons as possible to work at the same time. They divide into parties, and all keep to their separate stations without interfering with each other.

"As they begin their building at the top, and proceed downwards, it appears, as it goes on, broad at the top and narrow at the bottom; but when all is concluded, they bring the cells up level to each other; and, to protect the opening of the cells, give to this part an additional coating of wax.

"The space between the different combs, or as we may say, the streets, is invariably of the same width, four lines, which is the third of an inch; and I must pause to admire the sense of the bees in this admirable construction. If the

streets were wider, the bees would be too much dispersed, and too much cold air might penetrate their city. If narrower, the bees could not pass freely, and the business of the hive would not go on so briskly. On the approach of winter, they are often obliged to lengthen their honey cells; by which means they contract their streets, and make their habitations warmer. But, as during the winter they work little, and their stores are of the utmost importance to them, this puts them to no inconvenience; and when spring returns, they take care to cut short their cells again and widen their streets.

“Having given you this general notion of the city, I will proceed, in a few minutes, to gratify your curiosity about the royal residences. The smallest set of cells you can see, are appropriated for the eggs of the workers, who, you remember, are the smallest bees. Some larger cells receive the males, or drones; and a few others, very large, are set apart to receive the young queens, and are therefore called royal cells.

“Queens!” cried Wellingford; “why, can your monarchy boast of many sovereigns, who all reign at the same time?”

“No,” said I; “they own obedience to one queen only; but, have patience, and when the

proper time comes, all shall be explained to your satisfaction ; only believe that what I tell you, is perfectly true."

" Well, well !" said my impatient friend ; " I will endeavour to be quiet : only it seems very extraordinary that there should be one queen only, and a number of royal cells to educate the young queens in. I suppose we shall have a battle by and by, and all be killed but one."

" There are other cells set apart to receive the honey in, and these are deeper than the rest."

LETITIA. " You have mentioned cells for the eggs of workers, and of drones, and royal cells ; but surely you have missed the houses of the working bees themselves."

" Why, Letitia, these disinterested little beings are content to provide for the public good ; they build only for their young and their stores ; and they themselves lodge in the open streets and public places. Nor is every bee in a swarm provided with a separate cell to keep its food in : all are in common, and all are fed from the public storehouse.

" The queens only have private houses, or, as we ought to call them, palaces ; and, in building these, some deviation from the rule may again be observed. For instance, they are of a roundish

oblong form. Look at this piece of comb; here are two royal cells upon it."

LETITIA. "They do not favour their queens much, then, if this round rough lump of wax is all they make for their palaces."

"In these edifices they seem to study solidity more than elegance, anxious to provide for the safety and real comfort of their beloved sovereign. They are, as you may observe, raised above the rest of the comb; and wax, of which they are so thrifty in their own habitations, is never spared in these buildings: the rough surface to which you object, is, in fact, a succession of cavities, formed by little lumps of wax, which fortify and strengthen the outside of the palace. I had once the curiosity to weigh the royal cell, and found that it was equal to nearly a hundred common cells. And yet the one I took was not finished, nor was it quite so large as usual.

"They are equally prodigal too of their room: several smaller cells are sacrificed to serve as a foundation for a royal one, as well as a support to it. Sometimes they fix it in the very centre of the comb, as you see here; but it generally springs from the lower end of the comb. When but half built, it resembles an acorn cup, and is even sometimes fastened to the comb by a

little stalk ; but, as they continue it, they lessen its width, and contract it, so as to make the lower narrower than the upper end. This lower-end is left open at first : why and when they close it, I shall afterwards explain to you."

LETITIA. " I suppose, then, that as they spare neither wax nor room for these royal palaces, we may conclude they leave the outside full of little holes because they think it ornamental, since they could so easily plane it smooth if they wished."

" I think," replied I, " that this is a very fair conclusion ; and now, having given you a very full account of the habitations, which the bees form for themselves, let us vary the scene, by following the little things in their flights through the air, and see what is the daily occupation of these industrious work-people. My own garden, which is richly supplied by flowers, affords employment to many hundreds of my little pensioners, who do not care to lose their time by ranging to great distances, if they can employ it more profitably near home."

WELLINGFORD. " But stop, my friend, you have built a city, and placed before our eyes an empty set of habitations : would it not be best to begin

by telling us how these became stocked by inhabitants?"

"I think you are right, Wellingford; and, as I wish to confine your attention to this one hive, I must begin its history at least two months back. It then contained the remains of last year's population, plenty of workers, and one queen; a small, very small quantity of empty comb; the honey I had left in having been nearly consumed for winter use. When the workers had finished a tolerable number of new cells, in the manner I have been describing, the queen-mother went from cell to cell depositing her eggs; and, as if she perfectly understood the nature of each egg, deposited each in the cell adapted to it. I have seen her examine every cell attentively before she entered it, and quit it to search for another, if the first were not of the right kind. The eggs which are to produce workers are all laid first; and, so indefatigable is the queen-mother, that she allows herself no rest, but commonly lays two hundred eggs in a day, and if the weather be warm, a much greater number.

"This occupies her about ten or twelve days, during which time the workers are busy building the larger cells. Before she fills these with male

eggs, the queen increases so much in size, that she is hardly able to walk. For fifteen or twenty days, she is busy filling these cells; though their number is but as one to thirty, compared with those of the workers.

“The royal cells are then put in hand by the workers, and the queen again lays workers’ eggs. When the royal cells are completed, she deposits a single egg in each, but only every two or three days; resuming her old occupation of filling the workers’ cells in the intervals.

“By the end of March, the cells are all built and occupied; and the old bees, no longer detained at home by their labours, or bad weather, prepare to sally forth in search of the various things they have need of. You, Letitia, probably think that honey is the only thing the bees collect from flowers or plants.”

LETITIA. “Oh, I beg your pardon; have you not mentioned wax, of which their houses are built? I can assure you, I am very curious to hear where they get it from, or how they make it. I have often wished to know.”

“Well, then, your curiosity shall soon be gratified, at least in due order; for I have learned from the bees, that arrangement and method are the best economy. The bees form honey and

wax from the nectar of flowers; and, perhaps, since I have found such skilful geometricians and arithmeticians in the party, there may be one of my friends who can inform me from what part of the flower this nectar or honey is got."

Letitia and Elizabeth both smiled at the compliment paid them; while Harriet, a fair blooming girl, simply said, "She believed, honey was found in the nectaries of flowers, which were generally long narrow tubes, in the centre of the blossom, though the situation varied in almost every different flower."

"Your account is very right: botanists were long before they became acquainted with this natural reservoir of honey, but bees have ever known it; and, hidden as it is, are able, with their long tongues, to suck up the fluid from its deep well. This organ, which formerly was supposed to be a pump sucking up the honey within, is now discovered to be nothing but a tongue, which licks up the honey, and passes it onwards, upon its surface, to the mouth, which is concealed by the mandibles at its lower extremity.

"Follow me gently out of the arbour into my garden; here is a bee just alighted on this jasmine bush. Hark! that hum is caused by the motion of its wings; the hum ceases; the long tongue

is unrolled from under its head ; it is darted with the rapidity of lightning between the white leaves, or petals, of the flower, and the stamens, or little coloured stalks, in the centre of it. You must approach one at a time, for it requires very close observation. See how she throws out her tongue, then contracts it : how swiftly she moves it up and down, and lets not an atom of the delicious juice escape her."

WELLINGFORD. " I perceive plainly, that it licks the honey into its mouth. Now pray, let us hear how this honey gets home to the young, if the bees swallow it up as fast as they get it ?"

" You may well be inclined to be incredulous, Wellingford, for it is a very curious fact ; you have, however, yourself witnessed how they take the honey ; if we return to the hive, you may see them deposit it in their storehouses."

Wellingford assured me, he believed what I had told him ; but as he wished to watch the bees in the open air a little longer, he thought we might defer our visit to the hive for a few minutes.

" Well then," said I, " you have observed the bee which sucked in the honey from the jasmine, has flown from one flower to another, and appears to succeed in getting fresh liquid sweets from all. It has been disputed among the friends of the bees, whether each bee does not confine itself to

one particular kind of flower; but it seems now generally believed that they do, what we have certainly seen this do, take the nectar of most flowers within their reach."

LETITIA. "Is there honey then in every flower that grows?"

"Whether there is or not," said I, "the bees fly from some, and from others seem unable to extract honey: this is the case with the trumpet honeysuckle, which they never touch; although, when burst open, it lets out a drop or two of pure nectar."

LETITIA. "Then I should give this as another instance of the economy of the bees: that, as they are not sure of succeeding, they will not waste their time by making vain attempts at this flower. But why do they fly from any?"

"Because their instinct warns them that the nectar contained in such, is of a poisonous quality. This is the case with that noble flower, the crown imperial, whose white nectaries are so ornamental, appearing like wells of clear honey within the flower leaf. The bee takes no notice of this tempting sight, but passes by, without being for a moment diverted from his course.

"The oleander abounds in honey; and flies, less wary or less sagacious than bees, are killed by thousands as they suck in the sweet poison.

Bees never taste it. When it is a poor flower season, however, bees seem to lose this instinct, in their ardent desire to procure provender; and many consequently perish. Instances have been known of whole swarms being destroyed, merely by alighting upon poisonous trees. I remember hearing of a swarm, in New York, which, after passing a night upon a poison-ash, were found dead the next morning, with their bodies swelled to an enormous size."

MISS R. "From this account, it appears that some honey is poisonous to the bees themselves; is there not also some which, when collected by the bees, is poisonous to man? I have heard that the honey extracted from the beautiful American plant, the kalmia, for instance, is poisonous. Is this true?"

"I believe so; and, about thirty years since, so great a number of people died in the neighbourhood of Philadelphia, that the government made inquiries into the cause, and found that most of the people had been eating honey collected by the bees chiefly from that species of plants."

LETITIA. "I remember, in the account of the retreat of the Greeks, after the death of Cyrus, that they met with a kind of honey, on the shores of the Black Sea, which affected the soldiers in a

very curious manner. Those who ate but little seemed as if very drunk, while those who partook more plentifully of it, seemed either mad or in a dying state—numbers lying down on the ground, as if just defeated in battle.”

“This kind of honey,” said I, “is mentioned by Pliny, the first great naturalist; and was said by him to have been extracted from a beautiful plant, the rhododendron, whose fine lilac flowers I observed in your shrubbery the other day; and highly ornamental it is: but, please to remark, that in my garden, I allow neither the kalmia nor the rhododendron to shew their heads. I rather follow the advice of the poet; and,

Wild thyme and sav’ry set around their cell;
Sweet to the taste, and fragrant to the smell;
Set rows of rosemary with flowering stem,
And let thy purple violets drink the stream.

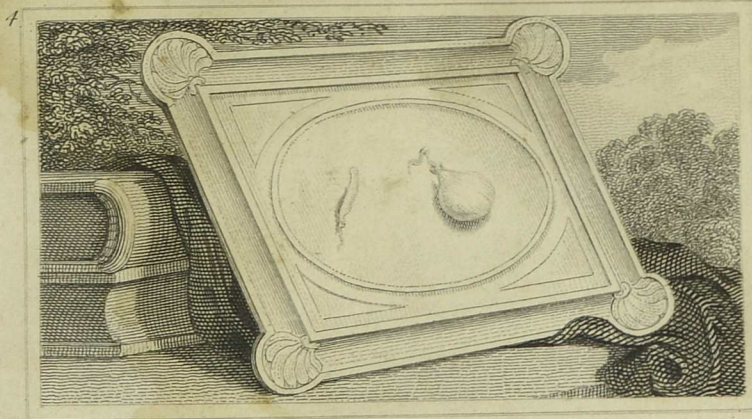
And now, I must explain to you the process the nectar undergoes before it becomes, properly speaking, honey. Every bee is provided with two stomachs; on this paper you will see a rough drawing I have made, in order to give an idea of the form of this part of a bee’s body. It is, of course, much larger than life, having been drawn from a microscopic view. This bag, which

looks like an indian-rubber bottle, is the first stomach, and the narrow part of it is called the neck of the stomach, or œsophagus. When empty, this stomach looks like a thin thread: when full, like a tiny white bladder. Into this first stomach goes all the honey which the bee collects with his tongue, and which, small as it is, it takes a long time, and the nectar from many, many flowers to fill.

“This examination is enough for our present purpose; we will study the other stomach when we learn how wax is collected. Now, Wellingford, your curiosity shall be pained no longer; we will follow these loaded bees to the hive, and through its windows see what they do with the treasure they have just collected.”

Wellingford declared that he could see the little things within the hive, but that they were so many, and made so great a bustle, that he could not say positively what they were doing.

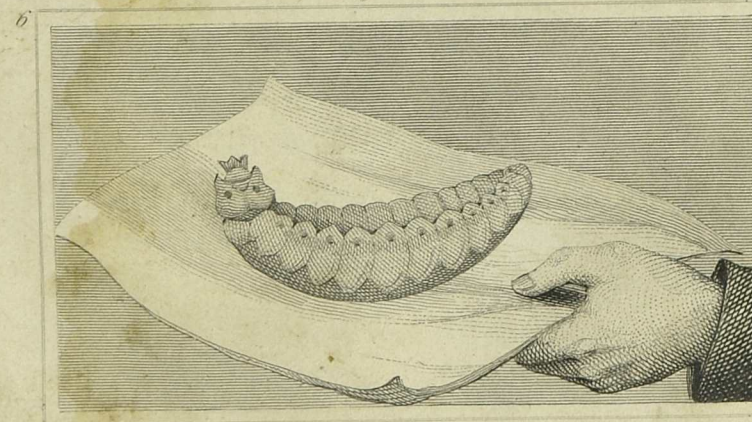
“Some,” said I, “disgorge the honey, which, after passing through their stomach has become a thicker fluid, into the empty cells destined to be storehouses. If the cells are already half filled, they are covered with a kind of cream, which always rises up at the top, and prevents the honey from running out of the combs; which, as I have



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before told you are placed horizontally in the hive. Cannot you perceive a bee busy with her mandibles, boring a small hole through this cream, and cannot you now see her, head foremost, discharge her honey into the cell and fill it up? She has still some left, and goes to the next cell, which she likewise opens and fills up. Those cells that are thus entirely filled up, are intended for store-houses, and will presently be sealed up by a waxen lid."

LETITIA. "I cannot conceive the use of this waxen lid, if the cream itself would prevent the honey from escaping from the cell."

"I will tell you the reason; for, without one, we may be sure the bees would not waste their wax in making a cover. Food of all kind, if kept long, must be shut up; and honey in particular, if exposed to the air, becomes rough and thick. As the honey deposited in these cells is intended for use all through the winter, it is very necessary to pay the greatest attention to its preservation, the heat of the hive itself keeping it constantly fluid; and by hermetically sealing up the cell, it remains in as fresh and clear a state as when first put in."

LETITIA. "I see the whole thing very clearly, for here is a bee come to a cell close to the window. I see her put her two mandibles and make a small

hole in the cream, then thrust her head in and empty the honey from her mouth; now she is carefully making up again the hole in the cream. How neatly she does her work, and how beautifully clear does the honey look through the transparent tubes!"

Pleased at the delight she took in making her own observations, I let her go on without interruption.

"See! see!" she cried. "Some of the bees who come in seem to be feeding the others with their newly gained honey. There seem to be cells with young ones in!"

"Stop, Letitia," cried Elizabeth, the clever accountant, who liked to have a clear notion of every thing; "do not go on to another subject yet, for I want to know more things about honey. And first of all, pray, Miss R. do explain to me the meaning of being *hermetically* sealed."

Miss R. "It means *chemically*; or in such a manner as chemists would seal up their most precious fluids, to prevent the slightest particle of air from getting in. I observed in the piece of dried comb, that the flat waxen lid which covered up the store cells of the bees, is of thicker wax than the sides, and fitted to the cell with the greatest nicety."

“ Their waxen lids are formed thus,” said I ; “ within the edge of the cell, they first make a circle, or ring of wax ; to this they add another ring ; and then another within that. In fact they go on making ring within ring, till the lid is completed.

“ I hope,” continued I, “ that you all admire the pattern set by my little friends, of prudence and foresight, in laying up stores from their time of abundance. You will be almost equally surprised to hear that the bees of my hives do not confine themselves to the honey they can collect from the flowers of my garden : they do not reason thus, as many an indolent person does, ‘ Whatever is within my reach I will get, and whatever is easy to be done I will do ;’ but they fly for a mile round in search of their stores ; they try every garden, and omit no flower that can yield them nectar.”

LETITIA. “ How do they find out the flowers that contain honey ?”

“ By their scent,” replied I, “ which is remarkably acute. Insects are not provided with a pair of ears like ours, and naturalists have been puzzled to find out where these organs were situated in bees. Some have believed them to be in the little holes in the sides for emitting air, while others

have declared they were in the antennæ. Huber, the celebrated naturalist of Geneva, whom I have before mentioned, has discovered them to be in the mouth, for he stopped the mouths of several with paste and set them at liberty ; after which he found that they were insensible of every odour.

“I have told you that bees fly a mile in search of honey, which by their acute scent they find in flowers where it lies deeply hid ; when their honey-bags or stomachs are full, they fly home again in a direct line ; and, I must own, this part of their economy of time and labour, seems to me one of their most astonishing instincts.”

LETITIA. “It is indeed very curious. I should have fancied them groping about in search of their distant habitations, and often getting to a wrong home at last. But there is one question I wish to ask ; honey, you have told me, feeds the bees : but is it of much use to us, after all our pains in collecting it ?”

“Honey is chiefly used for its medicinal properties at this time ; but formerly, among the ancients, it was reckoned almost divine food : they called it, in fact, a ‘gift of the gods.’ It served them for sugar, which was unknown in those days ; and they considered it a remedy for every complaint. Pythagoras and Democritus, and many other sages,

lived chiefly on bread and honey, from an idea that the use of it would lengthen their lives, and keep their minds vigorous."

Whether my young friends began to be afraid, that, having introduced the names of two philosophers, I should be getting too deep or too dull for them, I could not guess, but I saw a general movement among the party ; and even Wellingford had jumped up from the arbour-bench on which he had been lolling,—listening, however, to my discourse with marvellous patience. "I hope you will allow us to come again," said Letitia; "for, after all I have heard about honey, I am not satisfied until I see more of the young bees in the cells, and hear how they are brought up and educated, and when they will begin to fly and provide for themselves as the others do."

I gladly repeated my general invitation to the party, to come whenever they had nothing better to do; for I found that the more I told, the more I had to tell; and, having gone so far into the subject, I felt as eager to impart as they to learn.

"Good night," said I; "willing hearers make happy teachers." And I stood with my arms crossed over the wicket of my garden, until the whole group had descended the circuitous path down the hill, and passed the cottage belonging to the

blacksmith's forge, which was the boundary between their parish and my own.

CHAPTER V.

MORE than ever interested in the subject, my little party did not suffer many days to elapse before they again assembled in my garden.

“Your anxiety, Letitia,” said I, “to know how young bees get on, cannot yet be gratified; for, while the weather is fine, we had better observe what other duties the bees have in the open air besides that of collecting honey. This, though its first object when perched upon a flower, is not its only one; for after it has filled its honey-bag with the sweet nectar, it continues its robberies, and by means of the delicate and feathery hairs by which its body is covered, collects a quantity of pollen, or dust of the anthers, which are those little round knobs on the top of the fine threads in the centre of every flower. Observe, for instance, this white lily, which, if you smell, will leave its yellow dust upon your face. This is pollen, and is as necessary to the society within the hive as honey itself. We need not go far in search of a proof of what

I have been telling you ; for, see, a bee has perched upon this very flower, and has already ransacked its nectary."

LETITIA. "Its body is also covered with its yellow dust ; but what is it now about ?"

"It is brushing it off with the tufts of hair, or brushes, of its legs ; not to throw it away, but to collect all together, and knead it into two little balls. These she places within a hollow space at the bottom of her hinder legs, and they are prevented from falling out by a small tuft of hair ; these hollow spaces are called her baskets.

"In wet weather, they cannot so easily get rid of the pollen from their bodies ; they therefore return to the hive dusted all over with it, and there brush it off with their feet. When the anther of the flower is not burst, the bee will open it with its mandibles, and with its fore legs take out some pollen, which she passes to the middle pair of legs, and thence to the hinder pair, where it is safely deposited in the baskets.

"Now, I must tell you, it has long been a disputed point, whether or not the bee, in collecting the pollen, confines herself to one kind of plants, or gets it first from one and then another indiscriminately. One thing is certain, and we shall soon see this fact, that when they return

laden to the hive, some have their little balls, or pellets, of one colour, some of another, and in damp weather I have seen one bee with its body all orange, another yellow, and another white. This makes it appear plain enough to me that, at all events, a bee confines itself to those flowers whose pollens are of the same colour, and I think it most probable, to those of one kind also.

“To give you some idea of what may be done by each individual contributing its mite, I must tell you, that in a plentiful flower season like the present, the bees of one single hive, will, in the course of one day, bring home a pound or more of this pollen.”

LETITIA. “I can scarcely give credit to this account, when I see the very very tiny balls that each bee brings home after her flight.”

“You must not forget that each bee will make a number of these small collections in the course of one day; and that the hive contains probably between twenty and thirty thousand workers, all equally zealous and indefatigable. During the whole of the last month and the present, they collect all day long; when the weather is hotter, and their labours farther advanced, they confine their labours to the morning, leaving the hive, as I have frequently seen them do, at four o'clock in

the morning, and returning with their baskets full about eleven."

LETITIA. "You have not yet explained the use the bees make of this pollen."

"No; but I will tell you now. It is of great importance to them, for it forms their bread, *bee-bread*, or *sandarach*, as it is called; and, while honey is the dainty fare with which they regale their queens, the males during their short life, and in part their young; this bee-bread is the substantial food of the community. We have watched the bees stealing from flowers, nectar, or the contents of the nectaries, from which they make honey and wax; and pollen, which forms their bee-bread. Besides these two substances, there is a third, a kind of glue or gummy matter, called *propolis*, or *virgin wax*, used by the bees to cement and finish their combs.

"You must not suppose that all this information I am giving you, has been gleaned by my own observations. Naturalists have been engaged for years and years, without being able to settle the reality of a single fact. It was quite accidentally even that Huber, after being long puzzled, discovered from what tree this gummy matter was procured. After trying various experiments, he planted a number of cuttings of a kind of poplar,

whose leaves, before they quite unfold, are filled and covered with a glutinous kind of juice. These he placed in pots just before the hive, and presently he saw a bee perch upon a twig, open a bud with its mandibles, and suck up the gluten: with its second legs, it took it from its mouth, and so, passing it on to its baskets, conveyed it home.

“ Since this discovery, I have myself seen my bees collecting it from the tacahamahaca; that shrub, which you may know by the unpleasant smell of its leaves, resembling rhubarb. It is likewise found in the willow and birch. This gummy stuff, called *propolis*, is soft and red, and will pull out in a thread: it is very fragrant, and if put upon white metals, such as silver or tin, gives them a golden colour.”

LETITIA. “ I have not forgotten what you told us about the use of this propolis, in stopping up holes, and defending the weak places in the hive. Do they procure it from nothing but these trees?”

“ It is possible to make them use an artificial propolis; for instance, I once mixed up some turpentine and bees'-wax, and put it over the decayed part of a tree, near the hive. The bees soon attacked it, and I was amused to observe that, in their eagerness, one bee frequently came behind another, just as it was laden, and robbed it

of all it had collected. I have seen one bee lose a second and third load in the same manner, and patiently return to the tree to collect again.

“ But to judge of their patience, you should watch as I have done, and see the difficulty of getting at this rosin. You should see them tug and tug, till at last a little morsel gives way and becomes pliable. The bee loads herself with it; and places an enormous ball on each leg. It takes her at least half an hour to do all this, to pull it with her teeth, and work it up with her fore-legs, to knock it about with her pallet, and pass it from leg to leg, till she gets it into her basket.

“ These are the three substances collected by the bees: I have told you, that from the first of these, nectar, she forms her honey and wax; and I have shewn you the process the honey goes through before she deposits it in the comb. Shall I now explain to you how so harsh and insipid a substance as wax, is formed from the same sweet material; or are you wearied with the long and patient attention you have been kind enough to give me?”

Miss R. answered for her young friends, that, far from being tired, they had had their curiosity much gratified, and they were anxious to become thoroughly acquainted with a subject so worthy of

their study. "But," said she, "allow me to ask you one question. You say that wax, as well as honey, is made from the nectar of plants: surely you are mistaken; I thought that wax was made from the pollen or dust of the stamens?"

"It was thought so until lately; but it is now known that wax is made from honey. You remember, I told you that the bee had two stomachs, and I shewed you a picture of the first stomach, which holds the honey, which they afterwards deposit in their hive.

"The second stomach resembles a longish cask, covered with hoops from beginning to end; this never contains honey, but only beebread; but underneath it are a number of little pockets, of a soft and whitish substance, which are called *wax-pockets*. A part of the honey contained in the honey-bag, becomes converted into wax. It makes its appearance underneath these pockets, in the form of little scales, which the bees can take away from their bodies as they want it, or get their fellow-labourers to help them, as I have before explained in the making of the combs. Most of the wax used in Europe is the produce of our hive-bees; in America, there are wild bees, from which it is collected.

"Having thus followed the bee in her labours

out of doors, let us now see what use she makes of her stores when she gets home."

"Oh," cried Letitia, "this is what I have been most anxious to do;" and she pressed forward eagerly to the window of the glass hive. "But do tell me what that cluster of bees is about, that seem hanging all together just at the top."

"Those," said I, "are the very bees we have been talking about—the wax-gatherers. These bees are just come in from a laborious flight; and, having filled their own honey-bags, and given some to their companions, will hang together in that cluster for some time. It is now that the honey they have collected is going through the process that converts it into wax. Wait a few minutes, and tell me what you observe."

Letitia, after a few minutes' close attention, declared that she could fancy she saw other bees coming and seizing upon something from the bodies of their clustered brethren.

"I expected as much," said I; "the bees are so eager to get some materials for continuing their buildings, that they are not very attentive to the rights of justice, and are actually seizing upon the little scales of wax, as soon as they are formed.

~~X~~ "Having already shewn you how they use this

wax, when thus prepared, we will find out what the other class of workers are about."

LETITIA. "You mean the nurses; they are to feed the young, you know; but I see no young bees at all in the hive."

"What do you see then, at the bottom of the cells?" asked I.

"In the first place," said Letitia, "the inside of the hive is quite altered; it is almost entirely filled up with comb; and, instead of the little egg, I observe at the bottom of the few that are just opposite to me, a whitish lump."

"The insects have gone through their first metamorphosis, Letitia, and are become—do you remember what?"

As Letitia seemed to be recollecting herself, Sarah, the youngest of the party, stepped forward, and said she remembered very well that they were called *larvæ* in their second state.

With a smile of approbation for her good memory, I went to fetch a little drawing I had of the insect during this state of its existence.

"The larva, or maggot of the bee, is long; and, when partly grown, rolls itself up in a ring, with its head upon its back. Here is a full-grown one, and it resembles the large white worm met with in the rotten trunks of trees. It has no feet; and,

if brought out of its cell, looks starved, and moves feebly about. In fact, it is rather like a silkworm, having an upper and under lip, as well as two scaly teeth, which cover the mouth when it is closed."

"And are those tiny white and shiny globes its eyes?" asked Letitia.

"Yes," said I; "and beneath its mouth, though you cannot perceive it, is placed a spinning bag, something like that with which silkworms are provided, and with which they begin to spin their pretty little balls of silk."

LETITIA. "What! do bees spin silk like silkworms?"

"You shall hear by and by," said I; "at present, we must see how this larva, or maggot, subsists at the bottom of its cell. Now, whose office is it to bring them their food?"

LETITIA. "The nursing bees, you know; and I think I can see some, popping their heads down into the cells of the larvæ. Is this the way they feed them?"

"Yes. This is their occupation at the present moment. They return laden with honey and pollen; and with this and a portion of water, they form a kind of jelly, which they throw from their mouths into these cells, making for the young

a kind of bed of food; so that they have only to turn their heads and eat, whenever they have a mind.

“It is impossible for any tender mother or nurse, to be more attentive to their little ones than these nursing bees.”

“I think,” said Sarah, “that I can see a proof of this, if I am not mistaken. I have been watching a cell just close to the window, which a nurse has been supplying with jelly. Since she went away, I have seen several, one after the other, just pop their heads in, as if they were looking to see if the helpless young one wanted any thing. They seem satisfied with a single glance, and pass on to another and another, till they find one that needs food.”

“Well done, my little friend,” said I; “you will be one of our cleverest bee-students; for you have entered into their thoughts exactly.”

“While the larvæ are very young, the jelly which they are thus supplied with is of a whitish colour, and has very little taste; as they grow older it is more transparent, like jelly, of a yellow colour, and has rather more flavour.”

LETITIA. “You seem to know how their food tastes; have you ever eaten any of it?”

“I own I have had the curiosity to taste it

several times ; but you will think nothing of this, when I tell you, that Swammerdam, a famous naturalist, had the curiosity to eat one of the maggots, to discover what taste it had !”

“ And what did it taste like ?” asked Letitia.

“ It was very disagreeable, and tasted like rancid bacon ; but, surely, before you shudder so at the thought, you ought to remember how grateful we ought to be to that man who first had curiosity enough to swallow an oyster.

“ These watchful nurses supply the young larvæ several times every day, and are rewarded by seeing them grow rapidly. In five or six days, the maggot is full grown ; and when the nurses perceive this, they leave off bringing them food, their instinct teaching them that it would be useless in the state to which they are approaching.

“ The change from the larva, or maggot, into the pupa or chrysalis state, is one of the most dangerous and difficult operations in the life of an insect.

“ The nurses have still one duty to perform, which they never forget ; and this is, to stop the entrance of the cell with wax, in order that the insect may neither be exposed to the open air, nor troubled with visits. They then leave her to herself ; and the first thing she does is to spin

a web of silk, with which she lines the inside of her cell."

SARAH. "I cannot at all guess why she should give herself the trouble of doing that. Is it to adorn her cell?"

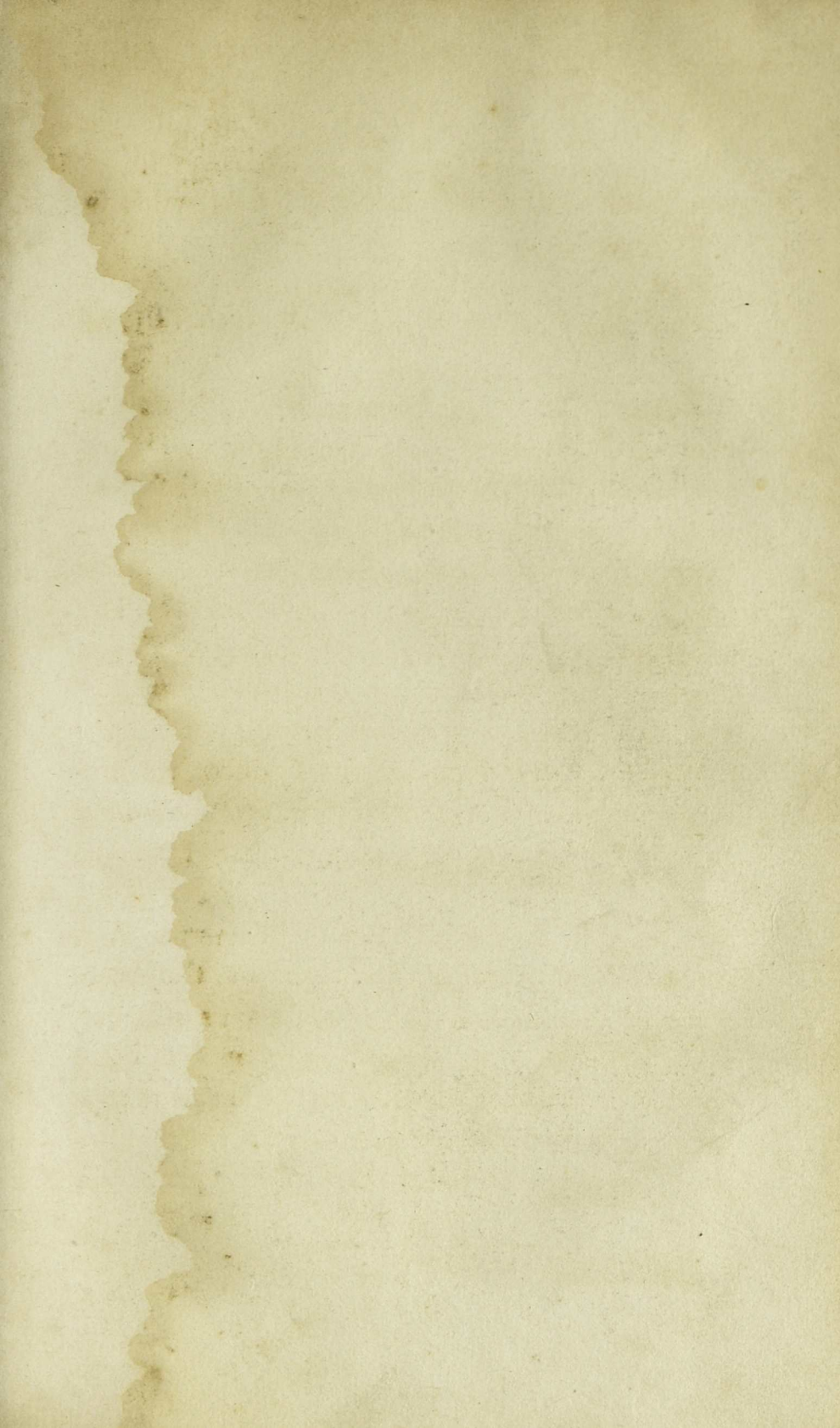
"A bee is too economical of her time and materials, to waste them in merely decorating her apartments. I can give you a more satisfactory explanation of her actions.

"Her instinct teaches her, that her body is about to become more tender; and, as all the jelly which served as bed and food is exhausted, she takes this means of lining her house, and of preventing the corners of it from hurting her.

"Nature, who gave her the instinct, has provided her too with a spinning bag, and some silky matter, as a means of guarding herself against this inconvenience.

"The silken thread spun by the pupa, is as fine and close as possible, and clings to the waxen walls of the house; and, what is very singular, is not taken away when the pupa has burst through its cell and become a perfect bee, although the cell is then cleaned out for the reception of fresh larvæ, by the industrious workpeople of the hive.

"As the shades of evening are coming on, we



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must leave these insects to their repose ; and, probably, before you come again, the second metamorphosis may have taken place, and the larvæ you now see so busily eating, may be enclosed within their silken web."

As it was too late for the party to prolong their walk, I put in a claim upon them, to take bachelor's fare with me at the tea-table ; with a promise on my part to escort them home in the evening.

We entered my cottage, and the young party were much amused by my original style of making tea ; for my politeness would not allow of any of my visitors presiding.

Amidst our merriment, we did not omit to quiz Sarah on the great penetration she had shewn about the bees ; and I accused her of having hunted into books and studied the subject, to make herself appear wiser than the others. Sarah was more diverted than any of the party at this attack upon her ; and declared she should avenge herself, by making me shew them the dead insects shut up in my cabinets.

I was rather glad of this hint, as it afforded me the means of amusing them for the remainder of the evening ; and I allowed them free liberty to ransack my shelves.

CHAPTER VI.

As I was now becoming very intimate with my new acquaintance, and had got over some of my shyness on facing so many females, I walked over to the school, one very fine afternoon, to fetch them to look at a comb-full of pupæ, which I had just discovered within my hive. It happened, fortunately, to be a half-holiday; and, as I heard the buzz of voices in the garden behind the house, I directed my steps thither through a dark shrubbery walk.

I was unobserved, therefore, by the little girls before I reached them, and overheard, without intending it, some of the conversation they were holding together, while twining the raspberry bushes which they had just gained permission to transplant from the larger beds.

The voice of Sarah was loudest, for she was recapitulating, with great animation, all that she had heard the last time she had been at Long Hampton. I just came upon them as they were crying out,—“O that we had a glass hive in our stone arbour, at the bottom of the garden!”

They all came running up to me when they saw

me ; and after a good laugh at little Sarah turning lecturer instead of me, I told them my errand, and bid them run to the house, and gain permission to accompany me home.

I followed them, and, entering the parlour, soon prevailed on Miss R. to form our usual party, and hasten to my arbour ; “ for,” said I, “ the season is advancing, and we should not delay our observations.”

We were again soon stationed around the glass hive in my arbour, each of its windows having two or three heads eagerly peeping through it. I waited till some one should make an observation on the state of the combs.

Letitia was the first to break silence. “ I have found,” said she, “ the bit of comb I saw last time, when every cell was filled with larvæ ; I see now they are all closed up, and therefore, I suppose, they are changed into pupæ. I can see nothing of what they are about, I suppose.”

“ Look,” said I, “ I have taken a piece out of the hive, and cut the tops off the cells. You may now see what they contain. It has spun its silk, thrown off the skin of a maggot, and is clothed in one of a much finer kind. It is still white. By and by, its eyes will look red, and its body will be covered with greyish hairs.

“ By degrees, beneath its delicate veil, it assumes the form of a perfect bee, and in another fortnight will bite its way out of its covering and its cell, and start into the world a full-grown and perfect bee.

“ To this state, she is, however, not yet arrived. We will leave her shut up in her cell, at her solitary labours, and see what the other members of the hive are about.”

LETITIA. “ I think you have forgotten the queen ; I have been looking about for her, hoping to see a royal personage followed by her train in great state, but I have not yet found her out. Perhaps she is not at home. Does she live most within the hive, or out of doors?”

“ I may appear to have neglected her majesty ; but it was only that I might be methodical in my account. I shall soon do her full justice.

“ We have followed the workers through their several changes, from the time when the queen left the egg in the cell. These occupy about twenty days of the life of a worker, and as many as twenty-four of that of a drone.

“ The manner of rearing a queen bee is very similar to that which I have been relating of the working bees. The eggs laid in a royal cell, are exactly the same in form and size as those

of the workers ; but they are fed with a kind of food, called *royal jelly*, which is less insipid than that given to the workers. It is pungent and stimulating, and the nurses are unwearied in their care to keep the cells constantly supplied with it. So abundantly do they provide it, that the royal little ones are unable to consume it all, and there is generally some left at the bottom of the cells which the queens leave.

“ In consequence of this rich fare, a queen becomes full-grown sooner than a working bee. In five days, it prepares to weave its web. This silken coating, or *cocoon*, as it is called, is different from the others, in not forming a complete covering for the body ; the head and throat, with part of the stomach, only being concealed by it. It is completed in twenty-four hours, and in two days and a half more, it changes into the pupa or chrysalis state. Four or five days more are sufficient for the perfection of its limbs ; so that in sixteen days from its birth, the full-grown queen is prepared to step forth into the world.

“ But who would envy the fate of this new-born monarch, whose very entrance into life is marked with care and sorrow ?”

LETITIA. “ How can that be ; since you have told us that the queen is so beloved by her sub-

jects, that they are ever anxious to shew their respect and affection: that she is allowed to take no part in the labours of the hive, but is fed from the choicest gleanings of the labourers?"

SARAH. "Even that does not surprise me so much, as to hear that royal cells are built, and queens reared, in a hive already supplied with one; because you told us that there was never more than one queen suffered to reign in a hive."

"I will satisfy all your doubts," said I; "and shall begin with those of Sarah, because that will partly explain the cause of Letitia's surprise. My hive, as you may observe, is, even in this early season, tolerably full of inhabitants. By the time the eggs already laid are all hatched, and the larvæ and pupæ become bees, it will be overstocked; a number of them will then collect together, fly off to some neighbouring tree or garden, and caught and put into another hive.

"This is called *swarming*, and every swarm requires a queen bee to lead the flight. I shall give you a fuller account of swarming some other time, but this will explain to you why it is necessary to rear new queens, whose lives and preservation are as essential to the colony as those of the old ones.

"And this, too, will lead to an explanation

of the strife and sorrow prepared for the young queen when she is ready to burst from her cell. While the old queen is still in the hive, waiting till the weather will allow her to lead out a swarm, the working bees, who, like ministers of state, conduct all public business, will not suffer the young queens to leave their cells. A band of guards surround them, and put an extra coating of wax on the top. In this they bore a hole, through which the royal prisoner stretches its trunk to receive its daily supply of food. While thus confined, she utters a plaintive kind of song."

LETITIA. "I do think she is to be pitied, if her own subjects begin by persecuting her."

"Not so," answered I; "they only wish to protect her from the fury of the old queen, whose jealousy is such, that she will permit no rival queens to share her honours; and her hatred of them so great, that nothing short of their destruction will satisfy her."

"It is for this reason, that the bees take upon themselves the office of guards, to keep off the approaches of the old queen. In their zeal, they even seem to forget their duty to her, and may be seen beating her away, if she attempts to come near."

“ This takes place whenever there is a prospect of a speedy swarm ; but, alas ! for the new queens, if swarming season is over, or the weather unfavourable. They are, in that case, deserted by their guards, and the old queen has full liberty to gratify her anger against her innocent victims.

“ She darts with fury upon the first royal cell she meets with : with her jaws bites through its waxen lid, pushes her back into the hole, and stings the poor defenceless bee to death.

“ As this seems an order of nature, it is supposed that the royal cocoons are left in the imperfect state I have before described, in order that the old queen may be able to introduce her sting.

“ As soon as this sad act is finished, the workers, who had been standing quietly by, enlarge the hole and drag out the dead body.

“ The old queen passes on to all the other royal cells, and if she finds the bee in the pupa state only, her rage is not so great ; she tears open the cell, but does not penetrate her sting into it. Its death, however, is equally certain, for the workers pull it out after the hole has been made, and leave it to perish.

“ Last year, the old queen of my glass-hive had been killed just as the young ones were prepared to enter the imago state. I was curious to ob-

serve the actions of the first who should escape from her cell, and actually witnessed the very scene I have been describing to you.

“Not more than ten minutes had elapsed, before she was seized with all the fury of jealousy, and the five or six royal cells contained within my hive were all torn open and despoiled, one after the other.”

SARAH. “This, surely, must be the most melancholy part of the history of bees?”

“You must prepare some more pity,” said I; “for I have much still to relate of the combats of the queens. I wish you could yourselves witness them, but the queen is not often visible, and it is only from the patient observations of many and many a year, that I have become acquainted with all that I am telling you.

“Many years ago, when my hive was in a very thin state, I saw two young queens emerge from their cells at the same moment. As soon as they perceived each other, they rushed furiously forward, until the jaws of each grasped the antennæ of the other. Their heads, their trunks, and stomachs, were mutually opposed, and they had only to curve their tails and sting each other, and both would have fallen down dead together. To my surprise, at this very

moment they parted, and fled from each other as if seized with the greatest fear. In a few minutes they seemed to have recovered from this panic, and returned to the attack. They again met, just in the same position, and as hastily fled away.

“The workers, all this time, were standing about in great agitation, which increased whenever the queens separated. Twice I observed them stop their flight, and hold them prisoners for more than a minute. At length the queen, who was either the strongest or the most furious, darted on her rival when she was not prepared, caught her by the wing, and stung her: then, letting go her wing, she withdrew her sting.

“The vanquished queen fell down, dragged herself feebly along; her strength soon failed her, and she expired.

“I see you look very woe-begone, Letitia, and think me perhaps very hard-hearted in telling you a tale of so much cruelty; but summon your fortitude, I have more to tell you still.”

LETITIA. “My curiosity to know more of these wonderful little beings, is, I fear, still greater than my compassion for their sufferings. But pray explain, before you go on, the anecdote you

have just been telling us. I cannot understand why the two bees ran away from each other just as their battle might have been ended !

“ There can be,” said I, “ but a single queen reigning in every hive. When a new one is added, therefore, one must perish ; but if both were destroyed, the hive would be left destitute of any queen at all, which would be equally contrary to the law of nature.”

SARAH. “ It is instinct then, which teaches these rival queens that it would be contrary to the interests of the state that both should die ; and which makes them retreat at the moment that such is likely to be the case.”

“ Exactly so. You shall now hear of an experiment I made, not long ago, which gave me still greater reason to admire the plan and design which seem to govern all the actions of these insects.

“ I painted the throat of a queen, in order that I might be able to distinguish her, and introduced her into a hive already provided with one.

“ Instantly, I saw my bee surrounded by a band of workers ; who advanced towards her, but not to caress and receive her kindly, as they would have done if she had been their true and lawful

sovereign. They crowded round her so closely, that in less than a minute she was deprived of liberty, and became their prisoner.

“ I was still more surprised, in observing that another set of workers had crowded round and detained their own queen ; and, as I soon perceived, not in order to prevent her from fighting, but from an anxiety to witness the combat which they knew must take place.

“ As soon as the right queen shewed signs of wishing to attack her rival, both clusters of bees gave way, and disappearing by degrees, left an open space between the combs for the battle.

“ As soon as the two queens were near enough to see each other, the rightful queen rushed furiously upon the pretender ; seized her with her jaws, and, fixing her to the comb, quickly despatched her with her ever-ready weapon, the sting.”

SARAH. “ I wonder that the workers, who, as you say, can act either as ministers of state or soldiers, and whom you represented as so loyal, I wonder that they should not unite to defend their beloved sovereign, rather than suffer her thus to expose her person to danger.”

“ Your observation, Sarah, shews great reflection. It is a subject which has puzzled every naturalist, who, like myself, has observed the

fact over and over again, without being able to account for this apparent inconsistency in the conduct of the working-bees.

“ But my lecture has, I think, been long enough for one afternoon ; I fetched you here, and I must take you back, before you become quite melancholy or grave.—What say you to another row down the river?—If you are courageous enough to venture to the Castle mill, follow me. I have got permission to take you home through the park ; and shall send my old dame to the lodge, to prepare tea for us.”

Joy gladdened the countenances of my little bee students, and we were quickly equipped and seated in my boat, which cut gaily through the waters. Mirth succeeded to our sedate conversations, and we made the shores resound with our laughter and singing.

The old grey walls of the castle soon greeted us ; at the romantic mill-dam at the end of the rock beneath them we landed, and started up the long avenues which lead to the castle lodge. Our walk was frequently suspended, that we might listen to the notes of the nightingales, who make these woods their favourite haunts ; and we listened with the greater eagerness, as we had reason to expect they would shortly desert us.

CHAPTER VII.

“ You have told us,” cried Letitia, the next time I was favoured by a visit from my young friends, “ of the various quarrels of the queens; now I wish very much to know, what would happen if a hive were left entirely without a queen? Would the bees mourn her loss? or would they go about hunting for another?”

“ I must explain the secret of Letitia’s curiosity on this subject,” said Miss R.; “ by telling you that we have been reading what Virgil says in his *Georgic* about bees. I think, Letitia, you learnt that passage relating to the affection of the subjects for their queen; or, as Virgil calls it, their king.”

When I begged to hear it, Letitia very pleasingly complied, and repeated the following lines.

Besides, not Egypt, India, Media, more
 With servile awe their idol king adore;
 While he survives, in concord and content
 The commons live, by no divisions rent;
 But the great monarch’s death dissolves the government.
 All goes to ruin, they themselves contrive
 To rob the honey, and subvert the hive.

The king presides, his subjects' toil surveys,
The servile rout their careful Cæsar praise:
Him they extol, they worship him alone,
They crowd his levees, and support his throne:
They raise him on their shoulders with a shout;
And when their sov'reign's quarrel calls them out,
His foes to mortal combat they defy,
And think it honour at his feet to die."

"Your curiosity shall be gratified," said I;
"and I will convince you that the poet has told
the truth about the loyalty of bees.

"The inhabitants of the hive are so intent upon
their occupations, so busy in feeding the young,
cleaning out some cells, and mending others, that
they do not always find out immediately when
they have lost their queen. But when, after a few
hours, they discover her departure, a scene of
tumult and consternation takes place. The bees
are all in agitation; a peculiar humming is heard;
they neglect their young, and rush backwards and
forwards across the combs as if they were frantic.

"It is singular to observe how the grief spreads
by degrees through the whole hive. At first, only
a few are aware of the loss of the queen; but they
communicate it to the rest, by mutually crossing
their antennæ, when they meet, and lightly striking
them. By degrees the whole are informed of the

sad story ; some of the workers rush furiously out of the hive, spread all around it, then go in again, then again leave it to renew their search."

" And does this tumult last long, asked Letitia ?"

" No," answered I, " not more than four or five hours. If the queen does not return, and you observe the hive again in about four-and-twenty hours, all is tranquillity, and a scene of industry. Instead of wasting time in useless grief, the workers set about repairing their loss ; and you will indeed think that I am relating a fiction, when I tell you, that they are able to convert the larva of a common working bee, into that of a queen bee. This is one of the latest and most extraordinary discoveries relating to bees. It was made by M. Schirach, and confirmed by numberless experiments by M. Huber, whom I have so frequently mentioned to you. I will describe to you the whole process ; and the more you reflect about it, the more astonished I am convinced you will feel.

" They choose the young common worms whom they intend to convert into royal ones, and begin by enlarging their cells. In order to do this, they are forced to destroy two or three of the neighbouring ones. We will suppose a set of

bees about one of these cells; for the account of their labour will apply equally to all the others, as they all go through the same process.

“The worm is chosen and deposited in its newly-enlarged cell: a large supply of royal jelly is then brought it; a cylindrical or round tube is next formed around the bee; the bottom of the cell remaining of the same shape as before.”

SARAH. “They leave the bottoms untouched, I suppose, that they may not disturb the young worms in the three opposite cells of the double comb?”

“Exactly so,” replied I; “but at the end of three days, a larger house becomes necessary for the worm, fattened by the rich food it has been feeding upon. On the third day, therefore, they gnaw through the three opposite cells, destroy the worms that inhabit them, and use the wax in building a new tube, which they fasten at right angles with the old one. They carry on their work downwards, and form the new tube wide at the top and narrow at the bottom.

“As the worm grows, the bees lengthen the cell; and one bee after another may be seen popping its head in, and giving it a constant supply of food. This they place before its mouth and round its body; and the bee, which can only move in a

spiral direction, keeps constantly turning to take its food, and thus insensibly descends to the opening of the cell. By this time it is prepared for its transformation into the nymph, or pupa state; and as any farther care would be useless, the cell is closed with wax and propolis, in the manner before described, and the insect left to its fate."

"How very miraculous!" exclaimed my young auditors.

"It does, indeed, appear so," replied I. "That a larger and warmer house, food of a higher flavour, and a different posture, should cause the insect to have a different kind of tongue and mandibles, a longer body, more brilliant colour, and shorter wings; that it should give it the power of laying eggs and leading swarms, instead of collecting honey and forming wax, are facts that require very strong proof, I allow."

LETITIA. "Do you yourself give credit to this extraordinary fact?"

"Indeed I do, Letitia; for, besides my own observations, and the ten years' experience of M. Huber, I think another celebrated naturalist, Bonnet, has given a just explanation of its causes. A particular kind of food, given in greater abundance than usual, may cause in the grubs of bees the developement of organs that would never have

made their appearance without. A more spacious habitation may likewise be absolutely necessary for the complete developement of the organs which this food causes to grow in every direction. The wings are, you know, as short as those of the common bee; and this too may be accounted for, from the stiffness of the substance of which they are composed, which does not allow of their increasing in proportion to the other parts of the body."

Miss R. "We must, I believe, yield to such excellent authority, for the truth of this singular fact. Pray tell me whether it signifies what age the grub is when taken out of its own small cell, to be thus fed and enlarged into a royal personage?"

"Here again naturalists differ; but I am inclined to join Huber in believing, that it is of little consequence how young a grub is, and that one of a day or two days old, may be converted into a queen, as well as one of three or more days old. The following experiment which I made, has, indeed, proved it. I had a hive which had been deprived of its queen; and I put into it some pieces of comb containing the grubs of workers, of about the same age as the others in the comb. I then took five of these workers out of their cells, and put

in five others only two days old. The bees, however, did not appear to take any notice of the change, but watched over them and enlarged their cells, as for the others; and after the usual time, I opened the cells and let out two perfect queens.

“ I have told you now what commonly takes place in a hive where the queen does not re-appear for twenty-four hours, especially if the hive be unprovided with any workers’ worms that can be converted into new queens. Their affection for the queen they have been accustomed to is sometimes too strong for them to get over so easily; and I can relate to you a story of a whole hive-full who actually died for love of their queen. But I shall incur your censure for what, I must own, was an act of barbarity on my part, in order to gratify my curiosity. One morning, very early, I took a swarm of bees that had been hived the day before, and placing it on the grass, with a hard stroke upon the ground shook out all the bees in a lump. As soon as they were a little quieted from this disturbance, I got a little stick and stirred them about, till I succeeded in finding the queen.

“ Having put her into a box, which I had

prepared for her, I carried her into the parlour, where I cut off her wings to disable her from flying, and shut her up in the box.

“I then returned to the garden, to see what the swarm would do when deprived of their sovereign, and I found them all in a tumult. Instead of keeping together in a cluster, like a bunch of grapes, as they usually do, they were spread out as broad as a cart-wheel, running up and down with a disconcerted tone, looking every where for their queen.

“After an hour or two of fruitless search, they flew away, and two things struck me as very singular in their flight: first, they flew to the very hedge on which the swarm had alighted the day before; and secondly, they flew about in little groups of forty and fifty, searching in every direction, instead of flocking together in one bunch.

“I then took the box out of my pocket and opened it, to see if the afflicted bees would know their queen without her wings. To my great amazement, I no sooner opened the box, than all the little bunches of bees began to collect about it, and surrounded it on all sides. Presently they were all collected; and, no longer

attempting to fly off in bunches, remained quietly about it, uttering their note of joy, so well known to those acquainted with bees.

“As night was approaching, I again hived them, and brought them into my garden. Next morning, I shook them off on the grass, as before, and witnessed their affectionate conduct to their queen, whom they would not leave, although from having her wings cut, she was unable to fly and lead them to a place of safety.

“I took her away from them several times in the course of the day, and they as constantly spread themselves into parties to look for her, never failing to flock around her when I placed her in sight.

“I had a party of friends with me, who were exceedingly amused at observing all this; and when evening approached, and I put her down for the last time, we again perceived the faithful bees close round their mutilated sovereign, preferring to remain out on the cold ground without food, and starve with her, than desert her.

“These faithful creatures spent five days in this manner, alternately looking out for her, and rejoicing over her when found. They tasted no food during the whole of this time; nor would the queen eat the honey I set before her while parted

from her subjects. At the end of the five days, they all died, except the queen bee, who lived a few hours longer, and then died too."

"Poor creatures!" said Letitia; "I wonder you could persevere in keeping them so long without their queen!"

"You think me very hard-hearted, no doubt; and, I fear, I shall scarcely excuse myself by saying, that my anxiety to ascertain how long the loyalty of these creatures would last, made me feel it a kind of duty to complete my experiment, painful as it was to my feelings.

"I think I told you that it was the law of the hive, that one queen only should reign in it; and that if more are allowed to live in it, it is only for a short time when they are expected to lead out swarms. Except in this case, more than one can be introduced into a hive only by force, since the bees guard the entrance night and day to prevent any intruders."

SARAH. "Here the workers turn soldiers then?"

"They make most vigilant sentinels; for, not content with using their eyes, they actually touch with their antennæ, which, you know, are their organs of feeling, every creature that presents itself at the door of the hive. If a stranger

queen approaches and attempts to enter, the bees on guard instantly seize upon her legs or wings with their teeth, and surround her so closely, that to enter would be impossible; she cannot even move. Then, some other bees from within come to assist the guards, and form a cluster around her. So closely are they packed, and so intent upon what they are about, that the whole bunch may be carried about for some time without their perceiving it. They have all their heads nearest to her; and if they keep her too long in this painful imprisonment, she perishes."

LETITIA. "Is she stung to death by the other bees?"

"No: it has been said so, but without truth. Her death may probably be in consequence of suffocation from want of air, or from hunger, but never from their stings. I have once seen an unfortunate queen in this situation stung to death, but it was my own fault. Out of compassion for her, I tried to get her out of the cluster; at which the bees were enraged, and, in darting out their stings, some of them struck the queen, and she died. I am quite convinced that if I had not interfered, the workers would have contented themselves with confining her; and what makes me still more certain of it is, that some of the workers

too were stung and died, which could not have been intentional."

LETITIA. "But will the bees never receive and pay homage to a new queen? It does not appear to me consistent with their notions of economy, either of their time or materials, to be at the trouble of erecting royal cells, and nursing up young queens, if they could avoid it."

"I have said, that these labours are not commenced until they have been many hours without a queen; but even if they have been commenced, a stranger queen will be well received, and even allowed to reign as soon as she enters, provided there has been sufficient time for the bees to mourn over and forget their former sovereign.

"I have had an opportunity of observing this: my glass-hive, last year, was deprived of its reigning monarch, and I introduced a new one, after the workers had actually begun to build twelve new royal cells. As soon as the stranger was placed upon the comb, the workers near her touched her with their antennæ, and, passing their trunks over every part of her body, gave her honey to eat. These workers then gave place to others, who treated her in the same manner; all vibrating their wings, and forming a circle around her. This agitation gradually spread, until it

was communicated to the workers on the other side of the comb, who came in their turn to see what was going on. They soon arrived, and, breaking through the circle formed by the first, approached the queen, felt her with their antennæ, and gave her honey. After that, they retired behind the others, and added to the circle, shaking their wings, and gently buzzing, as if they enjoyed some very agreeable sensations."

LETITIA. "This is a very interesting account of their orderly method of proceeding, and their unanimity. I suppose, then, they abandoned the royal cells they were beginning to construct?"

"Have patience, my good friend, Letitia," cried I, "and I will tell you in due time. The queen had not yet stirred from that part of the comb on which I had placed her; but in about a quarter of an hour she began to move. The bees did not oppose her, but opening the circle at that part towards which she turned, followed, and formed a guard around her; and, after a short time, she began to lay eggs in the empty cells.

"While all this was passing on one side of the comb, the workers at the royal cells, ignorant of the arrival of a new queen, were labouring most diligently: they watched the royal worms, and supplied them with jelly.

“ The queen at length reached this part of the comb, and was treated with the same degree of respect as she had met with from the others on her first arrival. The workers crowded around her, touched her with their antennæ, presented her with honey; and, as a complete proof that they accepted her for their queen, gave over their labours upon the royal cells, removed the worms, and devoured the food that had been collected for their use. The queen from this moment was acknowledged by all the hive, and reigned as if she had been born and bred amidst her subjects.”

SARAH. “ I, too, remember reading a story about the attachment of the working-bees to their queen. A celebrated naturalist, named Swammerdam, took the queen out of a swarm, and fastening her leg with a bit of cotton to the end of a long pole, drew her along. The whole swarm of bees followed and clustered around their queen, to protect and cover her; and thus all the swarm were led about in pursuit of their queen wherever Swammerdam chose to carry her.”

LETITIA. “ Since you have told your story, Sarah, I think I shall be able to tell mine, about a bee-master, or, at least, a man who called himself a master of bees. Certain it was, that they followed him as sheep follow their shepherd,

and even closer too, for he was entirely covered with them. His cap looked exactly like one of those swarms which, when they are about to settle, fix on some branch of a tree. The people about him bade him take it off, and the bees then placed themselves on his head, or shoulders, or hands. They never attempted to sting him, nor any of the persons near. They all followed him when he went away, and he had myriads around him besides those upon him. Although much pressed, he never would tell the secret, but only said, that he was master of the bees."

"Ah, the juggler!" cried I. "He had, no doubt, secured the beloved queen of the swarm, and had her safe either in his ear, or some other place that the bees were aware of."

After thanking my young friends for their amusing additions to my store of anecdotes, I entreated them to enter my arbour and partake of some strawberries and cream; over which we laughed and talked, till the shades of evening warned their prudent but most kind governess that it was time to depart.

CHAPTER VIII.

“THE next subject which will occupy our attention,” said I, when again my auditors had put on the appearance of anxious listeners, “will be that of the swarming of the bees, which I can no longer delay telling about; because I have received a hint, that several of the party will not be able to make observations for themselves, in consequence of the coming holidays, which will take them from their studies.”

“And from our amusements, too,” cried Letitia; “I shall pine for these charming Saturday afternoons, even when enjoying myself with all my friends at home.”

I smiled at the warmth of my young pupil; but thought to myself, that she would shortly change her note. However, I felt that we had no time to lose, and entered at once upon my subject.

“The usual swarming season is from the middle of May until the middle of June; but swarming may take place earlier or later. Much depends upon the state of the weather, for no swarm will

ever leave the hive while the weather is cold, or the hive not perfectly stocked with eggs."

LETITIA. "And do the bees give you no warning that they are about to swarm?—Do they fly out in a bunch quite unexpectedly?"

"No," replied I; "nothing that my little friends do is hastily performed, or without due reflection and preparation. But come, let me take you to the numerous hives in my garden; perhaps, at this very moment, some of their inhabitants may be busy preparing to swarm. Now is the season, and the sun shines most kindly." I was followed, not without some hesitation and lingering steps, into my garden; and as we passed along the range of hives, whose entrances were thronged with clusters of busy bees, Letitia cried out, "Ah! what noise is that I hear; it sounds like an unusual humming?"

"We are fortunate," said I; "this gentle humming is the prelude of a swarm; but do not be terrified; the bees will not start out and alight upon your head or shoulder. Swarms never set out at this time of the day, but they are making preparations for the morrow. This humming is one of the signs: another sign is their having kept house to-day; for scarcely any of the bees in that hive have pursued their usual labours in collecting

honey, or pollen. The hive, too, appears so full of bees, that many thousands, as you see, hang upon each other in clusters at the entrance ; this is another sign. I see too some drones, or males, making their appearance ; this, again, is a sign : and to-morrow, doubtless, there will be a swarm issuing from this very hive."

"But what," asked Sarah, "can be the meaning of this perpetual hum? I have held my ear close to the hive, and it has not ceased for an instant?"

"I must leave you Sarah, to form your own conjectures, to add to the amusing ones already invented. Some people say, the noise is occasioned by the queen, who makes a speech to her subjects before she leads them out. Others say, that she rouses them with a kind of trumpet, to give them courage for their undertaking ; while others, still more fantastic in their notions, say that the noise proceeds from the young queens, who sing out a kind of petition, that the old queen will allow them to leave their cells and lead out a swarm.

"All this, of course, is mere fancy ; and we may as well attempt to interpret the conversations of birds, when they utter responsive notes to each other. The noise you hear, whatever it

may mean, is occasioned by their striking their wings against the air; and the vibration of a single pair of wings, moved forcibly and swiftly, will produce a considerable hum. Except their wings, the bees have no other organs of voice; and if you cut off the wings of a bee, you render it quite dumb.

“ I have told you, that the bees, who have instinct adapted to every situation in which they are placed, carefully guard their young queens, if swarming season is at hand; and by keeping them imprisoned for a few days in their cells, prevent them from falling a sacrifice to the jealous fury of the old queen. The first swarm, or colony, which wings its flight from the parent hive, is always led by the old queen; whose frenzy, when she finds herself repulsed in all her attempts upon her rivals, amounts almost to delirium.

“ About eleven o'clock in the morning, when the sun has warmed the air, is the time the swarm generally issues from the hive. The hum increases as the time approaches for the little beings to set out on their adventures.

“ The queen, whose body has become very slender, as if in readiness for her flight, shews great signs of agitation. She still continues to examine

the cells as if going to lay, but suddenly withdraws it, without having laid. Sometimes she deposits her eggs irregularly. Her whole movements are disorderly. She runs over some of the bees in her way; sometimes, when she stops, the bees who meet her, stop also, and look at her attentively; then striking her with their antennæ, mount upon her back. Thus she continues her route across the combs with some of the workers upon her; none offer her honey, but she helps herself from the combs as she goes along. None pay her the usual attention and homage, or form the regular circles round her, but run after her, and rouse by their agitation the workers who were still busy in the combs.

“ You may trace her path across the combs, by the agitation which is every where excited: it is never quelled, and the queen soon runs through the whole hive, and causes the tumult to be general. If any corner still remains quiet, some of the agitated bees soon arrive and disturb it. The queen no longer lays her eggs in cells; she lets them fall at random, and the workers neglect to feed the young brood; those even that are just returning from the fields, laden with newly-gathered stores, no sooner enter the hive, than they become affected by the general agitation, and run blindly

about, careless of the baskets' full of pollen which encumber their feet.

“ At length they all rush precipitately to the entrance of the hive, the queen accompanies them, and the swarm issues forth.

“ The cause of this last rush, is, doubtless, the heat of the hive, which is so increased by the queen's restless movements, as to become intolerable: the bees clustered near the mouth and at the bottom of the hive, perspire so much, as to appear drenched with wet.”

My lecture was here interrupted by an earnest petition from my young hearers, that it might be postponed, and that they might come the next day and take their chance of seeing the bees issue from the hive they were now examining, and which I had assured them was on the point of swarming.

I, of course, could make no objection; and Miss R. kindly sanctioning the petitioners, I was soon left again to my solitary reflections, with a promise from the party to be with me early in the morning, and a parting exclamation from Letitia, of “ Oh, how lucky, that we should discover a hive ready to swarm !”

The next morning, the sun shone brighter than usual; my breakfast was over, and my gar-

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dener was busy preparing a hive for the reception of the new colony, when up came the rosy group of white and green damsels, out-walking their more sober-faced governess, and almost as disorderly and agitated as my bees themselves.

“We are in time, I hope,” said Letitia, who brushed her hair away from her eyes, and tried to look calm and cool, as she first reached my garden-gate: “Don’t tell me the bees have left the hive, or I shall break my heart!”

“Do not distress yourself, Miss Letitia,” answered I, very gravely. “You are in good time. Let us wait for the rest of the party, and then we will quietly station ourselves at the hive, and wait the forthcoming of the bees.”

I soon found by the increased hum, that the swarm was about to issue, and gave due notice of it to the girls, lest they should be terrified at the sight of so many enemies.

Some of the bees at length flew out. “See, see!” cried Letitia, “what a cloud of bees! I never before saw so curious a sight: they rise in the air all around us like flakes of snow in a winter’s day! Whither are they going? They hover about as if uncertain which way to turn.—Is the queen with them?”

“You shall soon see her,” said I; and, throw-

ing some handfuls of small gravel up to the swarm, to prevent them from ascending too high in the air, we soon saw them alight upon the branch of an apple-tree just near. I encouraged the girls to follow me, and when we reached the tree, I was able to point out to them the queen, at a little distance from the tribe of bees who had clustered around the branch.

As soon as the group was quite formed, the queen entered into the midst of it, and the bees surrounded her so thickly, that we lost sight of her.

LETITIA. "The group is very quiet, how long will it continue so?"

"Until the gardener has prepared his hive," answered I. "In the mean time, let us observe how this living ball of animals hang upon one another by their claws. Now the queen has joined them, they are quite quiet, not one leaves the general assembly to roam about."

"I have heard," said Sarah, "stories of brass pans and kettles being sounded when the bees swarmed; what was this for?"

"For the same reason," said I, "which made me throw dust up to them, to prevent them from soaring out of reach. The peasants know that the noise of thunder invariably causes bees to return

downwards to their hive, and they take the best method they can of imitating this noise.

“ Their observations are just, as far as they go ; but this plan does not always succeed, because it is not, in fact, the noise of the thunder which brings the bees so hastily back, but because they have instinct enough to know, that thunder is generally followed by rain ; it is the rain they fear, and the approach of it makes them anxious to be under the shelter of their hives.

“ Now my expedient of throwing up dust, or fine gravel, is more ingenious I think, and seldom fails ; for the bees mistake the minute particles for small drops of rain, and fancy the storm to be commencing.”

“ But what would happen,” asked Letitia, “ if the bees were left to themselves, and winged their flight as high as they pleased ?”

“ They would stand the chance of being lost in the trackless regions of air ; and, at all events, they would be lost to us. Our observations would be at an end ; and, if gain were our object in keeping bees, we should be poorer by the whole hive full of honey, which we naturally reckon upon from every new swarm.

On these accounts, we plant our hives in gardens ; and a careful bee-master, like myself, will

allow of none but dwarf and bushy shrubs to find admittance there; large trees would not only endanger the lives of my little subjects, but encourage them to become rebellious, and place themselves beyond the reach of my gardener, who is now so diligent in preparing a warm and safe habitation for them.

“I must not omit another amusing fiction related of bees, which is, that on the day before the swarm is to take place, spies are sent out from the hive to choose a proper place for the new colony to establish themselves in; and when they return, and have made their report, her majesty, the queen, sends some of her officers of state to prepare the place for her reception.

“But that this is merely a fable, we may ourselves judge; for if they had exercised their usual foresight, the swarm we are now watching would never have chosen that branch of a tree, exposed as they there are to every gust of wind and drop of rain.”

LETITIA. “But how can you tell that they intend to fix there, and that they are not merely resting themselves and preparing for another flight?”

“I know it; and you shall soon judge of the truth of what I tell you with your own eyes.

When the gardener has housed them, you will find that they have actually been all this time busy building combs in preparation for their residing there. It is possible, that when they had found out all the inconveniences of the situation, they might leave it, and seek a better ; but I have no doubt that their present intention is to remain where they are."

LETITIA. "I can have no hesitation in trusting to your report ; and pray tell me, if it ever happen that two queens go out with one swarm?"

"It is not an uncommon circumstance," answered I ; "but, in that case, the swarm invariably divides itself into two bands ; so that if they are all clustered in one wreath, as you see here, you may be sure there is only a single queen.

"The swarm, though at first it divides itself when it perceives that it has two leaders, soon becomes aware that it is not for the general interest to part, and the smaller band at length joins the larger one ; the queen, whose luckless fate it was to belong to the smaller party, falling a victim to the jealous fury of her more fortunate sister-queen.

"Till this contest is decided, and the affections and duty of the bees are all centred in one queen, no business is begun, nor even an habitation fixed upon.

“It sometimes happens, that a swarm goes out without a queen; but as soon as this is known to the whole party, they return to the hive from which they issued.”

LETITIA. “What a pity, that, when there are too many queens, one should not be secured, and given to the swarm which wants one.”

“The same idea,” said I, “entered into the head of Reaumur, a most indefatigable French naturalist, and he made an experiment of introducing an old queen, who had frequently led swarms, into a hive which was overstocked with inhabitants, and which only wanted a queen to lead them forth. Next morning, when he looked into the hive, he found the queen, whose throat he had marked with red, that he might know her again, lying dead among the workers; some of whom afterwards carried her out of the hive to some distance from it. Thus his experiment failed.”

LETITIA. “Look! look at the gardener, with a piece of gauze over his head, a great pair of gloves on, and a broom in his hand!”

“He is a careful old fellow; and the gauze over his head may sometimes be a necessary guard. I will tell you what happened to my maid Kitty, who is now a very heroine among the bees.

“The first time I required her assistance in

hiving my swarm, she put a cloth over her head and shoulders, upon which the queen bee perched, and in an instant she was covered thick with bees. When the cloth was taken off, she was quite a spectacle, her face and neck being quite black with them. She was so terrified, that she wanted to run off, but I persuaded her to be quiet, and let me hunt for the queen bee.

“I presently found her, and removed her into the hive, but the bees still kept their station upon poor Kitty. I gave another hunt, and found a second queen, which I removed likewise, and the bees immediately followed her into the hive, and left Kitty unhurt, and so brave, that she now is ready to assist me in any enterprize among them.

“But to return to old John, he has carefully cleaned out his hive, and rubbed the inside with such leaves and flowers, the fragrance of which he knows the little bees are fond of. Such as balm-leaves, and bean-flowers, and a little honey he has perhaps put in to coax the new comers.

“These precautions are not absolutely necessary, but the old fellow is determined to omit nothing to entice them in : see how he sets to work.”

LETITIA. “He approaches them cautiously, and reaches them with his little broom, but,—oh, John ! you are very clumsy !—large clusters have

dropped down upon the ground, instead of into the hive, and many are flying away !”

“ Never mind, Letitia ; he has done very well. He has turned the hive up into its right place on the stand ; and those who were groping on the ground, or flying away, are now eager to join their friends within.”

“ Yes,” said Letitia ; “ but how many of them are returning to the branch of the apple-tree !”

“ They are partial to the place on which they first alight, and it is often a very difficult matter to make them entirely leave it, for they will return thither again and again, although driven away every time. We will get John to rub the bough with some elder-leaves, or some rue, and their dislike to the smell of these will prevent them from visiting it again, and we can then approach and see whether they have begun their combs upon it.

“ At present, the gardener is busy in driving four stakes round the hive. Over this he will spread a cloth, and, as the sun is now very powerful, he will likewise spread a few branches, to form a more complete shade, for it would not do to remove the hive at present. After sunset, he will carry it to a stand by the side of the other

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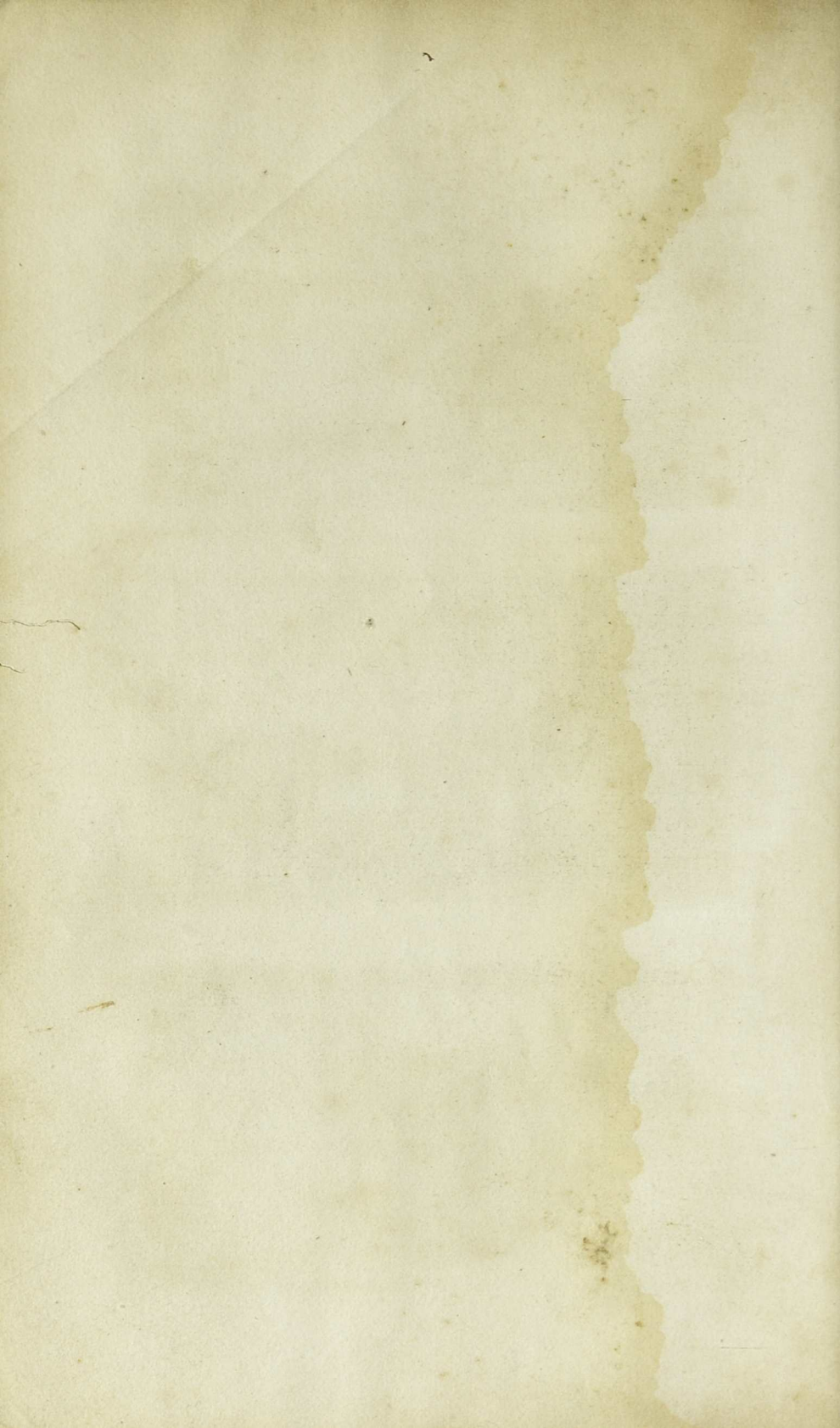
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hives, whose sheltered situation protects them both from heat and rain."

LETITIA. "Now suppose, that in spite of all your precautions, a new swarm of bees should sometimes perch upon a branch above the reach of John's arm, what would he do to bring them down?"

"I am glad to perceive," said I, "my friend, Letitia, so anxious to know every thing so thoroughly. A few days would, probably, enable you to have an opportunity of seeing his operations; but, as you may not be on the spot at the exact time, you shall hear what expedients John's sagacity provides him with in such a case. Sometimes he mounts a ladder, and holds the hive topsy-turvy, while my maid Kitty, who is almost as great a bee-manager as myself, mounts up some steps, and with a long broom sweeps the bees into the hive. If the swarm alights upon the end of the bough, so that the ladder cannot be placed near enough to it, the hive is inverted, and set up on a long thick pole, and a very long broom employed to sweep the bees into it. Other expedients are resorted to, according to the situation of the bees; but if all should fail, they must be suffered to remain till evening, when

they get drowsy, and can be more easily managed."

LETITIA. "I have ventured near the new hive, and long to see how the little industrious creatures set to work. How long will they continue in this quiet state? I hear no noise nor any sign of life."

"You may depend upon it, if John has taken proper care to make their house agreeable to them, it will not be long before they set to work. Quiet as they seem, many have even now mounted to the top of the hive and begun a comb; and not many days will elapse, before these cells will be filled with eggs. We shall not get a sight of it till it is many inches long, for they throng to relieve each other from their labour. None, as you perceive, have yet attempted to fly abroad; and, therefore, we must suppose they brought upon their bodies a store of wax to begin building with. All we can perceive is, that they have flown to the very top of the hive; and since they begin building always at the top, it is a sufficient proof that they are satisfied with their abode."

Miss R. now suggested, "that as they had seen the bees safely lodged in their hive, her party should retire, since the morning's lecture,

agreeable," she politely added, "as it was, rather interfered with their usual employments at home."

Letitia just begged leave to ask one question before they left.

"How many swarms will a hive send out in one season?"

"From three to five; and sometimes, at intervals, five or six in ten days. Even this new swarm may send out another; but this is not common, unless the first swarm be very early."

SARAH. "As Letitia has been allowed to ask a question, perhaps I may venture to ask if you can tell me how many bees there were in the thick bunch we have just seen hived?"

"That was a small swarm; yet I should think it contained about twelve thousand; I have seen one so numerous as to contain forty thousand. But the numbers vary very much, as well as their ages; for, I can assure you, it is not the young bees alone who follow the swarm; for old, as well as young, emigrate to the new colony."

CHAPTER IX.

THE visits of my young friends now became more frequent ; partly because they were so soon to cease altogether, and partly because they were becoming more and more interested with the subject, as they felt themselves better acquainted with it.

I was intently looking into my glass-hive, one morning, and in my eagerness exclaimed aloud, " Ah ! the rascal, he is caught !" when a gentle laugh behind me made me turn round.

" Ah, Letitia !" cried I, " you are just come in time to share my indignation, and see the robber punished for his crime."

" Robber !" said Letitia. " Are there such things as robbers among your friends, the bees ?"

" Can you wonder that the sweet treasure collected by this industrious race, and so carefully stored up by them, should become a source of envy and desire to the idle, who will not take the trouble to reap for themselves ?" said I. " See this great wasp, he now lies dead, after a most furious contest with several of the bees, whose cells he had invaded, in order to plunder. This race of

pirates, these wasps, are among the most persecuting enemies the bees have: sometimes, they attack them singly; but generally, they enter the hive in a body, and plunder it without mercy.

“I must confess, however, that] we have no right to be indignant at these robbers; for, after all, who can be greater enemies to bees than men, who entice them to labour, in order to destroy them, and take possession of their honey.

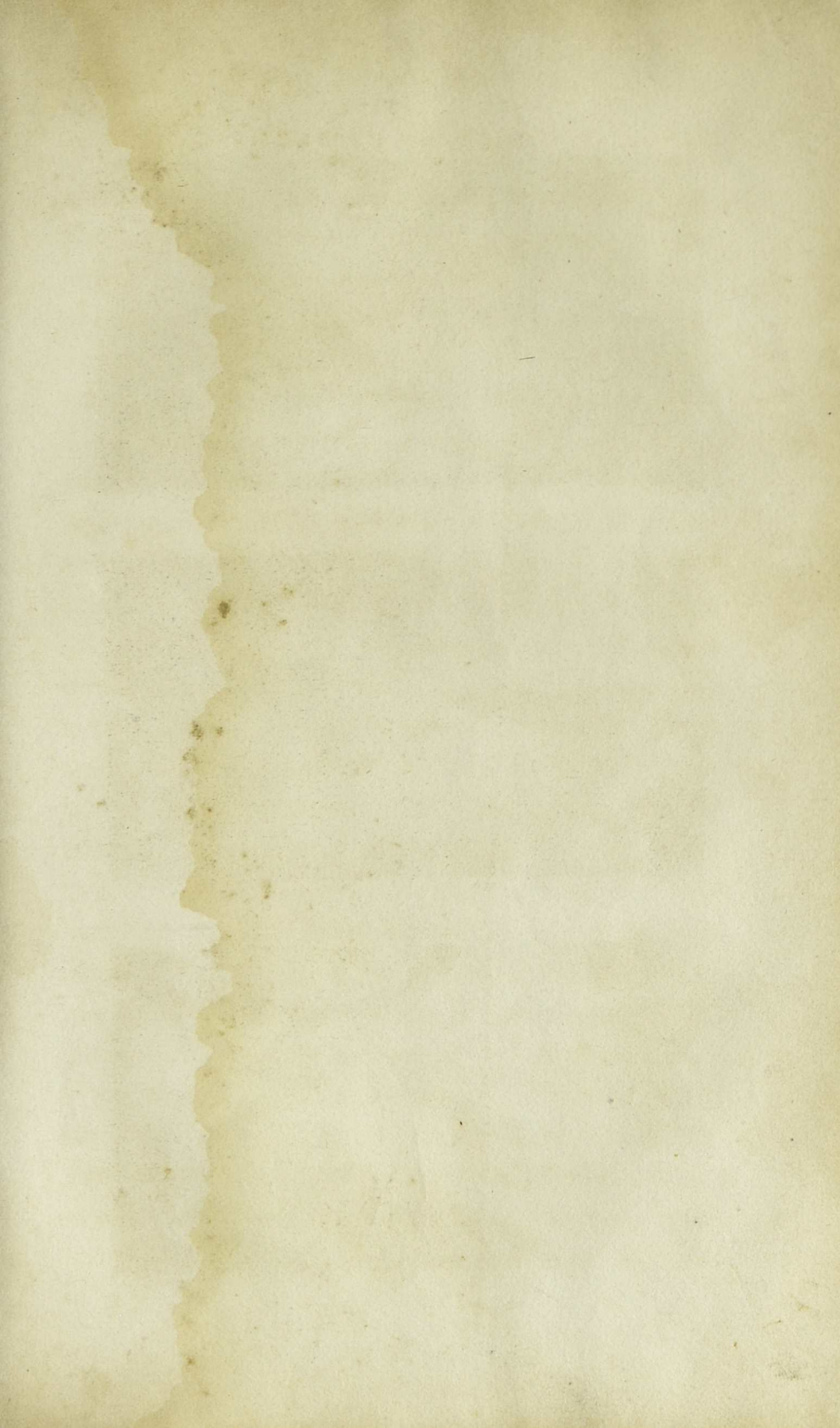
“Bees are assailed by numerous enemies, and are obliged to exercise constant vigilance, both in guarding and fortifying their hive. Wasps and hornets are more formidable than any. I have often seen them wind round and round a hive, watching an opportunity of attacking a bee, who, after hours of labour, is returning, loaded and tired, back to his hive. The bee finds little assistance from its sting, and in vain attempts to escape from her enemy, who kills her in a moment. I have seen a wasp pounce upon a bee, dart off with it, rip open its honey-bag, and devour its contents. Even while bees have been employed in sucking the honey out of the nectary of a flower, have I seen them carried instantly off by hornets or wasps. Just as the poor robin is snatched away by the hawk or kite! Sometimes, they join together in bands, or troops, and attack and enter a

hive: a bloody battle ensues, and lives are lost on both sides, but the wasps are generally victorious, and carry away with them a rich booty of honey."

LETITIA. "These are hateful enemies. I little thought that any thing could have increased my aversion for wasps; but this account of their idleness and gluttony makes them appear quite odious to me."

"You never expressed yourself so warmly against the bees, Letitia," said I, "much as you suffered from their stings. I must find a word, by and by, to say for the wasps. In the mean time, let us return to the enemies of the bees, for they have thousands besides wasps. Among animals, the bear and the badger are partial to the sweet taste of honey, and overturn the hives to plunder their contents; as for rats and mice, those universal robbers, there is no end to their thefts. They invade them at all times; but particularly in the winter, when, being in a torpid state, the bees are unable to defend or avenge themselves."

"Birds, too, appear in the train of robbers: the woodpecker can break through the hive and destroy all its inhabitants; while the swallow picks them up, and devours them like grains of corn."



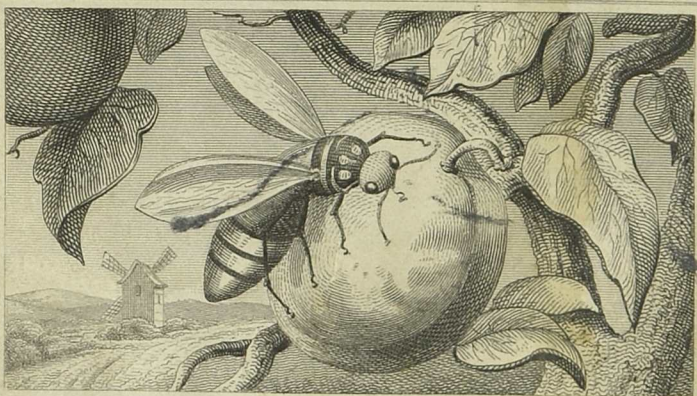
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Another bird, called the *bee-eater*, the sparrow, the cuckoo, and the titmouse, are all enemies to the bees. The titmouse makes a noise at the door of the hive, and when a bee comes out to see what is the matter, seizes, and eats it up. He will swallow a dozen at a time. Poultry of all kinds devour them singly.

“ Lizards and toads are said to watch for them, and swallow them. These are open warlike enemies. Spiders have also been reckoned among the number; but as their plan is to spread their tiny nets for the thoughtless and the idle, it is not often that they can boast of a victory over the industrious and sagacious bee.

“ I believe it is an equally mistaken notion, that ants are enemies to bees; for a small colony of these insects once planted themselves on the outside of the shutter of my glass hive. When completely settled there, I removed the shutter, and the bees and the ants continued within sight of each other without either attempting to interfere with the other.

“ Knowing the ants to be exceedingly fond of honey, I thought it might be modesty which prevented them from attacking the bees; but I found afterwards, that it was fear which kept them back; for, as soon as the bees had left that part

of the hive, the ants entered and ate the honey out of the cells.

“ Slugs and snails blindly creep into the hives, without knowing whither they are going ; but these are enemies which are soon got rid of.

“ Bees, too, are sometimes infested with vermin, clean as they keep both their persons and their habitations. There is a reddish kind of flea, which sticks to the bee's breast and neck, and, though it cannot pierce the scaly armour which covers the body of the bee, it creeps in between the joints, and sucks her blood. Young bees are never troubled with these little insects, which are no bigger than a very small pin's head. They do very little harm, but the hives into which they have obtruded, are not considered so valuable as others ; since it is a sign that they contain chiefly old bees.

“ Moths, of various kinds and sizes, are the most sly, as well as the most destructive enemies the bees have. The *wax-moth*, so called on account of the havoc it makes in the wax, though but a small caterpillar, delicate, and tender in its body, unarmed, and defenceless, can make its way, and feed upon the labours of many thousand warrior-bees, defended by scales, and armed with a murderous sting ! Ten or twelve of them will bore through a comb and break it to pieces ;

then, with the materials, build up a habitation for themselves, and thus oblige the bees to quit the place."

"How very curious!" exclaimed Letitia and Sarah at once. "Pray tell us more of this sly, but clever thief."

"I could tell you much," answered I, "of this curious insect tribe, called moths, and much that you would scarcely believe. I need hardly apprize you, that we apply the general term *moth*, to all those little worms who feed upon our clothes, our books, our furniture, &c.

"Some of these cut themselves out clothes, which they put on, walk with, and live under, as long as they continue in the caterpillar state. Others, more ingenious still, make themselves umbrellas, beneath which they crawl; while others have the art of building whole galleries, which serve both for houses and clothing. The whole life of a wax-moth is curious. An egg, so small as to be almost imperceptible, has been dropped by some stray moth into the corner of a honeycomb; in a few days it is hatched, and a small caterpillar arises from it, so minute that it escapes even the penetrating eyes of the inspector-bees. With the utmost swiftness, this little thing, born in the midst of enemies, spins itself a house, in the shape of a tube or gallery, large enough for it to

move up and down. This she glues to the waxen comb, which also provides her with very nice food. Peeping out of the gallery, she finds the same kind of food all around her; and, as she feeds and grows, her house becomes too small for her; she increases it, and thus eats her way through several combs, whose foundations being thus destroyed, soon give way. Finding, as she proceeds, that she is surrounded with enemies, she takes the precaution of building a stronger wall to her house, and mixes little bits of wax among her silken threads. The wax she contrives to stick upon the outside of her house, as well to prevent the bees from finding out her silken habitation, as to be a defence against their stings. The inside of her gallery continues a close texture of white silk, so soft as not to injure the tender body of the insect who moves to and fro within it."

LETITIA. "This is very curious; and I am amazed how it is that the bees, so strong, so active, and so clever as they are, have not found some means of extirpating these troublesome moths."

"I have not yet," said I, "told you all they have to suffer from them. There is one species—*Tinea mellonella*, who make frequent attacks upon the hive, and try to force themselves into it.

“ The bees, when they expect such an attack, place sentinels about the entrance of the hive. I have watched them by moonlight, pacing about with their antennæ stretched, and moving from right to left. I have seen the moths flutter about the entrance; and, apparently aware of the blindness of the bees, attempt to glide in between the sentinels, and to escape the touch of their antennæ.

“ The bees on guard in the night utter a low hum; but if their antennæ touch one of these moths, or any other enemy, the hum becomes louder; a commotion is raised, and the moth is quickly attacked by a body of workers from within.

“ The death’s-head hawk-moth is another enemy, from whose attacks they guard themselves in a very different manner.

“ In the autumn, when their storehouses are full, a band of these death’s-heads will contrive to get into the hive during the night, when the bees cannot see them. A great tumult takes place, a battle follows, and, the next morning, the ground about the hive is strewn with the dead bodies of bees, the hive has been robbed of all its honey, and the bees never return to it.

“ To prevent these disastrous incursions of

the death's-head moths, I generally have the door-way of my hives so narrow as only to admit a single bee at a time. But the bees themselves will sometimes fortify their hives. They build a thick wall, which resembles a regular fortification, with towers and huge gateways. This wall, constructed of wax and propolis, is erected behind the gateway, and pierced with little holes sufficient for one or two workers to pass through.

“ The fortifications are varied according to circumstances. Sometimes they consist of one wall, as I have described, with the holes resembling arcades at the top of the building ; sometimes, of a row of little towers, one behind another ; and sometimes, of a succession of walls, with gateways in different parts of them. But they only take this great trouble upon urgent necessity, and demolish them, when the danger is over, until the next season, when they perceive fresh signs of their enemies.

“ That they never construct these fortifications when the door-way has been already made so narrow, that they can have nothing to fear from these enemies, is a proof that our friends, the bees, are not wholly guided by blind instinct, entirely independent of all foresight and prudence.

“ But, however vigilant,” continued I, seeing my party still disposed to listen, “ bees are to keep off their real enemies, they are not ill-tempered if

unmolested. I have given you several proofs of this; but when their anger is once roused, they are indeed formidable creatures."

"I think I can testify that," said Letitia; "for the offending foot, which I unawares set upon their nest, still bears marks of their anger."

"Nor is their anger," said I, "confined to man: I have already told you the effect of it upon some of their own brethren, the males, who are massacred as soon as they are known to be no longer useful to the community. There are bees of a different kind, occasionally found in hives, whose heads and throats, having less down upon them, appear blacker than in other bees, and who therefore go by the name of *black bees*. These are always driven from the hive, and often killed; but the reason why, has been only conjectured, and is so unfavourable to my little favourites, that I am unwilling to explain it."

Miss R. observed, that it would scarcely be acting fairly as an historian, to mention the good, and keep back the unamiable traits.

"It has been supposed, then," continued I, "that these are the aged and infirm bees, who can no longer assist in gathering honey, or in feeding the young, and who are therefore useless within the hive.

"But what say you to a regular pitched battle

among the bees themselves? This sometimes takes place, and may, I hope, be equally traced to their notions of public good. In these battles, the bees are so eager, that it is difficult to part them: their whole aim seems to be to pierce each other with their sting, which, if once entered into the body of the bee, gives certain death. The conqueror is sometimes unable to extricate his sting, and then he also dies. For an hour, or even longer, this combat will last; and often, when the fighters are tired, they give up the contest in despair, and fly away.

“I have watched a combat of this kind with great interest; and I have seen, too, one swarm attacked by another that has chanced to take a fancy to the hive it occupies.

“If strange bees enter a hive, they are almost sure of being attacked, and a long and well-fought duel is often the consequence. In this case, the victor carries off the bee she has been fighting; and, bearing her between her legs, after flying, sometimes to a great distance, sometimes to a short one, deposits it on the ground. Beside the dead body, the bee rests itself, standing upon its four front legs, and rubbing its hinder ones together. Occasionally, the swarms of different hives seem to meet upon friendly terms. I once noticed a set of bees, visiting, as it were, another set; and each

bee seemed to be questioned as it entered the hive. But this friendly intercourse ceased after a few days, and a deadly battle ensued. These battles, in general, however, are fought in defence of their property. Ill-managed bees, who are not supplied with the necessary quantity of honey, actually turn robbers, or, as some call them, *corsair bees*. Early in the month of August, they begin their thefts; at first trying to enter a hive by stealth, and then growing bolder and attacking it in a body. If either of the queens be killed, the party to which she belonged joins the other, and assists in pilfering the stores of the hive. The most amusing sight, perhaps, is to see two or three robbers attack a solitary bee. One seizes it by one leg, a second by another leg: perhaps there are two on each side, who hold the legs or throat. The poor wretch thus assailed, puts out its tongue, which one of the robbers instantly goes and sucks, and when he leaves it, the rest follow his example. As their aim is merely to steal its honey, not to kill it, they then release the poor unfortunate creature.

“ But it is not the general character of bees to be unkind to each other; for I have often seen them assist one another in gathering honey from the flowers.”

I was well pleased to be interrupted by Letitia, who said, that, since she last saw me, she had met with a curious story of an idiot boy, who devoted himself to bees. He fed upon them, and they formed his chief amusement. In the winter, he dozed in an arm-chair, by the fire-side, in his father's house, while in summer he was actively employed in hunting bees. He was never afraid of them, but would seize them with his naked hands, and, pulling the sting out, would suck their bodies for the sake of the honey-bags. He would delight to fill his bosom with them, between his shirt and skin, and would stuff bottles full of them. He was an enemy to bees and to bee-owners; for he would steal into their gardens, sit down by the hives, rap them with his fingers, and catch the bees as they came out. In fact, he was so ravenous after this food, that he would overturn hives for the sake of eating the bees. Whenever the neighbours were making mead, he would linger about, begging a draught of bee-wine, as he called it. This lad would make a sound with his lips like the buzzing of a bee; he was pale and sallow; and, except in hunting bees, shewed no capacity whatever for any thing.

We all joined in thanking Letitia for this

story, and the party then left me, "fearing," they said, "that they should not have many more visits to pay."

CHAPTER X.

"I HAVE some few particulars," said I, the following Saturday, "relating to our friends, the bees, without which the history I have been giving you would be incomplete. For instance, we have seen a swarm leave a hive conducted by a young queen, and safely lodged in a new habitation; let us now go to the same hive and learn what took place in it after that event.

"The old queen, you may remember, led forth the swarm; and this fact, which has only recently been discovered, appears rather singular at first view of it."

LETITIA. "Yes, indeed; I should have thought it wisest if one of the young queens had led a colony out from the parent hive, and left the old queen still to reign over her own faithful subjects."

"However astonishing it may seem, I shall be able to give good reason for this regulation. In

order to prevent the plurality of queens, their jealousy of one another is unbounded, and therefore, at the time the young queens are just ready to escape from their cells, the agitation of the old one makes her quit it with a swarm, and this prevents the massacre of queens, which would otherwise take place.

“ When the remaining inhabitants of the hive find themselves without a queen, their attention is turned to the royal cells, in which, for some days, they had been guarding their young queens.

“ I told you before, that the queen only lays royal eggs every third day, so that they arrive at maturity one after the other, which is an admirable arrangement, for if they were all to burst out at once, all but one would soon be destroyed. The fact, that the workers who are on guard know which is the oldest, and let her out first, is a very singular one.

“ The eldest then is hatched, and the workers take but little notice of her, until she tries to approach the royal cells which contain the others; then the workers bite and pull her, and force her away. Wherever she turns, she finds royal cells, which she desires to attack, but is restrained by the workers, until she becomes so agitated that she paces about the combs, and, communicating

her disorder to some of the workers, they also become restless, make a rush to the entrance, and depart with the young queen at their head making a second colony.

“After the departure of this second swarm, the workers set free another queen, who acts in a manner very similar to the last. Thus, a populous hive will send out three or four swarms in succession. Between the two first there is generally an interval of nine or seven days, between the second and third a shorter time, and the fourth often leaves the hive the day after the third.

“You will allow that the bees have an excellent reason for confining their young queens; and I can add an additional one. It is quite necessary that they should swarm only on a very fine day; and if it turns out wet, contrary to their expectations, all the preparations they have been making are postponed until a better opportunity. Had the royal cells therefore all been opened, and the young queens liberated, there would have been too many in the hive, all but one must have been killed, and none left to lead the colonies.”

LETITIA. “You mentioned, just now, that the young queens were liberated from their imprisonment according to their ages: how is it possible

that their guards could discover which of the eggs were laid first ?”

“ Indeed, Letitia, many and many a conjecture has been wasted on this subject ; but I am disposed to think that it is by the humming sound emitted by the bees when they have entered the imago state, that the attentive workers are aware which it is their duty to set free. I have frequently heard this hum, and fancy I can even distinguish that it is stronger from some, probably from the older bees, than from others.

“ It is after the swarming season, at the beginning of autumn, that the massacre of the males, or drones, takes place, when the bees are preparing for the winter, and desirous of having as few mouths as possible to consume their winter store.

“ When the weather becomes too cold for them to fly abroad and procure food, they live upon what they have already collected. Bees are not torpid during the winter, as some have supposed. And therefore great attention is necessary to supply them with honey if their store is exhausted, for fear of their being either starved, or forced to turn robbers.

“ The temperature within a bee hive is much warmer than that of the open air ; and the bees move about and cluster together to preserve the

heat. Among the various duties of bees, both in summer and in winter, is the ventilation of their hives. How much they stand in need of this, you may imagine when you reflect upon their small confined habitations, the many thousands each contains, and the small opening, which is the only channel for the air to be admitted through.

“ Bees can expel the air from within the hive, and can attract the external air; and they do it in the following manner: they close their two wings together, so as to form them into something like a fan. These they move rapidly up and down, until they become almost invisible, and while so doing, they fix themselves firmly to the bottom of the hive by their feet and claws, stretching their first pair of legs forwards, and spreading out the second pair to the right and left; the third pair being placed close together under their stomach.

“ The workers are only employed in this office; sometimes twenty of them are engaged at once, some within, some without. Those within turn their back to the entrance, those without turn their head towards it. One bee can continue for half an hour at this occupation, scarcely taking a moment's rest; and its place is instantly supplied by another bee: when it leaves off, so that the

business of ventilation, in a well filled hive, is constantly going on. And by the incessant humming which accompanies it, you may always know what the bees are about."

MISS R. "After all I have heard you relate of the wonderful monarchy of bees, I cannot help deploring bitterly the cruel method of destroying all the inhabitants of the hive, whenever the honey is taken. Have not you, and other lovers of bees, contrived some means by which you might be robbers only, instead of murderers?"

"I deplore it as much as you do," answered I: "and that it remains a practice at present, must be attributed to the wilfulness of habit and prejudice. Would to heaven, that I could persuade others to adopt the more humane, as well as economical plan I have long used with mine; I could promise them, that, by sparing the lives of the bees, they would double their own gains the next year.

"To stifle the bees with the vapour of brimstone, which they set on fire and put into a hole in the ground, over which they place the hive, is the plan sometimes adopted; and there are various others, the effect of which is the same. The country people apologize for this unnecessary barbarity, by saying that the bees, being old, would be

unable to lead forth new swarms or to collect honey in the ensuing year, and that they would consume too much honey during the intermediate winter.

“ Thus I close my history of the hive bee, the most interesting, if not most useful, of all insects. There are various other kinds of bees, but few of which we have any particulars.

“ The *wild bee*, whose nest you trod upon, generally builds her cell in the hollows of decayed trees.

“ I could enumerate between fifty and sixty different kinds of bees, and some of them with peculiarities truly amusing. The *black bee*, which sleeps within the flower. The *red bee*, a native of Europe, which perforates trees, and, boring a hole through them all across, builds her cells and deposits her eggs within the hole. This bee is red, very hairy, and its wings are of a bluish tinge.

“ The *muscorum*, or yellow hairy bee, has a white belly, and builds her combs in mossy grounds, in order to form a nest of this soft material. These bees set to work in the following manner: they form themselves into a chain, from the nest to the place where the moss was laid. The foremost in the chain tears a bit of moss up with its teeth, and cleaning it piece by piece with her teeth (for which they are called *carding bees*)

passes the unravelled morsel, by means of her feet, beneath her body, on to the next bee, who passes it on in like manner to the third. A continued chain of moss is thus formed, which is interwoven with the nicest skill by those nearest the nest. When the whole fabric is completed, they shelter and protect it by means of an arch of wax, thin but tenacious, a substance not exactly like common bees' wax.

“Another and still more curious kind of bee, is the *leaf cutter*, or *black bee*, whose nest is made of leaves curiously plaited in the form of a mat, or quilt. There are several varieties of the leaf-cutter, all equally industrious and ingenious. Some dig into the ground, and form cells resembling so many thimbles one within another, others give them the shape of goose-quills. These are all composed of bits of leaves. Each kind keeps to its own kind of tree, some the rose-leaf tree, others the chestnut. A careful observer may discover rose trees, cut as it were with a pinking iron, and may procure himself the pleasure of seeing with what dexterity a bee, destitute of any instruments, can cut out a circular piece of a leaf, suited for the bottom or for the lid of his habitation. The sides of these are formed of oval pieces, of the same regular dimensions. Into these cells, an egg with

appropriate food, is deposited by its skilful architect."

LETITIA. "I have been hoping, among this list of bees, to hear some account of that beautiful one, which we call the *humble bee*, and which is so easily distinguished from other bees by its size and the musical tone of its hum."

"The humble bees," answered I, "are deserving of some attention, although, when compared with our little citizens the hive bees, they are mere rustics. They form a kind of link between bees and wasps, the hairiness of the body making them more like the former. Like them too, they live in societies, and collect honey and build cells of wax, and their architecture, though rude and irregular, is very ingenious.

"They build in hedge-rows and meadows, where the soil is entangled by roots of trees, and form the dome of their nest with moss, lined with a thin coating of wax to keep out the wet. The lower part of their nest is scooped out of the ground, and the entrance is in this part, through a gallery which conceals it from observation.

"When the moss roof is removed, a few horizontal combs are seen, placed one upon another, and fastened by small pillars of wax. The combs are oval and of a pale yellow colour; some of the cells,

containing the unhatched brood, closed, others open. Some round lumps of wax are found at the top of the nest, which contain young larvæ, with a supply of food, made of pollen moistened with honey. In the corners of the combs, are little waxen goblets filled with the same food, from which the larvæ have escaped.

“I have just described to you the method in which the carding bees remove the moss with which they build, and it is in exactly the same manner that the humble bees convey the moss for their domes; thus, like the hive bees, sparing no pains to save their time and labour.

“The society of humble bees consists of large females, small females, males, and workers. The large females look like giants beside the others, and their duty in the nest is in proportion to their size. The large female builds the cells and fills them with eggs, and while thus employed, the workers are watching their opportunity to seize and devour the eggs; hence she has the additional task of guarding and protecting them, for many hours after they are laid.

“The workers, nevertheless, feed the young; yet it is the female who, as they grow, increases the size of their cells; and afterwards assists

them in cutting open the coccoon, in which they are enclosed during the pupa state.

“ The small females likewise lay eggs; but in other respects they are more like workers, and assist in their various occupations. The queen-mother is very jealous of her tiny rivals, and always furious when they usurp her office of filling the cells with eggs.

“ Their affection for their young is not exceeded by hive bees; they spare no trouble nor attention to add to their comforts; the workers have been known to assemble together in a cold night, and cluster upon a comb full of larvæ, in order to keep it warm.

“ The workers perform the same offices as those in the societies of hive bees. In collecting honey, if they cannot procure it from the open part of the flower, they will make a hole at the bottom of the blossom, and push in their proboscis, to search for the nectar wherever it may be hid.

“ I have heard an amusing anecdote of a party of hive bees going to visit the nest of some humble bees, to beg, borrow, or steal some honey; and the anecdote is a proof of the good temper of the humble bees. It was in a time of scarcity, and the

hive bees not only took possession of what honey they could find, but entered and occupied the nest. Some few humble bees who remained, went out to collect fresh store, some of which they brought home. The hive bees licked them, presented them their proboscis, and, in fact, persuaded them to give up the contents of their honey-bags; the humble bees then flew off to gather more, and the hive bees parted from them very amicably, never attempting to hurt them with their stings. The population of a nest of humble bees is very small compared with that of the hive bee, two or three hundred being the usual number."

I was afraid my little party would begin to be wearied with my continued details; but as this was positively the last visit they could pay me previous to the holidays, Letitia begged hard for a few particulars relating to wasps; "since," she said, "I had once hinted that it was in my power to relate something that would give her a more favourable opinion of them."

"Why," Miss Letitia," answered I, "wasps are such notorious depredators, that in attempting to defend them, I shall have many well-grounded prejudices to overcome. However, I

will tell you fairly what I know of them ; and I must begin by saying that that is not much, for it is neither a pleasing nor an easy task to make observations about so irritable an insect.

“ If the hive bees may be called the skilful citizens, and the humble bees, the rude but honest villagers ; the wasps must be considered as thieves and robbers.

“ Wasps hive in societies, and have, like humble bees, two kinds of females, who both lay eggs. The large female wasp, or queen, leads a life of labour ; but in the autumn can boast of as numerous a family of subjects as even the queen bee herself.

“ The nest of the wasp contains sometimes, a population of thirty thousand ; and the duty of the workers to the young, begins at their very birth. Their activity in feeding them is quite amusing ; they fly from cell to cell to see what is wanting ; and it is to supply the craving of their little ones, that these wasps, who are not able to collect honey out of flowers for themselves, have recourse to the plunder of their neighbours. The fruit he is so fond of stealing, the sugar you grudge him so much when he disturbs you at breakfast ; the ripe peach or apricot he conceals

himself in, while he is scooping out the ripest morsels,—these all are conveyed by their affectionate care to their young; and, gluttons as you call them, are untasted by themselves as long as there is a hungry cry from the cells.

“The solid food, which they collect from butcher’s meat and other substances, is given to the larger grubs; and as they lay up no store, they have some difficulty in supplying the numerous inhabitants of the nest, when, in autumn, the number amounts to thirty or forty thousand.

“Owing to their improvidence, the wasps are distressed for food when cold weather comes; and on a frosty day, a wasps’ nest presents a scene of horror. The old wasps drag out the grubs from their cells and destroy them, preferring that cruel way of treating to the still more cruel one of suffering them to linger on and starve to death by degrees.

“This is a brief history of their short lives, about which I will leave my little moralist, Sarah, to ponder.”

Thus ended my lectures, for which I received the gratifying thanks of my young friends and their governess; who, to my great regret, took leave of me for some time; and to me the parting

was melancholy, for they had enlivened my solitude by their sympathy in my favourite studies.

“Farewell,” said Letitia, as she lingered by the garden-gate; “I will emulate the bees for their industry, and the bee-master for his patience; and I shall ever feel grateful for the sting, which brought me so much entertainment.”

THE HISTORY OF ANTS.

CHAPTER I.

Six weeks passed away ; and to me they were weeks of dreary solitude. The occasional visits of my young friends had cheered me, and given an additional interest to my pursuits. They were gone, and were enjoying themselves in their several homes, reaping the fruits of their studies in the approbation of their parents ; while I strolled solitarily about my garden, without any interruption, except from old John, with his long stories about the last swarm he had hived.

Wellington was absent on a short excursion to the continent ; and Miss R. and her sisters were all visiting their different friends, or exploring the beautiful scenery of the north.

I am half ashamed to confess that I felt weary of confining my attention to one species of insects, interesting as I had hitherto found them, and de-

serving of much more persevering observation than I had bestowed upon them.

My thoughts were directed towards ants, whose industry and ingenuity, though not so beneficial to mankind, are equally admirable with those of bees.

“I will study the history of the industrious ant,” said I to myself; “and by the time my young friends return to school, I may have gleaned information that may entice them now and then to renew their visits to my humble cottage.”

And who ever repented *the necessity* of gaining information, whether from want of money or want of occupation? Not, I am sure, the naturalist; his studies, apparently insignificant, are full of interest: they are without expense, they induce him to stroll into the fields, to climb the hills, where the fresh air he breathes gives him health and vigour: they lead him, above all, to admire the order and contrivances of nature, and to adore the Providence which governs even the minute tribes of the insect world.

It is my disposition to be ardent in whatever I undertake: and I set to work to store myself with facts both from nature and from books.

I had got all these tolerably well arranged in my head, when the time approached for the return of my young friends. Sauntering down towards

the village, one morning, I was agreeably surprised to see the gates of the white house thrown open, as if in readiness for approaching carriages. I entered, and perceived a chaise at the door, whose numerous trunks and packages were being conveyed into the inner room by Hannah, more than usually active, from the momentary expectation of fresh arrivals. I retreated through the gate by which I had entered, fearing I might be troublesome, and that I might encounter strangers, of whom I had ever an invincible dread.

I returned to Long Hampton, and, a few days afterwards, despatched a note to Miss R. stating, that if the friends of the hive were willing to study new "scenes of industry," I should be happy to introduce them to the "formicary," or habitations of the ants, an industrious society of citizens, almost equally worthy of curiosity and admiration with the bees.

The reply to this note was brought in person the following Saturday afternoon, when Letitia, Sarah, and two or three others, with Miss R. at their head, again entered my tiny domains at Long Hampton. Some time was spent in hearty greetings and mutual inquiries; their curiosity to hear of their friends, the bees, only being equalled by mine to learn all the events of the holidays.

“And you have deserted your bees, and *descended* to the study of ants!” said Letitia.

“I have,” replied I; “and I wish you to ‘descend’ with me; for, I promise you, these little insects will rise rapidly in your estimation. Nor am I discouraged by the contempt you now express for them, remembering, as I do, the antipathy you felt for bees, when first I began to give you a history of them.”

“I will promise you one thing, before you begin,” said Letitia, “that I shall be delighted to hear what you have to say. And I have no doubt that I shall be much entertained in the new study; but I never shall, or can, take the same interest in, and feel the same affection for ants, which I have done for bees.”

“I shall not attempt to contradict you, Letitia,” said I; “and I have to thank you for your promise of attention, which is particularly necessary while I go through the *dry* part of my history.

“Ants, like bees, are of the hymenopterous tribe of insects; and, like bees too, their societies consist of three different kinds of individuals, workers, males, and females.

“The workers and females are armed with a sting; their antennæ have twelve articulations, or

joints. The males have thirteen of these articulations in their antennæ. Ants differ from bees in this respect, the males and females only having wings, the workers none.

“ I must again refer you to my little drawings, where you will perceive the figure of an ant. Its head is triangular, pointed at the end ; its two teeth, called mandibles, are placed at the termination, and the mouth is beneath. Its large eyes are placed on each side, with three small ones above, which form a triangle. The antennæ are situated in the fore part of the head, the palpi, or feelers, under the lower jaws.

“ The mandibles of the workers and females are horny, curved, and moveable, and adapted to serve many useful purposes ; those of the male are soft, and covered with fine hair.

“ It has been supposed that ants have no tongue ; but I have observed, that when they drink they project from their lower jaws a tiny yellow tube, which alternately advances and retires ; and I have no doubt that this performs the office of a tongue for them.

“ The head of the ant is joined to its body by a thin short neck ; and the corselet, or body, consists of several horny pieces, in the middle of which are placed four wings. These are large

and transparent. They have six legs, and at the extremity of each, a spine, or spur. The foot, or tarsus, is covered with a fringe-work of strong hair cut regularly, and with this brush the insect cleans its antennæ, head, and body.

“The workers are much smaller than the females, from whom they differ in having no sting, nor any wings; as well as in the shape and colour of their bodies.

“After this general description of ants, I shall carry you to their habitations, of which there is an infinitely greater variety than among the bees. The ant-hills, those mounds of earth, which you would hardly believe to be raised by such little work-people, is one species of architecture among them. Sometimes they form their houses of leaves and stalks; and sometimes they build them in the trunks of the most solid trees.

“And now you must accompany me to the ant-hills, which are so plentiful in my favourite wood on the top of yonder hill; that wood from which I first saw my little friends, when the unlucky accident of the bees’ nest took place.”

“Unlucky!” exclaimed Letitia; “I have long since learned to consider it as one of the most fortunate circumstances of my life—of my school

life, at least," added she, as she perceived an incredulous smile on my countenance.

We continued chatting till we reached the stunted firs which formed the wood; and at the foot of these trees, the ant-hills spread in every direction.

"The kind of ant which forms these mounds is called the *fallow ants*, from its colour, which is of a pale red. There are two varieties of the fallow ant, one of which has a black mark in its back, and the other has a back of the same colour as its corselet or body.

"The only difference between the two is, that those with the black backs build in meadows and hedge-rows, instead of woods: they all collect the same materials for building: leaves, bits of wood and straw, stones, &c.; every thing, in fact, that can add to the height of the building—small shells, barley, oats, and corn: the three latter of which used to be considered as stored up for winter use, but it is now discovered that they are collected merely for the purposes of architecture."

LETITIA. "But what can be the use of this *magnificent* structure, if they do not want the room to lay up winter stores; surely a smaller house would be more suitable for these little crea-

tures. I am afraid we shall have to convict them of pride."

"The pride of ingenuity they might feel, Letitia, as you will presently acknowledge. We are all apt to judge superficially of the actions of others; and surely you are not competent to speak, till you have seen something more than the outside of the dwelling-place of ants.

"The mound, which appears an useless mass of rubbish heaped together, is an invention, equally simple and clever, for the purposes of carrying off the water from the ant-hill, and protecting its inmates from the attacks of enemies, and the injuries of the weather.

"The base of this dome is built of pebbles, forming a cone, above which, the wooden part of the building is in the shape of a sugar-loaf; and the whole is finished up with soil.

"This is merely the outside covering of the ant-hill; crooked, funnel-shaped avenues branch underneath, leading from the roof to the interior, which is by far the greater portion of the establishment. The entrance is sometimes formed by a large opening at top, sometimes by a number of small ones, surrounded by narrow passages which extend to the very bottom of the dome. These numerous passages are necessary for the

ants, who always prefer working in the open air, and are, therefore, constantly passing in and out. Such numbers are collected together on the outside of the mound, that they do not fear the approach of enemies, although their habitation is thus exposed."

LETITIA. "But when night comes, do not they retire within; and is not their house then exposed not only to enemies, but to rain and cold air?"

"The question is a very natural one, and it is a subject that has engaged much of my attention; for, if this were the case, the prudence and instinct of ants would seem in this instance to fail them.

"Many and many an hour's watching, and many a walk, both night and morning, has this engaged me in; and at length I made a grand discovery. I observed that these apertures changed their appearance every hour, and that as night approached, these spacious passages, which admitted so many ants during the day, gradually became less, and at length quite disappeared; the ants retired within to rest, and the dome was closed on all sides."

"I own," cried Letitia, "you have excited my admiration as well as curiosity! Were you able to perceive how they accomplished this?"

“ Indeed, I never rested till I made it out. At first I could distinguish nothing, from the confusion of the scene, with so many thousands of ants moving upon the mound; but after patient observation, and that you know, Letitia, overcomes every difficulty, I found out what they were about.

“ I perceived them bring little bits of wood to the entrances of the various avenues; these they placed above the apertures, and often sunk them into the stubble; then they went to fetch something else, which they placed upon the first row, each succeeding piece being smaller and smaller. With dried leaves and other larger kind of materials they then covered the roof, and gradually retired within; one or two remaining after the last passages were closed, who either remained without, or were concealed behind the doors, while the rest pursued their occupations or indulged in repose.”

SARAH. “ Quite masons in miniature, I declare! Were you ever in time to observe the opening of the city gates in a morning?”

“ I have seen it over and over again, till my curiosity had thoroughly satisfied itself. I visited these ant-hills quite early in the morning, and saw at first, only one or two solitary guards; by degrees, a few others crept from beneath the

edges of the little roofs, slanting over the entrances of the openings. Other ants then came forth, the wooden bars were by degrees removed, though by the labour of some hours. At length, the passages were all open, and the materials with which they had been closed, were scattered about the mound.

“Nor does their sagacity cease here, for if the morning proves rainy, the ants never open their avenues. When the sky is cloudy, they are opened in part, and instantly shut when the rain begins. Thus, they are not only gifted with instinct to act, but it would seem also as if they were conscious *why* they were thus acting.

“I wish you had been my companions when I witnessed the whole process of the construction of an ant-hill, from the time that it was merely a hole in the earth.

“Some few set to work to search for materials suitable for the construction of the exterior, and began the work by filling up the entrance. Others were employed in mixing the soil which had been thrown out of the hollow, with the leaves and bits of wood collected by their brother labourers. With this they formed a solid foundation for their dome, which increased every day.

“ Here and there they left cavities for the galleries they intended to construct leading to the outside. These passages were entire throughout the whole process. The building gradually assumed the form of a dome, but it was far from solid. This roof, in fact, contains many apartments.

“ By digging or mining within it, they form their spacious halls, which, though low and clumsy, are well suited for receiving the larvæ and pupæ.

“ There are galleries which lead from one hall to another, and they are made in the same manner. To enable them to form a neater building than they could do with soil and their other materials alone, they mix them up with rain water, which, hardening in the sun, binds and forms a compact wall, parts of which may be taken away and replaced, without injuring the rest. It serves too, as a preservative against damp; for I have never found that even the hardest rain penetrated above a quarter of an inch into the nest, unless it were out of repair or had been deserted by its inhabitants.

“ The largest chamber is in the centre of the nest; it is higher than the rest, and crossed only by the beams which form its ceiling. All the

galleries terminate in this chamber, which is their usual place of abode.

“ Of this part of the building I can speak with certainty ; for I placed a pane of glass to one of their apertures, which enabled me to take a very good view of the interior.

“ The part under ground is not so easy to be viewed ; indeed it can only be observed when placed by the side of a hill. By then raising the straw roof, the whole can be seen. As this part of the architecture of the fallow ants is similar to that of the mason ants, I shall give you an account of them both together.

“ The *mason ants* are those whose habitations look like hillocks of earth, without the mixture of any other materials, and whose interior consists of labyrinths, lodges, vaults, and galleries innumerable, all constructed with great ingenuity.

“ The brown, the yellow, and the microscopic ants, are all species of the mason ants. The brown ant is one of the smallest, and is distinguished by the beautiful finish of its work. Its body is of a shining red-brown, the head a little deeper, and its antennæ and feet rather lighter. Of all the tribes of ants, this is the most industrious. It forms its nests in stories, the partitions of which are very thin, and the substance of

which they are composed, so finely grained, that it presents a smooth unpolished surface.

These stories are all sloped to correspond with the dome of the nest, and are placed one upon another to the ground-floor, which leads into the subterranean passages. There is no great regularity observed in these buildings, the plan of which they vary and alter as much as they please. In each story there are halls, lodges of narrower dimensions, and galleries of general communication. The largest halls have arched ceilings, supported by little pillars, or thin walls. There are chambers, too, which have only one entrance leading into the lower story; and there are likewise open spaces, forming a cross-road in which all the other roads terminate.

I have ever found, on opening one of these curious nests, that the lower apartments and open spaces were filled with the older ants, while the larvæ and pupæ were kept in the apartments nearer the surface. This, however, depends upon the weather, the young ones requiring a certain degree of warmth.

“ Would you believe, that an ant-hill, such as I have been describing to you, consists of upwards of twenty stories above, and twenty below the surface of the ground?

“The heat of the different apartments varies; and when the sun is very powerful upon the upper rooms, the young are removed into those at the bottom. The rainy season, on the contrary, renders the lower apartments damp and cold, and then the upper ones are inhabited by both old ants and their young.”

LETITIA. “How astonishing, that with their little delicate teeth, these ants can work up the soil so as to make walls and build houses so many stories high!”

“True, Letitia; and to me it was for a long time a puzzle how they moistened the soil, in order to render it sufficiently soft and flexible for their purpose, and yet that it should be so solid. Is it, thought I, a fluid furnished by the ants themselves, similar to that which the mason bees employ? I took particular notice of an ant-hill, of a round form, in the grass close to the pathway. It was perfect, not having sustained any injury. I saw no ants, or very few, come out all through the day: they were terrified by the heat of the sun’s rays, which they cannot stand. Towards evening, when the air was cool, and there was dew upon the grass, they began to make new apertures, put out their antennæ, and at length ventured out upon the grass.

“ I remembered the opinion of some of the ancient naturalists, that ants build their houses in the moonlight, when the moon is at its full. This notion is, doubtless, fanciful ; but I certainly perceived, that, contrary to the practice of the fallow ants, who are out in the day time, and shut up during night, the brown ants always worked after sunset.

“ Another difference between them and the fallow ants was, that they worked during a shower of rain : this I frequently observed, for often and often have I seen them, as soon as it began to rain, leave their subterraneous dwelling, and return to it almost immediately, carrying between their teeth little pellets of earth, which they put down upon the roof of their nest. I was doubtful what this could be for, till I saw that little walls were starting up on every side, with spaces between them. Pillars ranged between them, shewed me that they were laying a foundation for a story, with halls, lodges, and passages. Each ant collected a little pellet of earth, which it scraped up with its mandibles from the bottom of its house. This little heap could easily be moulded into the form they wished ; and when they had placed it upon the spot on which it was to remain, they worked it up with their teeth to make it even. Then they

passed their antennæ over it, to give it a finish and put each particle in its proper place. By the help of the fore feet, with which they pressed it lightly, the whole was then made compact.

“ With the greatest speed they proceeded in this work, and went over it again, adding to it where materials were wanting, and laying foundations for pillars and galleries. When the whole was of a certain height, they covered it in by an arched ceiling.

“ They then left this part of their work, and, fixing to the inside and upper part of the wall, fragments of moistened earth horizontally, they formed a ledge, which would exactly meet another proceeding from the opposite wall.

“ In some parts of the nest, the scaffolding for a lodge might be seen ; in others, a finished hall, with its roof supported by pillars.

“ I cannot say when I have been more interested than in seeing this busy troop of masons, arriving with their pellets one after another in admirable order, and preserving perfect harmony united with the greatest eagerness to use the rainy hour in adding to the height of their building.

“ The firmness of these buildings surprised me exceedingly ; for, I own, I was constantly expecting

that the rain, which incessantly fell upon them, would force them to give way. But I was mistaken : there was great stability in all their works, which the rain seemed to increase rather than diminish.

“ A shower of rain seems in fact necessary to complete the work, and to varnish over those places where the galleries remain uncovered. All the inequalities of the architecture then vanish, the roofs of the stories, formed of a variety of pieces, look like one smooth surface. The heat of the sun, coming afterwards, hardens and finishes the building.

“ Each story was completed in the course of seven or eight hours ; and as soon as one was finished the indefatigable ants began another. When the rain ceased, they were forced to stop ; a sharp north wind so dried up their walls, that many of them fell to powder ; and the ants, in despair, abandoned their employment, and actually pulled to pieces and destroyed all the apartments that remained uncovered, and scattered the materials.

“ Since rain is so essential to these industrious little masons, it is natural they should choose Spring as the best season for building, in consequence of the gentle showers which are then frequent. It is for the works they raise above ground

that they need the materials they collect; and their art consists in the double operation of building and mining at the same time, the soil they throw up from the one being used in the other part of their labours.

“ Before I conclude my account of the labours of the brown ants, I must tell you that they frequently construct galleries, which lead from their nests to the feet of trees at some distance, in order to reach their food with greater security.

“ Among the number of mason ants may be reckoned the dark ash-coloured, with red antennæ and feet.

“ The architecture of the ash-coloured ant is of a more simple and heavy kind than that of the brown ant. Its hillock is formed of thick walls made of coarse earth; the stories are clearly marked out; and the rooms are large, with vaulted roofs. Instead of galleries, they have wide passages, of an oval form, surrounded by embankments of earth. The pillars of their rooms are large, in proportion to the arched ceilings they have to support.

“ They have none of the nicety or finish about their works, which the brown ants have. The very simplicity in their buildings has enabled me to make closer observations of them than I have been able to do of the brown and fallow ants.

“ I have felt a strong curiosity to find out

whether ants act in concert one with another; or if each ant determined for itself what it should set about; and I am inclined to believe the latter.

“The quickness with which they seize any favourable opportunity for beginning their work is astonishing. An ant discovers upon the nest two straws placed cross-wise, and it strikes him it would be a good beginning of a lodge. He examines it all round, places parcels of earth up the sides of the stalks to fill up the spaces, and so intent is this little creature upon his plan, that he does not hesitate to destroy the labours of other ants in his eagerness to collect materials. He goes, returns, and continues his building, until he has done sufficient to make his plan apparent to his companions, who then go on with the work.

“I have likewise seen several pieces of straw so thrown together, as if on purpose to form the roof of a story: I have seen an ant approach it, and, struck with its suitableness, set to work upon it, and, plastering the sides of the straw with earth, form the beams for the ceiling; then, placing several rows of the same materials one beside the other, the roof became distinctly marked out, and other workmen joined the original founder in completing his work.

“When they wish to enlarge the boundaries of their hill, they search the neighbourhood, and,

generally, are able to find blades of grass or stalks of corn growing upright, which seem exactly suited for pillars ; and these industrious little creatures set instantly to work to plaster up the sides with earth, which they do in the neatest manner, making them solid by repeatedly adding a fresh layer. They then leave them to be hardened by the wind, and afterwards by throwing arches from pillar to pillar, form an extensive range. When they want smaller rooms, they have only to add fresh clay between the pillars all the way up to the roof, and by leaving small openings every now and then they gain their object."

I now paused, somewhat surprised to find that the minute details I had been entering upon, of the mode of building of the fallow and mason ants, had taken up so much time that the shades of evening were absolutely stealing upon us. My attentive auditors had seated themselves on some dry turf around the fir trees, and appeared, like myself, to have forgotten all but the interest of the subject.

When I stopped, however, they started up, and Miss R. laughingly declared, that, since I had thus detained them, I could do nothing less than see them safe home.

What is more agreeable than to be told to do what one wishes to do? In high good-humour, therefore, I sauntered down the hill, in conversation sedate but pleasing; while Letitia and her juvenile companions, weary of their long silence, were frolicking about, laughing and talking in their merriest mood.

CHAPTER II.

HAVING agreed, before we parted, to meet on the following afternoon at the wood on the hill, I resumed my lecture at the time and place appointed.

“ I have given you an ample account of the architecture of the fallow ants, and of some species of the mason ants: I now proceed to describe that of the *timber ants*, or those who inhabit trees. There are several different kinds even of this ant, I shall begin with the fuliginous, so called from its shining black colour. Their republics are composed of a numerous race, but they are less frequently met with than the ants I have before mentioned.

“To form an idea of their cities, bored or hollowed out in the trunk of a tree, is no very easy matter. They consist of numberless horizontal stories, whose ceilings, as thin as a card, are supported, sometimes by upright partitions, so as to form a number of cells, sometimes by a set of slender pillars, between which you can see to the very end of the story. The whole is composed of blackish smoky-looking wood. You must behold the numerous lodges, halls, and passages, to form an idea of these little beings, and to judge of the effects of persevering labour.”

LETITIA. “The wood they build with is blackish, you say. How is that? Have they the art of painting in addition to their skill in carpenter’s work?”

“I am obliged, Letitia, to confess my ignorance on that point, in common with other naturalists. Whatever tree the ant bores in, the oak, the willow, &c. the wood always becomes of this blackish colour, with which the cells are stained, not only on the outside but all through, if the walls be thin. There are other species of ants who build in trees; but only the fuliginous produce this effect. I have even noticed at the foot of trees inhabited by them, a quantity of blackish liquor. The vegetation of the tree does not appear to be injured by

the ants boring in it. The fact is, we cannot have our curiosity gratified by observing the labours of these ants as they go on, otherwise we should soon discover the origin of this black tint; but how is it possible to see these little things, who anxiously screen themselves from notice in the interior of a tree? I have tried many times, and endeavoured to coax them to construct their habitation where I could inspect them; but, notwithstanding my sugar and honey, they abandoned the nest I had given them, to seek for another more retired.

“I was obliged therefore to take a piece of their nest to pieces, and to rest satisfied with admiring the delicacy and lightness of their thin partitions, and their double rows of horizontal galleries, which correspond to the circular form of the layers of wood.

“The stories which spread downwards into the thick roots, are not constructed with the same regularity as those in the trunk, probably owing to the wood being more fibrous and knotty; but they still continue to be horizontal, and intersected with numerous partitions; and in proportion as the wood is harder, their work is more delicate, and often arrives at an extreme degree of lightness. I have seen pieces, from eight to ten inches

in breadth and height, formed of wood as thin as paper, containing a number of rooms. The appearance is truly singular; the entrance to these apartments, hewn out with so much labour, are very wide; and, instead of chambers and extensive galleries, the layers of wood are bored in arcades, through which the ants can have a ready passage to every part of the nest.

“ The red ant, another species of timber ant, and rather larger than the last, builds, like them, in trees, but on a smaller scale. They, too, form stories, which are divided into small chambers, or lodges, with very thin divisions. The wood is not blackened, and is not harder than a cork.

“ The most curious circumstance relating to red ants is, that they are skilful masons as well as carvers, and often make their nests in the earth.

“ They are not, however, the only ants which display a double talent; and I must leave them, to introduce you to the Ethiopian and the yellow ant, who have a talent peculiar to themselves.

“ The *Ethiopian ant* is so called, from its jet black colour; it makes its long galleries and lodges in the trunks of the oldest trees, and the singularity attending the industry of these ants is, that they use the wood which has fallen to powder at the

bottom of the tree, to stop up every hole in the floor of their houses, and to close useless passages.

“ The *yellow ant* displays still greater industry in constructing whole stories with decayed wood, choosing the smallest particles, and mixing them up at the bottom of the tree with a little earth and spiders' web, until they form a substance as consistent as the *papier maché* of which teaboard are made.

“ These are the most striking facts relating to the architectural skill of ants; there are, indeed, many others almost equally singular, but I am fearful of hearing complaints of fatigue from my young friends. There are *field ants*, who build little chambers one above the other, along the stems of plants, and who, if they require it, can connect together grains of sand with merely the assistance of a little moistened earth. There is the *sanguine ant*, who, with dry leaves, earth, and some other materials, forms a wall, difficult to break, and through which no water can enter.

“ In New South Wales, there are ants who build their nests entirely of the leaves of trees. Several of these, which are each as large as a hand, are glued together; and to keep them in a proper position, thousands of ants unite their strength;

for if driven away before they have accomplished their design, the leaves spring back violently.

“ There is an ant, met with in Cayenne, which builds its nest of down collected from the seeds of a species of cotton-tree: and in Tobago, there is a sort, called the *parasol ant*, who cut round pieces out of the leaves of trees and plants, and convey them to their nest: while thus occupied, they bear some resemblance to persons carrying umbrellas, or parasols, from which they take their name.

“ As I have been anxious to collect as many facts as possible, relating to these extraordinary little insects, I must not omit what I have met with concerning the *termites*, called by travellers, *white ants*. They are abundant in Africa, and may justly be termed a species of mason-ants. Their habitations, indeed, are extraordinary, compared to the size of the insect which builds them. Some are more than twelve feet in height, and so firm as to bear the pressure of several men upon them.

“ They station sentinels to watch the wild cattle, which are quietly grazing below, in order to bring them the first notice of danger. They begin their city, by building little turrets of clay at short distances from each other, of the shape of sugar-

loaves. On the top of these, they build others: those in the middle being the highest. The spaces between are then covered, and the inner turrets taken down, leaving what forms the cupola, or dome. The clay thus saved, they make use of in building chambers: the nurseries are of wood, enclosed in these chambers of clay, and ranged as close as possible around the royal cell. This apartment is, like the others, arched over, and situated in the centre of the building. At first, it is made small, but is increased as the queen increases in size. The queen, before she begins to lay her eggs, is equal in size to twenty thousand labourers; and she lays as many as eighty thousand eggs in the course of four-and-twenty hours.

“Of course, the number of cells must be immense. The subterraneous passages wind about in a spiral direction, for the ascent would be otherwise too steep: to shorten, indeed, the distance to the upper nurseries, into which they have to carry the eggs, they throw up an arch with steps, which shortens the passage.

“When they go upon their pilfering expeditions, which are highly dreaded in the neighbourhood, they construct covered galleries of clay, which run to a considerable distance, and under which they can go and return in safety.

“ Having thus given you an insight into the habitations of the ant, I vote that we should stroll down the hill to my cottage, for I shall have again to call in the assistance of my little sketches. As we go along, I must remind you of the metamorphosis all insects undergo, which I hope some of my party have not forgotten.”

“ None of us, I hope,” said Letitia; “ the egg, the larva, the pupa, and the imago, are the four different states of an insect.”

“ Right, my young friend,” answered I. “ We must begin with the egg; but I must first of all acquaint you, that these insects, which we have seen exposing themselves to damp, and cold, and every danger, shew the greatest anxiety and tenderness for their little ones, who are so delicately formed, that the least breath of cold air would endanger their lives. For this reason, they are carefully concealed from observation, nor is light even allowed to penetrate their abode.

“ You will scarcely believe the difficulty I have had in watching the conduct of the ants in the interior of their nests, and their ingenuity in baffling all my attempts to introduce light into them. Whenever I placed a pane of glass against their cells, so as to enable me to see into them, they either abandoned their works, or prevented me.

from benefitting by mine. One time, they would heap up materials, so as to darken all their walls; another time they seemed to discover that my glass pane would make an excellent wall, but as its transparency was an inconvenience to them, they plastered it over with moistened earth, so that it was no longer transparent.

“ I tried another plan ; I took away a portion of an ant-hill, and placed against the remainder a thin board inclining to the south. The warmth attracted the ants, who brought their little ones to it. By removing this board, I was able to observe the growth of the young ones ; though as soon as they were disturbed the workers hastened to convey them underground out of sight.

“ As soon as the ants found out this plan of mine, they built a real wall of earth behind the wooden board, and I was obliged to vary my schemes. After great perseverance, accompanied with great caution, I accustomed them by degrees to suffer a little light to enter their abode ; and made a kind of frame, fixed to a table, two sides of which were glazed and covered with shutters.

“ Into this frame I turned a nest of fallow ants ; who, liking the situation, soon began to build, and by removing occasionally the shutters, I could

watch their progress, and observe the care they took of their young."

By this time we had reached my cottage-garden, where an agreeable surprise awaited my little friends. We entered the well-known arbour, now no longer pink with hawthorn-blossom, but brown and musty, half leafless in fact. The inside, however, had been decorated, by John's active exertions, with such flowers as the season afforded; dahlias and chrysanthemums, in the midst of which, instead of a hive, stood a table, supporting the frame I had just described.

I removed the shutter: "See," I cried, "what is passing within; here the pupæ are heaped up in their lodges by hundreds; there the larvæ are collected and guarded by the workers. You may see here a bundle of eggs, and you may perceive, too, a party of workers, in attendance upon an ant of larger size, whom they follow every where. This is the queen-mother, or one of them rather; for ants, unlike the bees, have several in each colony.

"See how she walks, laying her eggs as she goes on. Her attendants take up the eggs, or seize them the very moment they are laid; they collect them together, and carry them in little heaps in their mouths."

LETITIA. "How very very small they are; surely they must have some contrivance to fasten them together, to enable the ants to carry them in their mandibles."

"Probably they have some contrivance, some glutinous liquid, by which they hold them; you observe, they turn them with their tongues, and pass them one after the other between their teeth, and thus keep them moistened.

"These eggs are too minute for us to distinguish at present; but, when closely examined, are found to be of different sizes, forms, and colours; the smallest are white and opake, the largest transparent, and those of the middle size semi-transparent. In some, which are very clear, a ring is perceptible, and it is at this part that the egg opens, and from which the larva makes its appearance. I suppose, that the moisture afforded to the eggs by the workers, as they pass them across their mouths, is necessary for their existence; for I have never been able to preserve any eggs that I have removed, they always dried up before they were hatched.

"In fifteen days, the larva, or little worm, quits its shell; its body is transparent, and consists merely of a head and rings; no appearance of feet and antennæ are visible. These larvæ are de-

pendent upon the workers, who take the greatest care of them, as I have before told you. A body of ants guard them, who, raised upon their feet, stand prepared to sting any approaching enemy; another set of workers clear the passages, and remove any materials that might be out of place. Other workers are seen taking their repose, to all appearance fast asleep; but a busy scene presents itself, when the sun's warmth makes them think it desirable to transport their little ones to enjoy it. The ants from the outside rapidly descend within, striking with their antennæ all the ants they meet on the way; run after each other, jostle their companions, who at the same time ascend into the frame, and then return to add to the general confusion, until the passages become all filled up with a swarm of workers.

“The object of all the ants, as soon as they became aware of the sun's appearance, seemed to be to carry up the larvæ and pupæ to the top of the ant-hill, and to leave them there to feel the influence of the heat. Their labours were unceasing; the female larvæ, which were heavier than the others, were carried with much difficulty through the narrow passages leading from the bottom to the top of the hill. After they had been there for about a quarter of an hour, the

workers again removed them for fear the heat should be too powerful, and placed them in chambers, under a ceiling of straw, which only in part intercepted the heat.

“Then did these little beings, after having performed their duty to their young, think of themselves, and stretching themselves in heaps in the sun seemed to enjoy repose. This, however, did not last long; and, as the sun declined, they by degrees carried back the larvæ.

“When the time for feeding the larvæ was arrived, each ant came to a larva and offered it food.”

“MISS R. “There is nothing, I think, more wonderful in nature than the metamorphosis of insects; that this little shapeless, helpless worm, should afterwards become a nimble, industrious, and enterprising ant!”

“They would, indeed, be incredible, if we were not daily witnesses of them,” said I. “Who would believe that the beautiful butterfly, proudly unfolding its radiant wings to the sun, was ever a creeping caterpillar? That beautiful silver-winged fly we see before us was originally a water insect; and that little creature, which lives but a few hours as a winged insect, belonged at first to the same element. The gnat, so great an

enemy to us all, was once an inhabitant of a stagnant pool; and the beetle, that flits along at even, was shut up as a worm amidst rocks and stones for a long time. Thousands of instances could I enumerate—but I forget my subject.—Let us return to our ants.

“The little worms, or larvæ, have instinct enough to ask for their food, and receive it as young birds do from their parents. They raise their body, and search for the mouth of the appointed workers, who then opens its mandibles, and allows the young to suck the fluid out of its mouth.

“This food is probably of a sweet nature, and is given to the different larvæ in quantities proportioned to their age and sex.

“The next care, after feeding the larvæ, is to keep them clean, which the workers do by passing their tongue and mandibles constantly over their bodies, which they keep perfectly white. I could never be weary of witnessing the affectionate care, and constant attention shewn by the ants to their young, in which I am certain that they are exceeded by no creature whatever.

“Most of the larvæ spin a cocoon similar to the bees; but it is a singular fact, that there are some larvæ which never spin.

“ In some species of ants, the larvæ are heaped up in the lowermost room of the nest, and pass the winter there; this is the case with the yellow and the field ants, but never with the fallow, the ash-coloured, or the mining ants. Those which pass the winter in this state are covered with hair, but none of the others are so.

“ In the beginning of summer, the insect is transformed into its third, or pupa state, and is a perfect ant, except that it wants firmness and strength. After a few moments, it becomes motionless; then it gradually changes its colour from white to pale yellow, then to red, or brown, or black, according to its species. Even in this state, they are dependent upon the workers; for they cannot extricate themselves from the web they have spun in their larvæ state; and the labourers, though not at all related to them, shew a zeal and attachment in performing this office for them, which we should admire if they were their real parents. I have seen two or three males and females in their cocoons in one of the largest cavities of my frame. I observed a number of labourers assembled around them in constant motion: three or four mounted upon a cocoon, to open it with their teeth, at the part near the head; these tore away some of the silken threads, in order to thin

it, and by dint of biting and pinching, they made a number of holes in it: they afterwards tried to increase these holes by tearing away more silk; but, not succeeding, they put one of their teeth into a hole, and cutting each thread, one after another with great patience, made themselves a passage through a part of the web. They then uncovered the feet and head of the insect, but finding a larger opening necessary, cut on with their teeth, just as you would cut with your scissars.

“ While this was going on, there was great agitation in the nest, and several workers succeeded one another in the employment: nor were their labours ended when the pupa was extricated: there still remained another kind of satin-like skin, which covered the whole insect. When this was removed, it had every part perfectly displayed—antennæ, wings, and feet, and could walk and receive nourishment, of which last alone it now stood in need.

“ On every part of the hill were the ants thus employed, and they are most orderly creatures; they collected the shreds of the cocoons, and carried them into their most distant lodges. Some kinds of ants remove them to a distance from the nest,

while others cover their nest with them, or collect them into one apartment.

“The education of the young ants then commences: the workers watch and follow them, go with them in their excursions, teach them the various paths and labyrinths of their habitation. They have another and difficult task, too, in unfolding the wings of the males and females, which would otherwise remain always folded; and this they perform so delicately as not to injure the tender members.

“And here I take my leave for this evening of the industrious ant, for whom I cannot doubt but my young friends already feel more admiration than they at first expected.”

The whole group readily acknowledged this; and, well pleased with each other, as well as with our subject, we separated, after a promise from them of another visit soon.

CHAPTER III.

“WE must take leave for the present,” said I, at our next meeting, “of my glazed ant-hill, and

take a walk down to the river, to survey the mounds which rise all along the meadow by its side."

We reached the meadow, and were fortunate enough to find an ant-hill in the state I had wished.

"We have seen the interior of the nest of these singular little beings, now tell me what you see on the exterior."

"I see," cried Letitia, "thousand of ants, with glittering wings, walking about the hill."

"These are the males and females of the field ants; you may trace them, too, climbing every plant in the neighbourhood of their habitation. The workers follow them like humble attendants; some escort them merely, while some follow and attempt to bring them back to the hill. The male ants display their brilliant wings as they come forth by hundreds from their subterranean dwelling, while the females, though much larger, are fewer in number."

"This is a very pretty sight," cried Sarah; "what a variety there is in the colour of the insects!"

"Some are all of one colour; the workers yellow, the males black, and the females flaxen," said I; "yet their wings have all the beautiful hues of the rainbow: others are varied; the body of the workers

is ash-coloured, stained with red; the males, with black bodies, have yellow feet, and white wings; the females have brown bodies, with orange spots. But see what an agitation is spread over the ant-hill. The little workers run from one of their winged brethren to another, touching them with their antennæ, and offering them food. At length the males and females fly off, and the workers return alone to the nest, and close the entrances.

“This swarming of the winged part of the community takes place in a warm summer morning, and is frequent even so late in the year as September.

“Ants have not, like bees, the power of finding their own nests, and of returning to them. After once leaving them, they never return: the males die an early death, the duration of their life probably not exceeding a few weeks.

“The females, when they come again to the ground, strip themselves of their wings with their antennæ. They wander up and down for some time in search of a nest, and at length finding a suitable place, deposit their eggs, and perform all the duties to the young which are usually performed by the workers.

“All the winged females, however, do not leave the nest; some are retained prisoners by the

workers, whose instinct teaches them that they are necessary to the community; and some remain voluntarily. These are all attended by the workers, who guard them closely until they begin to lay their eggs; a single ant then accompanies each, and provides her with whatever she needs. This sentinel seizes the first egg she lays and carries it off to a cell, another worker succeeding to her post. As the female continues laying, the ants begin to treat her with the same homage as the bees pay to their queen; ten or fifteen wait upon her, offer her food, and lead her through the narrow passages of the nest. When she wishes to rest, a party of ants surround her.

“Many females, I have before told you, live in one nest; no rivalry is shewn by one to another: each has her court; and though they have no real power, for that belongs to the indefatigable workers, they have great honour and affection shewn them. I have seen a queen-ant enter one of the apartments, and joy and exultation has spread itself all through it. The workers prance and skip and frolic about, as if congratulating themselves with the presence of their queen. Some walk over her, others dance round her, while all cluster about and encircle her.

“We have now,” continued I, “made all the

observations we can from the ant-hill itself; and the damps of an autumnal evening, though they may not affect young and healthy damsels like yourselves, are not to be despised by a rheumatic man as I am. Let us return to the sofa of my parlour; and, after my lecture, I will regale you with some of Kitty's mead, of which she is not a little proud."

Letitia rather pertly remarked, "that she was glad Kitty had not forgotten the bees, although her master had slighted them of late."

"Are not my visits to the formicary as much for your benefit as mine, Miss Letitia," answered I; "I doubt if you would be entirely satisfied now, if you were to hear no more of these new acquaintance of mine and your's?"

"No, indeed, I should not," answered Letitia; "you have introduced us to the different individuals, the winged males and females, and the wingless industrious labourers, but of their relation one to another I have yet to learn."

"I have some curious facts on this subject, well worthy your attention," answered I. "I told you how the nests are guarded at night: these faithful watchmen are not wanting in courage; and, when attacked, are ever ready to defend themselves bravely. Some, however, always steal down into

the interior of the nest with news of the danger. The alarm spreads throughout the city, and bands of labourers crowd to the assistance of their brethren, full of alarm and uneasiness. What is worthy, too, of our admiration, is the conduct of those labourers destined to take care of the young, who, in the first moments of alarm, convey their charge to the very bottom of the nest, and deposit them in safety.

“ To learn in what manner the alarm was communicated from one to another, I was forced to watch a society of Herculean ants, which are much larger than common ants, and live in the hollows of trees, which they never leave until the spring. I watched them, then, and disturbed the ants who were at the greatest distance from their companions, by blowing upon them. Immediately I saw these run to the others and give them gentle blows upon the body with their heads; and, by thus communicating their fear or anger, the alarm became general, and they all ran to and fro in great confusion.

“ Ants make excursions in bodies; and it is curious how they are able to follow each other's steps from place to place.

“ M. Bonnet, a celebrated naturalist, thought it

was by the smell that they followed the same track ; but I am of opinion that they actually fetch one another. I have amused myself with putting pieces of nests in my room, and watching when and where the ants thus dispersed would unite again. They set out a thousand different ways, without any clue to guide them, till at length, one of them accidentally discovered a chink in the flooring, which led into a darkened cavity. I traced this very ant returning to its companions, and, by particular movements of its antennæ, imparting the joyful news. It even led the way to the entrance for some, who, in their turn, returned and served as guides for more ants. By degrees, all received intimation, by having had their antennæ struck, and the whole party of ants were soon safely lodged in the hole of the floor."

MISS R. " I remember a story of Dr. Franklin, who discovered a number of ants feasting upon some treacle in one of his cupboards. He put the whole army to flight, as he supposed, and hung up the treacle-pot by a string to the ceiling, but what was his astonishment to see one single ant steal from the treacle-pot, climb up the string to the ceiling, and reach its nest. In a very short time many of the other ants set out to ac-

company him ; these crossed the ceiling, and, descending the string feasted upon the treacle, which they continued to visit till it was all consumed."

" All ants, however, do not communicate by means of the antennæ. I am now going to tell you of the migrations of ants, who are occasionally induced to quit their old abode, and establish themselves in a fresh one. Ants are induced thus to remove their habitation, by finding their former one either damp, or exposed to the attack of an enemy ; and their manner of doing it is so singular, that I am induced to give you a complete history of it.

" What do you think, for instance, of ants carrying each other ?"

LETITIA. " How droll ! surely if one ant is able to take a journey, the others would be equally capable of doing so !"

" What," answered I, " do you think yourself, Miss Letitia, equally capable with me of bearing a long journey ? If we were to set out to walk together for many miles, I fancy you would be glad enough to make use of my shoulders, before I should even think of being tired. But, whatever be their motive, whether the age, the sickness, or the infancy of their companions, it is true that a part of the community carries the rest.

" I have seen them remove their habitation ; and

have seen, about half-a-dozen yards from their old one, a new ant-hill start up, communicating with the other, by a path across the grass, along which the ants were passing and repassing in great numbers. All those who were going to the new ant-hill, were loaded with their companions; and all those returning to the old one, were running one after another, no doubt, to convey some more.

“ I have made this experiment, by driving ants from their old nests, and forcing them to seek a new one, so often, that I cannot doubt the truth of what I am telling you.

“ I have observed, that at first there are very few carriers, but after a while these few enticed others to join them in forming a new colony. It was amusing to watch the arrival of the recruiters at the old ant-hill; they eagerly approached the ants, stroked them with their antennæ, pulled them with their pincers, and actually appeared to be begging them to go with them. When they seemed willing to set off, they seized them by their mandibles, the carrier-ant turned itself about to take up the other, which rolled itself up as it hung from the neck of the carrier. This was all quite amicable; they stroked each other occasionally with their antennæ, just as they do when they are about to take their food.

“ I have noticed, that it is not always in so

peaceable a manner that the recruiters act, for they sometimes seize the ants by surprise, and drag them forward, without allowing any time for resistance.

“ This recruiting continued many days, and when all the ants belonging to the old hill were acquainted with the road to the new city, their companions ceased to carry them, and confined their labours to the construction of chambers and avenues in the new abode. When some of these were finished, they fetched the larvæ and pupæ from their old habitation, and deposited them in safety ; after which, they escorted their males and females, and then abandoned their old hill for ever.

“ These little creatures are very particular in the choice of a place for their city, and often change it two or three times, if the situation does not please them.

“ I have known instances of the new ant-hill being at a considerable distance from the old one, and, in that case, the ants have a kind of half-way-house, in which they deposit their larvæ and males and females, which they cannot transport in one journey. For this purpose, they make a hole in the earth, and even construct chambers, which they

cover with bits of straw, and raise to look something like a small ant-hill. Here they station sentinels, to open the gates morning and evening, as at the real ant-hill. In the fir-grove on the hill, there is a number of large ant-hills, connected together by tracks, which seem like so many cities of one kingdom. The tracks, which are as much as a hundred feet in length, and several inches broad, are not caused by the passing and repassing of the ants, as one would naturally suppose, but are dug out of the soil by the ants themselves. This art is confined to the fallow ants; but the plan of recruiting, or rather of colonizing, is common to the fallow, the Ethiopian, the ash-coloured, the sanguine, and the mining ants. The valuable gift of communicating with each other by means of the antennæ, is in use among the brown, the yellow, the fuliginous, and many other kinds."

MISS R. "The affectionate care, which the ants bestow upon their young, and upon their companions, appears almost unaccountable to me."

"With ourselves," answered I, "affection springs from an acquaintance with the good qualities of a fellow-creature; but with ants, as with bees, it arises from an instinct, given doubtless for the benefit of their society. Their friend-

ship is universal ; they have no rivalry, no unkind feelings, to sow dissension among the members of the republic.

“ You will think me too complimentary, if, after this eulogium, I venture to compare a republic of ants to the inhabitants of the white school-house of yonder village : if you will not allow the comparison, I will make bold to offer it as a model worthy the imitation even of my amiable and industrious friends.”

I observed Letitia and Sarah, and, indeed, the whole of the party, look somewhat sly, and half ashamed, as I glanced at them ; conscious, perhaps, that there were too many different tempers and dispositions thrown together in their spacious school-room, to permit of that entire harmony which I had been describing as natural to the ants.

“ Ants,” continued I, “ may be even divided in the middle, and will still continue to defend their habitation, and convey their young to places of safety : thus, you see, they will not yield to our friends the bees, either in patriotism or in affectionate regard to their offspring. And with this compliment we will leave them for the present.”

CHAPTER IV.

“ I SAW you smile, Letitia, when I was, last week, talking of the perfect harmony of the ants, and comparing it with the state of the inhabitants of your school-room. Alas ! discord is, I fear, inseparable from every state of society.

“ We have seen that bees, usually so pacific and friendly towards each other, at times seem to forget their amiable character : and this, too, we shall find to be the case with ants.

“ The ants of southern countries are more war-like than those of our own ; they attack small animals, and destroy rats. The ants we are acquainted with confine themselves to beetles and caterpillars for their largest prey ; they will, however, pull to pieces a dead frog or lizard.

“ Ants are not sly, but make war openly. Strange to say, the females and the workers only are armed ; they have a sting, whose venom, you know, causes a slight irritation on the skin ; and this and their pincers are their only weapons. As the males are not armed, they are

exempted from the burden of war; and as the females only use their weapons for self-defence, and make their escape upon the slightest alarm, it is the workers alone whose lot it is to defend the habitation, or commit depredations for the good of the community.

“ Some of the various species of ants are without a sting, but these bite their enemies, and then pour into the wound they have made with their teeth a drop of venom, which renders it exceedingly painful.

“ But the most furious combats are between the ants themselves. Several little ones sometimes attack a single large one; they fasten upon its feet, drag it to the ground, and thus prevent it from escaping. The fury of these little things is incredible: you might tear away their limbs, or cut them in pieces, sooner than make them quit their hold. I have seen a victorious worker carrying about the head or antennæ of the ant he had conquered; and it is no uncommon thing to see one drag after him the whole body of his enemy, with which his feet had got so entangled during the battle, that he could not extricate himself.

“ If the ants are of equal size, those with a sting have a great advantage over the others. The red ant has both kinds of weapons. In our

country, the ants with stings are the smallest kinds.

“ When large ants attack smaller ones, they seem to do it by surprise, to prevent the small ones from clinging to their feet. They seize them by the upper part of the body, and strangle them. When the small ones, however, have time to guard against an attack, they give notice of it to their companions, who come in crowds to their assistance.

“ I once saw a battle between the herculean and the sanguine ants. The former quitted their abode in the tree, and advanced to the very gates of the dwelling of the sanguine ants: these were more numerous, though smaller, than their adversaries. They defended themselves bravely; but, great numbers of them being killed, they resolved to remove their habitation, and, with great activity, conveyed their young to a distance of fifty feet. A few workers were stationed here and there to guard their retreat, and preserve the new city from a sudden attack; these kept their mandibles open as a posture of defiance, and struck against each other when they met. When the herculean ants approached, the sentinels in front assailed them furiously; at first they fought in single combat. A sanguine ant would throw him-

self upon the herculean one, fasten upon its head, and shower its venom upon him. Sometimes, the herculean ant would seize his audacious enemy between its feet, and the two warriors rolled together in the dust. The largest ant, at first, had the advantage, but the numbers who came to the assistance of the smaller one, and the venom they all spurted, generally decided the victory in favour of the latter; while the herculean ant either perished, or was conveyed prisoner to the enemy's camp.

“Some species of ants engage in regular wars. The fallow ants, in particular, are jealous of every other kingdom of ants in their neighbourhood; and I have beheld pitched battles between two nations whose territories bordered upon each other.

“Two armies met together, about half-way between their two hills, and formed a prodigious crowd of insects, which occupied a square of two feet in width. The battle began; the ants fought in pairs, and seized their antagonists by their mandibles. Numbers were employed in carrying off the prisoners, who made many attempts to escape, as if aware that they should perish when they arrived at the camp. The scene of battle was about a yard square; num-

bers of dead bodies strewed the ground, and I perceived the strong smell of the venom with which they were covered.

“ There were groups and chains of ants, holding each other by their legs and pincers: six or eight would all be firmly locked together, and a band of warriors breaking in would force them asunder.

“ When night came, the two parties retired to their own habitations, but renewed the attack before daylight the next morning. The battle raged more furiously than ever; so desperately did they fight, that not even my presence could divert them.”

LETITIA. “ But how can each of these little creatures know his own party ?”

“ Indeed, their instinct in this respect shews itself in a new point of view to us; but who shall attempt to explain it? The battle I have been describing terminated, at length, without the destruction of either ant-hill; long continued rains stopped the warfare, and our warriors ceased to frequent the path that led to the enemy's camp.

“ I could add innumerable anecdotes of the warlike disposition of ants, but am afraid of wearying you. I should like you to accompany

me again to my favourite hill, the abode of the fallow ants, whose nests we first examined, and see if we can find any engaged in their *gymnastic* exercises.

“ I see you stare with surprise at the term I make use of ; but I will explain it. On a fine sunny day, I have seen the ants heaped together on the surface of their hillock. None being at work, I stooped to see what could be their occupation, and found they were actually wrestling one with another. At first, I thought they were fighting ; but finding that they emitted no venom, and that none were wounded or hurt, I concluded they were amusing themselves with sham fights.

“ This rude kind of sport is not general among the ants ; it is principally confined to the fallow ants. The others, however, have amusements of a different kind, and gambol and turn each other about as young dogs would do in their play.”

We reached the hill ; but I could not prevail upon my young friends to be as cautious as the occasion required ; the ants consequently took fright, and frustrated our design.

“ The most singular part in the history of ants,” continued I, as we returned homewards, “ is their language ; or, in other words, the use of their

antennæ, that extraordinary organ which performs so many important offices to the ants. I have already mentioned a variety of instances, in which they are of essential service to them, and I have others still to mention.

“Ants do not, like bees, build magazines and store them with food; some, therefore, are obliged to seek it daily, whose office it is to bring home a supply for those who do not go out. When they meet with ripe fruit, or juicy animals, such as worms, or lizards, which they cannot bring home, they feed upon them; and on their return disgorge the liquid provision into the mouths of their companions, in the following manner: the ant who is hungry, strikes with its antennæ the ant who has brought a supply of food; then, with open mouth and extended tongue, it draws near to receive the fluid, which I have observed to pass from the mouth of one to that of the other. All this time, the ant who is receiving food, caresses its kind friend by striking it rapidly with its antennæ, and stroking the side of its head with its fore-feet, which are furnished with brushes, and move as nimbly and gently as the antennæ.

“The ant who is returned with its stomach full, informs the hungry crew of its wish to unburden itself of its store, by striking its antennæ;

a movement which even the larvæ understand, who erect themselves, and present their mouths as they observe it.

“ There are small insects, called *pucerons*, or *aphides*, which live upon vegetable substances, and are found fixed upon the leaves, or young branches, or between the fibres of the bark. After sucking in their nutriment, they expel it in the form of small drops, and it is this fluid that forms the chief nourishment of ants. They watch the moment when the pucerons are about to eject it, and immediately seize it; and they likewise have the art of obtaining it at whatever time they wish. An ant reaches a leaf which contains several pucerons, and approaching one of them, strokes its back with its antennæ, as if to caress it, upon which the puceron ejects the fluid, and the ant immediately sucks it up. The ant then comes up to another puceron and obtains another supply of fluid by a similar manœuvre; and, after visiting four or five, returns contentedly to its nest. A few repasts will satisfy it.

“ These pucerons, if there are no ants near them, scatter this liquid to some distance, or drop it on the leaves, from which the ants frequently take it.

“ The brown ant is the most skilful in obtain-

ing this honey from the pucerons; the fallow, the ash coloured, and the red, have a similar power, though not in an equal degree. The red ant receives this drop, and with great dexterity employs its antennæ to conduct it to its mouth.

“Ants are also indebted to the gall insects for a supply of food, which is ejected from a hole upon the back; these, like the pucerons, feed upon the juices of leaves and branches of trees. The ants stroke them with their antennæ and lick up the sweet drop ejected by these *gall* insects, or *kermes*, in the same manner as they do that from the pucerons.

“When the ants are not present to receive it, the kermes, like the pucerons, scatter the fluid to some distance.

“This food is a never failing resource to the ants; I have seen thousands of them ascending and descending the trunk of an oak covered with these insects. Those ascending are thin, and walk quickly; those descending have their stomachs filled, and move with difficulty.

“I have often puzzled myself to discover what those ants do who never quit their abode; the yellow ants, for instance, called by the common people red ants, who frequent our meadows and

orchards. These are literally subterranean insects, and neither go in chase of other insects, nor suck the sweet juices of fruit.

“One day, however, I turned up the earth of which their nest was composed, and found it contained pucerons of various species, some white, others flesh-coloured, and others green and violet.

“These pucerons subsist upon the roots of plants, and may be seen after rain, when the plants can be easily pulled up by the roots.”

LETITIA. “But how do the pucerons come there in the first instance?”

“They are,” replied I, “most probably carried thither by the ants, who know full well the value of these little beings; for, in fact, they constitute the sole wealth of an ant-hill; they are their cattle and their sheep. I am inclined to think the yellow ants search for them in the subterranean galleries they have dug out, and finding them among the roots, bring them to their nest.

“Many species of ants have these pucerons in their nests; the red, the brown, and the surf ants, are in possession of them in winter, spring, and autumn, when other food is scarce.

“Some other insects, likewise, live among the ants, such as woodlice, earwigs, &c., but they do

not seem either to be of use, or to be troublesome to them."

LETITIA. "You once said that it was a mistaken notion, that ants laid up stores for winter use; and that the bits of wheat and other grain found in their hills, were not to form granaries, but to assist in the building of their habitations. If this be the case, how do these little insects subsist during winter?"

"When the weather is very cold, ants are, like bees, in a kind of torpid state; but only during extreme cold. I have seen ants walking over the snow. It is during this season, when other food fails them, that they are entirely indebted for their preservation to the pucerons, in whom they have a never failing resource. Those ants who have not the art of bringing the pucerons to their own nest, know how to find them out upon the branches or within the bark of trees, and obtain a supply of food from them.

"The eggs of the pucerons are guarded by the ants with the same jealous affection as their own; they carefully conceal them from observation, and pass their tongue over them, to glue them together, in the same way as they do their own. They are hatched in the spring, and the almost full-grown

insect starts from its shell, and rewards the ants who have so carefully watched and preserved it, by supplying them with nourishment."

I was here reminded by my young friends, that their visit must be a short one, in consequence of their having a concert to rehearse, which was to take place on the following Saturday, and which would also interrupt their weekly attendance at my cottage.

The disappointment to myself was somewhat alleviated by a polite invitation to this concert, from Miss R., which I most willingly accepted.

CHAPTER V.

THE concert passed off exceedingly well; and, if I had been gratified by the thirst for information displayed in the eager attention of my young friends to my humble lectures, I was no less charmed to see them display the lighter accomplishments and graces suited to their age and sex.

The concert was followed by a ball; and here Letitia bore away the palm, as Sarah had in performing her concerto upon the piano. The old bachelor was not allowed to escape making himself ridiculous, and, before the evening ended,

had displayed his antiquated notions of dancing in a country dance, which followed all the fine figure dances and quadrilles.

“It is well, my young friends,” said I, when we next assembled, “that you have had a week to laugh at, and, I hope, forget, the droll steps of your lecturer, otherwise he might not perhaps be listened to with that gravity which is suitable to his present office.

“I grieve to say, that office is coming to a conclusion; and that after next week I quit this summer retreat, which your occasional visits have rendered a most agreeable one to me. I will lose no time in telling you all the other facts I have been able to glean; they relate chiefly to the habits of some kinds of ants different from any that I have before mentioned.

I shall begin with the *rufescent*, or, as I have named them, the *amazon ant*. The warfare they carry on with other kinds of ants is of an extraordinary description. I have seen an army of them, extending about eight or ten inches, moving rapidly along, quit the road, pass a hedge, enter a meadow, and, winding along the grass, without straggling, approach a nest of dark ash-coloured ants. Some of its inhabitants were guarding the entrance of the dome; and, on seeing

the enemy approach, they darted forth upon its advanced guard. The alarm was sounded, and the ants came pouring from the interior of the nest. The amazon army, quickening its march, arrived at the foot of the ant-hill, and in an instant fell upon the ash-coloured ants, who retired defeated to the bottom of their nest. The amazons now ascended the hillock, crowded upon the top of it, and took possession of the different avenues; while some with their teeth endeavoured to make an opening on the side of the dome. They succeeded; and the amazon army entered the nest, out of which they soon returned, each bearing a larva or pupa in its mouth. The whole army now returned by the path along which they had come, but all in disorder and confusion; I could distinguish them in the grass, by the white eggs they carried, but as they entered a field of corn, I lost sight of them. I went back to look at the conquered ant-hill, and found a few ash-coloured ants perched upon the stalks of plants, holding in their mouths the pupæ they had been able to rescue from the amazons.

“ This battle would not have surprised me half so much as it did, had it not been for a discovery I made in some ant-hills near my house.

“ I found, to my utter astonishment, that there were ash-coloured, or negro workers in every nest of amazons; and I found, too, that they lived on very friendly terms together: that the negro ants received the amazons whenever they returned from an attack, such as I have described, helped them to unburden themselves of the captive larvæ, and to deposit them in proper cells. These, therefore, may be called compound ant-hills, since they are composed of two different kinds of ants. They, no doubt, originally belong to the amazon ants, and the negro labourers proceed possibly from the larvæ which have been taken prisoners in war. These, being hatched and brought up in a strange nation, not only live sociably with their captors, but assist them in taking care of their young, in removing their habitations, seeking provisions, forming new galleries, acting as sentinels, and, in short, they lead the same active lives which they would have done had they been born and brought up within their own nest.

“ The amazon ants leave all their domestic care to their negro slaves, and reserve themselves for their warlike expeditions. I destroyed a part of their nest, upon one occasion, while the amazons were absent: the negro ants immediately set

to work and built new galleries; the consequence was, that when the amazons came home, they did not know how to get into the inside of the nest. I saw an amazon go to a negro and apply its antennæ to it, as if asking something; and I then noticed the negro take it up with its pincers, and deposit it at one of the entrances: the amazon unrolled itself, caressed its kind friend, and entered its dwelling. Sometimes, they will carry the amazons some distance, if they have quite forgotten the road about the galleries. It is a curious sight, to see a number of these little industrious negro ants, each bearing one of its warlike comrades upon its back.

“ There are other kinds of ants, who form compound ant-hills. Such are the *mining ants*, who likewise unite with, or are the slaves of the amazons. These miners form vast ant-hills, much larger than they would construct for themselves: they go out in a crowd from morning till evening, to forage in the neighbourhood, and provide food for their colony; on their return, they share their food with the amazons, who are as lazy in this colony, as when they live with the negro ants.”

LETITIA. “ The ash-coloured and mining ants may be looked upon as negro slaves to the ama-

zons, stolen before their very birth, and ignorant of their being in a land of strangers."

"In fact, they are so," answered I. "I have another association of ants to introduce you to, which are the *sanguine ants*, who are likewise indebted to their negro brethren for their valuable services.

"The sanguine ants resemble the fallow ants, except in colour; their head, feet, and throat, being of a blood hue. Their hills are composed of fragments of leaves, stalks, moss, and stones, and as difficult to break as mortar. It is not the work alone of the negroes, for, unlike the amazons, the sanguine ants share the labours of the nest with their slaves.

"The sanguine ants are not so warlike as the amazons; their chief employment is in hunting small ants, which they eat: they leave the nest in troops, and lie in ambush near an ant-hill till the inhabitants come forth, whom they dart upon and make them their prey.

"The sanguine ants make war against the ash-coloured, and, like the amazons, seem only anxious to bring away the larvæ and pupæ. I could amuse you with a history of many a battle, or rather a siege, in which I have observed every stratagem

that skilful generals and well-practised soldiers could devise and perform ; but I hope that I have sufficiently interested you to induce you to make observations for yourselves. I refer you to nature ; there you will find inexhaustible stores of amusement and interest : and you will ascertain that, far from exaggerating the truth, I have still left much for you to learn for yourselves.

“ I have given you the principal facts which are known relating to ants ; and I have opened to your inspection “ Scenes of Industry ” in the insect world, worthy of admiration and imitation.

“ Nor can I take leave of you, my young friends, without adding, that I have ill succeeded in the task I proposed to myself, if I have not, in some degree, increased your reverence and affection for that Being, who gave to these little insects those wonderful instincts, which are so admirably adapted to the duties they are destined to fulfil.”

THE END.

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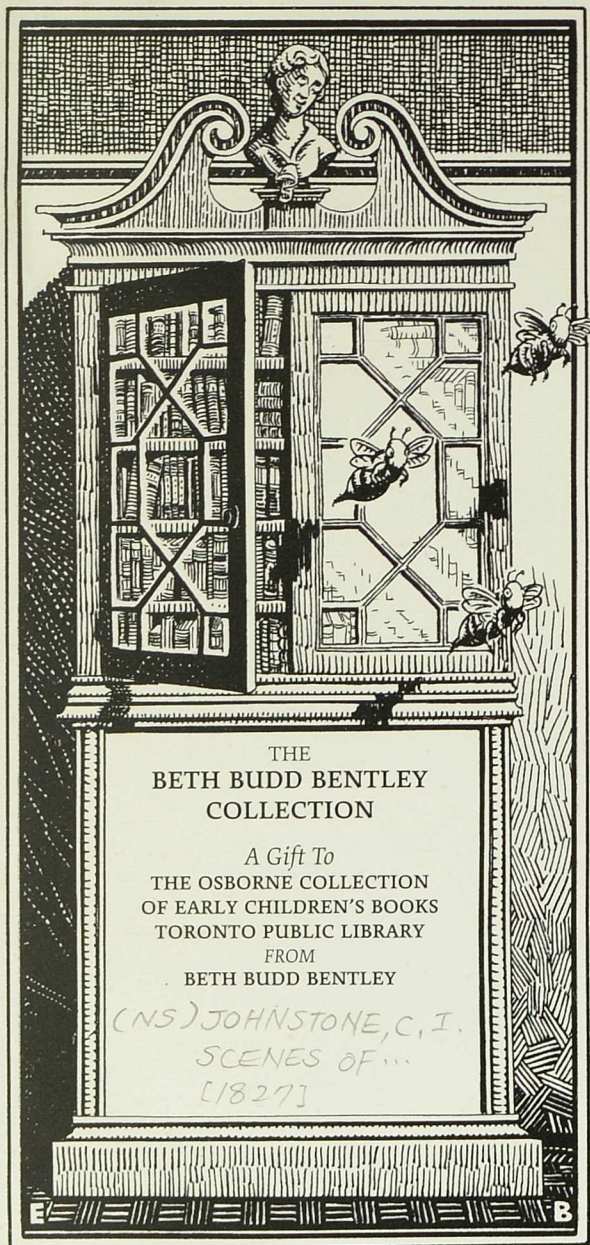
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