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INSECT HUNTER'S COMPANION

LONDON:

E. NEWMAN, PRINTER, DEVONSHIRE STREET,  
BISHOPSGATE.

THE  
INSECT HUNTER'S COMPANION

BEING

Instructions for Collecting and Preserving

BUTTERFLIES AND MOTHS

AND COMPRISING

AN ESSAY ON PUPA DIGGING

BY

THE REV. JOSEPH GREENE, M.A.



Second Edition.

WITH A CHAPTER ON COLEOPTERA

By EDWARD NEWMAN, F.L.S.

LATE PRESIDENT OF THE ENTOMOLOGICAL SOCIETY.

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LONDON

JOHN VAN VOORST, PATERNOSTER ROW

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1870

ADVERTISEMENT  
TO THE FIRST EDITION.

Two circumstances have induced to the issue of this little publication—*first*, the demand for the Rev. Mr. Greene's 'Pupa Digging,' now out of print; and, *secondly*, the incessant inquiries I have received from readers of the 'Insect Hunters' for instructions how to collect and preserve insects.

Mr. Greene, at my express desire, has most kindly undertaken the task of authorship: like myself he is well aware of the great want of such a work among beginners, to whom these pages are especially addressed.

In addition, I have only to say that Mr. Greene has no pecuniary interest in this literary venture.

EDWARD NEWMAN.

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ADVERTISEMENT  
TO THE SECOND EDITION.

For some years, during which the 'Insect Hunter's Companion' has been out of print, Mr. Greene has been incessantly urged to issue a SECOND EDITION, and has at length consented.

A new feature in this Edition is a short chapter on collecting and preserving BEETLES, which I have added, with Mr. Greene's kind permission.

EDWARD NEWMAN.



## PUPA DIGGING.

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SOME years since a few remarks of mine on this subject were read before the Entomological Society. I imagined the matter to have excited little or no interest, until I read, with, I trust, pardonable gratification, the following passage in an article addressed to the 'Intelligencer,' p. 74:—"Most of your readers will recollect a paper on digging for pupæ, which gave such an impetus to that mode of collecting." On reading this paragraph I forthwith determined that I would, if spared, write a few additional observations for the pages of the 'Zoologist,' in the hope that its readers might thereby be persuaded, in however slight a degree, to apply themselves with zeal to the only method by which their favourite study can be pursued during the long and dreary months of winter and early spring. I am the more induced to take this step, from the fact that I not unfrequently receive communications from my entomological friends and correspondents, making grievous complaints of their want of success; some asking information as to the "modus operandi;" all

inquiring, "What is the cause of my want of success?" In reference to the first of these questions, some remarks will be found at the close of this paper; in regard to the second, "What is the cause of my failure?" I answer, "Many causes doubtless combine to produce this undesirable result, such as want of experience, a sticky and clayey soil, unfavourable (*i. e.* wet) weather, &c. But I have no hesitation in expressing my firm conviction that, in nine cases out of ten, want of *success* proceeds from want of *patience*. A meets B. "Have you heard," inquires A, "of C's wonderful success in pupa digging? He has taken Dodonæa, Chaonia, Fagi, Ocularis, and I don't know how many rare insects." "You don't say so," excitedly replies B; "how is it done?" "Oh," replies A, "simply enough: take a common garden-trowel and a box lined with moss; dig at the roots of any good sized tree, or tear off the moss, and the pupæ will tumble into your box *ad libitum*." Enthusiastic B rushes home, seizes a trowel, procures a box large enough to hold all the pupæ for miles round, and departs, buoyant with hope, upon his first pupa-digging excursion. "Let me see," he soliloquises, "what shall I do with my *surplus* pupæ? Ah! Mr. L. wants Trepida; well, he shall have two: and <sup>if</sup> I remember rightly, Mr. S., who sent me so many insects I did not possess, said he wanted Ridens; therefore he shall have three." While thus meditating a majestic oak strikes his eye. "Lo!" he exclaims, "the very tree for both species!" Nervously, yet

firmly, he grasps the trowel, and approaches the unconscious tree. Forthwith the trowel is inserted half a foot into the earth, and, by a prodigious muscular effort, a gigantic sod is turned up. Eagerly he gloats over and peers into the sod lying before him: nothing meets his eye but a writhing worm and a wriggling centipede. "Why, how is this? here's *nothing!*" With crushed hopes he is about to leave, when suddenly he remembers that he was directed to tap it gently, and then tear the roots asunder. The sod is tapped—an earwig! The sod is discerpted—a woodlouse! Perspiring with his exertions, with aching back he rises from his knees, looking rather foolish. (N.B. The digger's feelings, at this crisis, are often additionally lacerated by a small mob of boys, looking on with gaping mouths). He rises, I repeat, from his knees, takes up his huge box, and goes to a poplar: the same process—the same result. Then to a birch: ditto, ditto. This is too much! Angry and disappointed, he hastens home, seizes a sheet of paper, and writes off to the author of "that paper" on pupa digging, to ask, "What is the cause of my want of success?" Partly, my friend, ignorance of the proper method of setting to work, but much more the want of patience and perseverance. I know nothing which requires a more constant and vigorous exercise of these virtues than pupa digging. A *total* want of success is undoubtedly disheartening; and accordingly, in the hope of encouraging despondent "diggers," I now append a list of insects, all of which

have been taken by me in this way. Having this object in view, the commonest species are included, with a description of the tree, locality, time of appearance, &c. While this may prove uninteresting to the experienced, it will, I trust, be instructive to the beginner, for whom I write. Where no other locality is mentioned, Suffolk is intended. As there appears to be a biennial change in our nomenclature, I have thought it best to adopt, as most generally known and used, Doubleday's 'Synonymic List.'

? monthly or fortnightly.

*Thecla Rubi*. A pupa of this insect was once found under moss on a log of wood. Bucks.

*Satyrus Ægeria*. I have several times met with the pupa of this butterfly, suspended from blades of grass, when digging at the roots of trees. It is a beautiful grass-green colour, and passes the winter in that state.

*Sesia apiformis*. This insect, though I have not seen it on the wing, seems to swarm here, judging from the number of pupa-cases in the trunks of poplars. The larvæ of this and the allied species, as is well known, feed on the live wood of various trees. They are full fed towards the close of autumn, when they spin a leathery cocoon composed of the comminuted wood. They pass the winter in the larva state, turning to pupæ in April, which is the best time to look for them. Their presence may be detected by the holes or galleries, which are about the thickness of an ordinary pipe-stalk. These holes will always be found on the trunks, near the ground. Sometimes the top of the

pupa-case will be seen stopping up the hole. It must then be carefully cut out, remembering that the case is frequently two inches long. Occasionally, however, the cocoons are formed in or upon the dead bark collected about the roots of large poplars, when they may easily be secured. In either instance the operation requires very delicate handling. The cases must be kept *damp*. I will not venture to advise how this can best be done. *Sesia Bembeciformis* may be found in the trunks of willows, though I have myself never done more than find the empty case.

*Smerinthus Tiliæ*. Found commonly. Birch and elm. Prefers the narrow angles formed by the roots, getting in as far as possible. October, &c.

*Smerinthus Populi*. Common. Various poplars; edges rather than the angles. October, &c.

*Smerinthus ocellatus*. Scarce. Willows. October, &c.

*Euchelia Jacobææ*. This insect is, I believe, considered very common, yet I never took more than one specimen in England: far otherwise, however, in Ireland, where it abounds, and I have taken the pupæ in boundless profusion under loose bark on wych elms; of course the larvæ must have crawled up the trunks to form their cocoons, as they feed on the ragwort. I think it must be *local*, as that plant is very common here, yet I have not seen the insect. *shug*

*Lithosia rubricollis*. In abundance under damp moss, decayed bark, &c. Chrysalis short and stout, enclosed in a delicate white web: should be occasionally damped. Fir, larch, oak, &c. October, &c.

*Lithosia quadra*. Occasionally. Spun up on palings in the neighbourhood of oak trees covered with lichens; also, occasionally, in the crevices of the bark. End of June.

*Lithosia griseola*. May be found under moss on lichen-bearing trees, preferring, however, poplars. June.

*Arctia lubricipeda* and *Menthastri*. Common. Spun up in loose rubbish collected about the roots of various trees. October, &c. It is perhaps almost unnecessary to say that the larvæ do not feed on trees, but various low-growing plants.

*Arctia mendica*. Rarely. Under moss on trees bordering damp ditches. Gloucestershire. October, &c.

*Liparis monacha*. This singular chrysalis may be found by examining the trunks of oaks, in the crevices of the bark of which tree it spins up. End of July.

*Orgyia pudibunda*. The conspicuous yellow cocoon of this species is easily detected among loose rubbish collected about the roots of trees; sometimes under loose bark. The larva is polyphagous, and consequently the pupa may be found at various trees, preferring, I think, oak and elm. October, &c.

*Orgyia Coryli*. Very plentifully under moss on beech; generally at the roots, and not on the trunk. October, &c. Bucks.

*Eriogaster lanestris*. I was much surprised at finding two pupæ of this pretty insect at the roots of an *elm*: I thought it was exclusively a hawthorn-feeder, but there was no hawthorn at all near at hand. October, &c.

*Trichiura Cratægi*. The compact egg-shaped cocoon

of this species I have once or twice met with at the roots of poplar, the larva having probably wandered from some neighbouring hawthorn. July.

✓ *Pœcilocampa Populi*. This insect is found in various situations, and on various trees—ash, poplar, &c.: sometimes it will be found firmly glued to the inside of a piece of loose bark, or to the tree itself; at others spun up tightly among decayed leaves, dead grass, &c. It ought to be among the early captures of the pupa digger, as it is common and not difficult to find. The cocoon is black. August and September.

✓ *Platypteryx falcula*. Where birch is common, examine the leaves joined together, and you will not unfrequently find the pupa of this species. June, and again in September, &c.

✓ *Platypteryx unguicula*. Substituting beech for birch, the same remarks apply to this as to the preceding.

✓ *Cerura furcula*. Under bark and on trunks of willow, occasionally. September, &c.

✓ *Cerura bifida*. Occasionally on trunks and under bark of poplars. September, &c.

✓ *Cerura vinula*. On trunks of poplar and willow. September, &c.

*Cerura bicuspis*. There can be no doubt that this insect occurs here (Derbyshire.) It has been taken several times in the neighbourhood of Burton-on-Trent. I have found the cocoons—empty, I am sorry to say—here, on alder; but as yet all my efforts to find one from which the insect had not escaped have been fruitless. The vacant cocoons have been found almost invariably

about four feet from the ground, and on the north side of the tree. Very rarely the larva spins its cocoon on the wood, and not in the crevices or chinks. Of course they are much more easily detected in the former situation, but I do not remember to have seen it more than once. I feel sure it must be a rare species, as, though I have examined dozens of trees, I have not found more than ten or twelve empty cocoons. The directions which follow, for finding *Furcula* and *Bifida*, may perhaps be more useful to others than they have been to myself in finding *Bicuspis*. It is also, I think, a good plan to *scrape* the trunk with the edge of the trowel. Alder and birch? September.

In regard to the first two of these insects, the best way, I think, to find them is to draw the finger slowly down the trunk, and carefully to examine the line thus formed and about an inch on each side of it; they will generally be found at distances varying from one to three feet from the ground. You will almost invariably find *Vinula* close to the ground.

*Y. chalybeata* ✓ *Stauropus Fagi*. Once found between two decayed beech-leaves. Halton, Bucks. October.

*M. ranae* ✓ *Petasia cassinea*. One female at roots of elm. July. Gloucestershire.

✓ *Ptilodontis palpina*. Occasionally at poplars, but much more frequently at willows, especially when on the banks of ditches, streams, &c. When in such situations, that side of the trunk which faces the stream is often clothed with grassy sods of loose, dry, friable earth: this is the place for *Palpina*; shake the sod well,



and the cocoon, which is grayish and of weak consistency, will generally be found among the dry roots: it is easily distinguishable from that of *Dictæa*, being much smaller (*i. e.* the cocoon), and not so much mixed up with earth. End of September.

✓ *Notodonta camelina*. Very common under moss on various trees—beech, elm, &c. A little experience will soon enable the beginner to detect it: the pupa is enclosed in a weak cocoon, and, unlike the other species in this genus, terminates in a single point or spike. October, &c.

✓ *Notodonta cucullina*. Once found under moss on a beech tree, having doubtless wandered from some neighbouring maple. October. Halton, Bucks.

✓ *Notodonta dictæa*. See remarks on *Palpina*. This species forms a large cocoon, sometimes nearly the size of *Trepida*.

*Notodonta dictæoides*? I have found the empty pupa-cases of this species at the roots of birch. I put a note of interrogation, as, having never bred it, I am not sure.

✓ *Notodonta dromedarius*. The only pupæ of this insect I ever found were in Ireland: they were all, nine in number, taken at the roots of an alder, and produced the variety commonly known, I believe, by the name of *Perfusca*: they seem to me very different from the English specimens of *Dromedarius*. October.

✓ *Notodonta ziczac*. Rarely, at roots of poplar. October, &c.

✓ *Notodonta trepida*. This autumn I have succeeded in taking no less than seventeen of this fine insect: it

appears to prefer a sandy soil, and does not seem so partial to *corners* as others of this genus. Oak. September, &c.

✓ Notodonta dodonæa. During the present and preceding autumns I have taken upwards of 300 pupæ of this species, mixed with Chaonia, which is much rarer here, and goes down a full month earlier. Search as usual the dry friable sods collected in the corners, or the corners themselves without any sod. The cocoon is sometimes attached to the tree, but more usually among the roots: in either case great caution is necessary. It is a good plan, when you have pulled the sod out, to put your hand in and gently feel the trunk for any cocoons which may adhere to it. Not unfrequently a sod will be found *loosely* attached to the trunk of the tree, and not among the roots. When this is the case, and the soil composing it is dry and friable, it is a favoured locality with larvæ. By taking hold of the *grass*, and pulling gently, the sod can easily be removed, and the pupæ will fall down, or, if spun up, will not uncommonly be found fixed to the trunk, or that part of the sod which lay against it. This observation is of general application. It is not easy to tell the difference between Dodonæa and Chaonia; but the latter is, I think, stouter, smoother and not so glossy. Oak. September, October, &c.

✓ Buff Soil Pygæra bucephala. Various trees. October, &c.

Nudaria mundana. Spun up on old walls, garden doors, &c. Gloucestershire.

✓ ✓ Clostera curtula. Seven. It is well worthy of notice,

in regard to this species, that the larva enters the pupa state *on* the tree; I had imagined that it did so among *dead* leaves: this is not the case, at least not necessarily. When full fed it joins two leaves firmly together, and remains there till they fall off. I was not aware of this fact till the present autumn: this hint may, I hope, enable others to obtain this apparently much-prized insect. I should add that they had not *turned* when I found them, but they never came out of the leaves. Various poplars (shrubs, best). October.

*Clostera reclusa*. Like the preceding, the pupa of this insect may be found occasionally spun up between two leaves on the living tree. Dwarf sallows, best. September.

*Diloba cæruleocephala*. The pupa may be taken (by those who want it) under the bark on the trunks of old hawthorns, crab trees, &c. July and August.

*Acronycta Psi*. Common under bark on various trees. October, &c.

*Acronycta tridens*. I have little doubt that the pupa I am in the habit of taking under bark on hawthorns is this species, but as *Psi* also feeds on that tree, and it appears impossible to separate the two species, except by breeding them, I am unwilling to speak positively. October, &c.

*Acronycta megacephala*. By no means uncommon under loose bark on poplars, occasionally on willows: it is not very easy to get at, as it enters into the smallest chinks. Break off every bit of loose bark with the point of the trowel, and the pupa-case, which, with the pupa,

*Dark Digger*  
*Light Digger*

*Dark Digger*

*Dark Digger*

closely resembles that of *Psi*, will be found firmly glued to the surface. The cocoon is formed of decayed wood. October, &c.

*Acronycta Aceris*. Five: all on *oak*, not sycamore. October, &c.

*Acronycta Ligustri*. Abundant under moss on ash trees. The moss must be *very* carefully torn off: the pupa-case, which is black and very tough, not *hard*, will in most cases be found adhering to the moss: if there be no moss, examine the trunk. There are often long perpendicular slits in the bark of ash trees, and this is a favourite hybernaculum for *Ligustri*. If both moss and loose bark are wanting, go to another tree. October, &c.

*Acronycta Leporina*. Beneath loose bark on alders. Derbyshire.

*Ceropacha Or.* Very rarely under moss and dry rubbish on and about poplars. October, &c. Gloucestershire.

*Ceropacha ocularis*. Of this rare and beautiful species I took, last autumn, four; up to the present time I have taken nine more, four being unfortunately stung. The pupa is black and stout (something like *Coryli*), enclosed in an extremely delicate open net-work of a rusty brown colour: it is very difficult to find; it frequently, nay generally, spins on the surface of spreading moss, or barely beneath it—sometimes between two leaves; in this latter case it is soon blown away, and, in the former, falls an easy prey to the first prowling mouse: it should, therefore, be sought for as soon as possible after the change: this, I think, should certainly not be later than

the first week in October. Various poplars. [I paid a visit in the autumn of 1861 to my old ground in Suffolk. On that occasion I took five pupæ of this insect. I found the following a very good method of obtaining it:—Instead of turning up the sod, lay hold of the grass lying close to the trunk, and pull it (the sod) from the tree about an inch or so; and the pupa, if there, will almost invariably be found attached to the tree, or else among the blades of grass which lie close to it. Its presence may be detected by the open net-work alluded to above. If, after pulling the grass from the trunk, small pieces of bark are found loosely attached to it, *i. e.* the trunk, they should be carefully removed and examined, as behind them the larva frequently spins up.]

*Ceropacha ridens*. Of this also rare and very beautiful insect I took twenty-six last autumn; up to the present time I have only found seven. Like the last species, it is extremely difficult to find, and should be sought for as soon as possible, *viz.*, middle and end of August.\* The following directions may enable others to find it:—Detached oaks growing in *meadows*, of a dry, loamy soil, seem the best; the situation evidently preferred is the

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\* I take this opportunity of correcting a mistake in the 'Manual' respecting the larva of this species and that of *Flavicornis*. In that work they (the larvæ) are said to be found in *September*. This is a strange error: *Flavicornis* is one of the earliest *spring* feeders, while *Ridens* is found a little later in the season. I have taken the *pupa* of this latter, as stated above, in the middle of August, and, without any question, there is but *one* brood of both these species.

corners filled with dry rubbish, and little stunted brambles. Insert the trowel well into the earth, six or seven inches from the *angle*, and turn up the sod, bramble and all, if possible: to find the pupa, after this is done, is a work both of time and pain; it will not do, in this case, to *tap* the sod. First carefully examine the dead leaves, for they frequently spin up in them: you must then, regardless of scratches, tear the roots asunder as gently as possible. The cocoon is very weak, composed of little bits of stick, dried leaves, &c., and requires delicate handling. Indeed, the whole concern demands an elaborate manipulation. This is one of those pupæ, to find which exacts a large exercise of the two virtues already alluded to. (N.B. Pupa diggers wearing *gloves* will return home with empty boxes).  
Oak.

*Bryophila perla* and *glandifera*. I have taken the pupæ of both these species here (Clifton) in plenty, and bred the most lovely specimens from them. The cocoons are formed in the soft, friable mortar on old walls, or, occasionally, between the wall and the coping-stone of the walls which surround the villas in this locality. A little practice renders their detection easy. The larva works its way some little distance into the mortar, covering the place of exit with finely powdered particles of it (very much like *Apiformis* on a small scale), and the eye will soon learn to distinguish between this and the adjoining material. They may be cut out with a pen-knife, remembering, however, to cut deep; and it is well to hold a pill-box to catch the pupa, for it

is very active, and frequently wriggles out, and falls to the ground. Middle of July.

*Apamea unanimitis*. The hibernating larvæ of this species may be commonly found under loose bark on willows growing near damp ditches, in April. When you return home place them in a box with a little earth and moss, and, without further care on your part, the perfect insect will appear in June. If it be preferred, the *pupa* may be found in the same situations, about the beginning of June. The same remark applies to *Xylophasia hepatica* and *X. rurea*.

*Xylomiges conspicillaris*. Once taken at Cheltenham. August, 1868.

*Xylophasia hepatica* and *rurea*. Like *Apamea unanimitis*, I have found the larvæ (full-fed) of both these species in April, under damp moss on stumps of trees, &c. : they require no attention. *Hepatica* I have generally found under damp moss on *poplars*.

*Segetia xanthographa*. This much-abused, yet, when bred, pretty insect, may be found at the roots of most trees. End of July, August.

*Noctua C-nigrum* and *festiva*. Occasionally at roots of trees. July.

*Noctua plecta*. Very common at roots of various trees. October, &c.

*Noctua augur*. I was very much surprised to find two pupæ of this species, this year (1862), in a curious place, *viz.*, the juncture of the branches of a pollard willow. I was looking at the time for the larvæ of *Ypsilon*, and found them spun up under the loose bark.

I do not imply that the larvæ eat the willow, as I believe its food is low-growing plants; but it is interesting, as showing in what apparently unlikely places pupæ may be found.

*Agrotis putris*. Very common at the roots of various trees. October, &c.

*Tæniocampa stabilis, instabilis, gothica, cruda*. Extremely abundant at the roots of various trees. October, &c.

*Tæniocampa munda*. A few at roots of oak. Gloucestershire. October, &c.

*Tæniocampa Populeti*. Of this rare species I once found a "nest" of thirteen at the roots of a poplar. It goes much deeper into the earth than most other insects. Bucks.

The last eight species may easily be found by simply shaking the sod, or loosening the earth, and by taking a large number (I once had 1000 pupæ of *Instabilis*) of the common species, some curious and beautiful varieties may be obtained without trouble.

*Orthosia Ypsilon*. The larva of this species may be found in profusion under loose moss and bark on willows and poplars, but they must be fed. Beginning of June. The *pupa* may be taken in July, in the same situations, or spun up at the roots.

*Orthosia macilenta*. Of this species, so difficult to obtain in good condition when in the perfect state, I have found only three. The chrysalis, which is extremely delicate, is enclosed in a weak cocoon. Birch. September.



*Cerastis Vaccinii*. I turned up two or three pupæ at the roots of wych elm, during my visit to Suffolk in the autumn of 1861.

*Cosmia diffinis*. Not uncommon where elms abound. Spins up close to the trunk. End of July. Bucks.

*Cosmia affinis*. Same time and place as the preceding.

*Cosmia trapezina*. Ditto, ditto.

*Cirrhœdia xerampelina*. Of this rare species I took forty-seven in 1855; in 1856 I only met with eight. It is perhaps the most difficult of all pupæ to find, and, when found, the most liable to be injured. The following directions may be found useful:—They are to be sought for at roots of ash: trees of good growth need only be tried; those on the borders of streams and damp ditches will be found most productive. This insect forms a hard, egg-shaped cocoon. Turn up the loose dry earth, rubbish or moss about, or adhering to, that side of the tree which faces the stream; crumble it *very* carefully with the hand: should you see something resembling a cocoon, of a dark muddy colour, take it up and try whether you have obtained a prize; but in this trying lies the danger: though hard, the cocoon is extremely *brittle*, and almost the slightest pressure crushes it: the best way, therefore, when you think you have a cocoon, is to pare one end with a penknife as gently as possible: if, after scraping it in this manner, you find it is a cocoon, you have found *Xerampelina*, and may congratulate yourself. You may look for it as early as the beginning of August, certainly not later than the first week of September. I may add that Mr. Doubleday

informs me that the larva feeds on the seeds of ash trees. [Subsequent experience leads me somewhat to modify the above. I find it is by no means the fact that the pupa-case is always *brittle*. It certainly was so in Suffolk: this may have been due to the soil. In Hampshire and Derbyshire, however, where I have taken it not uncommonly, the cocoon is soft and leathery. I am decidedly wrong in giving September as one of the months in which to find it: this is much too late. This insect, *Croceago*, and, I believe, all the species of the genus *Xanthia*, are full fed in June. I can speak from actual knowledge of all except *Croceago* and *Aurago*; but they do not turn to the pupa state for four or five weeks. This presents a double difficulty to the pupa digger—first, that of hitting the precise time *when* to dig; and secondly, the great danger of injuring the larva if not turned, or the pupa if only just turned. As a rule I should recommend the last week in July as the time in which to begin. You may go on till the middle and end of August, about which time, if fortunate, you may sometimes see the insect itself drying its wings on the trunks of the trees, about a foot from the ground. This takes place generally from about two to four P.M. “Subsequent experience,” however, by no means leads me to alter my opinion as to the difficulty of finding the pupa. I must acknowledge that it is hard and sometimes disheartening work, but you are repaid when you see a magnificent fellow drying his wings in the breeding-cage: to sum up, the caterpillar barely enters the earth, and the most likely place for

the pupa is among the loose rubbish composed of bits of stick, dry roots, &c., collected round the trunks. All this should be most carefully and completely separated and examined. I may remark here that the pupæ of all these species most closely resemble each other, and it has often been a marvel to me how such large insects can be contained in so small a compass.]

*Xanthia ferruginea*, *aurago* and *citrago*. I have found all these species, though rarely, at roots of wych elm and lime trees. August. Bucks.

*Xanthia gilvago*. I have bred splendid specimens of this insect since I came to Derbyshire. The larva feeds on the seeds of the wych elm, and goes down about the same time as *Xerampelina*. Like it, too, as I have already remarked, it remains a considerable time in the larva state, and is difficult to find. It spins a weak, web-like cocoon among dry rubbish. It may be found in the same way, and at the same time, as *Xerampelina*, but at the roots of wych elm.

*Tethea subtusa*. The pupa may not unfrequently be found under loose bark on poplars. End of June.

*Agriopsis aprilina*. In the utmost profusion: I have taken as many as twenty at one tree. This will be one of the first pupæ found by the beginner: nothing can be easier; merely turn up the earth and break it, and they will tumble out of their brittle cocoons in plenty. Oak. July and August.

*Mamestra Persicariæ*. Common under moss on various trees. October, &c.

*Hadena Proteus*. Not uncommon at roots of oak.

Cocoon greatly resembles that of *Xerampelina*. July and August.

*Hadena Pisi* and *thalassina*. May occasionally be found under moss, stones, stumps, &c.; on or about heaths. October, &c.

*Heliothis marginatus*. Once found, but I cannot say where.

*Abrostola triplasia* and *Urticæ*. They may both be found, though not commonly, under moss on ash trees, throughout the autumn.

*Plusia Gamma*. I have found the pupa of this insect spun up between the leaves of hollyhocks. The contrast between the dense blackness of the pupa and the pure white of the web which contains it is very striking. *Found on garden Beans '70 Ed*

*Catocala nupta*. This fine chrysalis occurs not unfrequently under loose bark on willows: it never enters the earth, as far as my experience goes. August.

*Mania Maura*. Under bark on willows and poplars. July.

*Mania typica*. Not uncommon under coping-stones on walls round gardens. The cocoon is formed of loose mortar.

*Botys urticalis*. This is the only *Pyralis* of which I ever found the pupa, and, strictly speaking, not even that, since it was the hibernating larva. It (the larva) may frequently be found enclosed in a comfortable cocoon under the bark of most trees; I shall not soon forget my disappointment when the perfect insect made its appearance.

*Geometra papilionaria*. At roots of oak. Beginning of July.

*Eurymene dolabraria*. This beautiful insect I used to take in plenty under moss on beech trees in Bucks: it occurs also, but much more sparingly, on oak. The larva enters the moss at the first convenient place, and therefore, in tearing it off (which should be done with the *hand*, not the trowel), great care must be taken in loosening the *edge* of the moss, for *there* the pupa is, I may say, invariably found. October, &c.

*Pericallia syringaria*. This very singular pupa may occasionally be found suspended by its tail to a leaf of privet or lilac, in June.

*Ennomos illunaria*. I once found, as stated in my first paper, a whole brood of this species at the roots of one ash tree. Not met with since. September. [I took two pupæ spun up in dead leaves lying about the roots of a lime tree, in the autumn of 1860, at Newrath Bridge, Co. Wicklow, Ireland, from which I bred the two largest males I have ever seen.]

*Ennomos fuscantaria*. Once found spun up at the roots of an ash. August. Brandeston.

*Ennomos tiliaria*. Two or three spun up between blades of grass growing in the corners formed by the roots. Birch. August.

*Odontopera bidentaria*. Common under moss everywhere. October, &c.

*Crocallis elinguaris*. The pupæ of this species may be taken in comparative plenty under moss on poplars, about the end of June or beginning of July.

*Anisopteryx æscularia*. Not uncommon at roots of elm and oak. October, &c.

*Hybernia leucophearia*. One female at roots of, I think, a sycamore.

*Hybernia rupicapraria* and *progemma*. Very common at roots of elm throughout summer and autumn.

*Hybernia aurantiaria* and *defoliaria*. Also common in the same situations. Should be looked for not later than September.

The above four species may be found in little "clusters" in dry nooks formed by the roots of elm trees, and beautiful varieties thus procured; much trouble in looking for the apterous females will also be saved.

*Phigalia pilosaria*. Common at roots of elm. October, &c.

*Biston hirtarius*. Common at roots of ash. This pupa may be known by a row of dull yellow spots on each side. In October, &c.

*Amphydasis prodromaria* and *betularia*. Both common; the former at roots of oak, the latter at those of elm. October, &c.

*Boarmia abietaria*. Found in profusion at roots of fir trees in Gloucestershire. Last week in June: this time should be strictly adhered to, as the insect sometimes remains only eight days in the pupa state.

*Tephrosia crepuscularia*. Several, in the New Forest, under moss on oak trees. October, &c.

*Tephrosia consonaria*. This insect appears in the perfect state about the first week in May: the pupa

should be looked for in April, under moss and at the roots of beech: it appears to be exclusively attached to that tree. Bucks.

*Cidaria corylata*. Common at roots of elm and lime. The pupa is enclosed in a web-like cocoon, and is greenish yellow, powdered with brown spots. October, &c.

*Cidaria russata*. Common at roots of willows.

*Ypsipetes elutaria*. In abundance at roots of willows: most extraordinary varieties may be thus obtained. July.

*Ypsipetes impluviaria*. Common under moss on alders. October, &c.

*Ypsipetes ruberaria*. I once took about a dozen of this insect under loose bark on poplar. Bucks. April. The larva hibernates, I think; for, if I remember rightly, some had not turned when I found them in the spring.

The pupæ of the three last-named species are all black and very active.

*Cidaria miaria*. Very common at roots of willows. August.

*Cidaria psitticaria*. Much rarer. Birch and sycamore.

The pupæ of both these species (together with that of *Epione apiciaria*, which I forgot to mention in its right place) may be found spun up in loose grass, or attached to the trunk: the latter species at willow. The pupæ of all three have a purple bloom, and I cannot see any difference between them.

*Oporabia dilutaria* and *Cheimatobia brumaria*. These two common insects may be found in the utmost profusion at the roots of almost any tree throughout the summer. There appears to be an impression on the minds of some that *Autumnaria* and *Filigrammaria* are only varieties of these species. Of course the best way to decide the question is by breeding them: this I have not done, but out of many hundred pupæ of *Dilutaria* I have never had anything like either of them. I am aware that up to this time they have only been taken in Scotland, or, at any rate, in the North. As I have had no "digging" in either of those localities, the above fact may be thought of little value. I would venture to recommend the northern collectors to dig at the roots of *elm* and oak any time during the summer, and to collect as many pupæ as possible. (N.B. I suppose every one knows the pupa of *Dilutaria*). Should the three insects, or two of them, be or not be produced from these pupæ, it would, I think, assist considerably in solving the question. In my opinion all three are abundantly distinct.

*Eupithecia exiguaria*. Occasionally under bark on hawthorn. October, &c.

*Eupithecia abbreviaria*. Occasionally under bark on oak. October, &c.

*Eupithecia castigaria*. Occasionally under bark on hawthorn. October, &c.

*Eupithecia vulgata*. Occasionally under loose bark on various trees—hawthorn; crab tree, &c. October.

*Eupithecia fraxinata*. Of this rare species I have been fortunate enough, at different times, to take seven.



I believe the food of the larva is not ascertained, but I have little doubt that it feeds on ash, as all my pupæ were taken under moss on that tree. To find it, see directions under the head of *Eurymene dolabraria*. October, &c.

*Eupithecia dodonæaria*. This very pretty insect I am in the habit of taking under loose bark on hawthorns throughout the winter and spring. It is enclosed in a delicate web.

*Eupithecia lariciata*. Occasionally under moss on fir trees. Clifton.

*Cidaria ribesaria*. When currant trees rest against a wall, the pupa may often be found in the crannies and chinks. Beginning of July.

## REMARKS.

1. The above list, it will be seen, comprises no less than 133 insects, including many of the rarer species. It might have been considerably increased by adding others, which may occasionally be found in digging gardens, stubbing up roots, turning sods of grass, &c.; but as no fixed rules can be laid down in reference to these methods, or, to speak more correctly, since I can give none, I have confined myself strictly to *trees*, on or about which all the above may be found by assiduous collectors.

2. An examination of the list will show at once that the following trees are the most productive, *viz.*, poplar,

willow, oak, elm, birch, beech, ash and hawthorn. But *all* trees should be tried. Knock off the loose bark and loosen the moss on every tree you pass. I do not think there is much use in digging at the *roots* of any trees, except those mentioned, unless a particular insect be wanted, such as *Boarmia abietaria* or *Trachea piniperda*, at roots of fir, &c., &c.

3. It will also be seen, by referring to the list, that in a very large majority of instances September and October are quoted as the best time for searching; and this is undoubtedly the case. From whatever cause or causes—such as mice, damp, mould, earwigs, &c. (I have *seen* earwigs eating a soft pupa)—chrysalides become scarcer and scarcer as the season advances, meaning by the term *season* winter and spring. If the collector, therefore, wants any particular species, obviously his best plan is to search for the pupa as soon as possible after the larva has gone down or spun up. Assuming that the collector knows the period when the insect he wants is feeding as a larva, and its probable or usual duration in that state, a little experience will soon enable him to know how soon he ought to dig for the pupa. A fortnight will generally be found ample time. Let us take *Notodonta dodonæa* as an example. The larva of this insect is full fed about the 25th of August. Allowing, then, a fortnight for the change, the collector should begin to dig about the second week in September; and during the ensuing three weeks of that month he will probably find more specimens than during the whole of the remainder of the season. Of course *all* the larvæ

of the same species are not full fed on the same *day*, many causes combining to produce some uncertainty in this respect; but, as a rule, the variation is not considerable. But though, for the above reason, the pupa digger should be unusually active in his exertions during September and October, let him by no means afterwards sink into inglorious ease, content to rest on his laurels. Pupæ may be found all the year round. I seldom let anything like a fine day pass without taking a good walk into the country, trowel in hand; and if I return home in January with only *two* pupæ, instead of the *eight* which I might very probably have taken in October, I am quite satisfied. Successful or unsuccessful, I can confidently recommend the *exercise* to the corpulent and obese.

### HINTS.

At the risk of appearing tedious, I append a few observations as to the method of digging, the best localities, &c. I am aware that these observations have, for the most part, appeared elsewhere; but, considering that this paper would be incomplete if they were entirely omitted, I must ask the indulgence of my readers for recapitulating some of them.

The only implements required are a common garden trowel and a small box filled with damp moss, for the purpose of carrying the pupæ, which should be handled as seldom as possible and with the utmost tenderness.

I may here remark that the pupa digger must not be surprised or disheartened if some of his pupæ dry up. This is caused by some unlucky, probably *unseen*, injury, inflicted at the time of capture, and, however great his caution, will not unfrequently occur. But to return. With regard to localities, the best are unquestionably parks and meadows with *scattered* timber trees. Those trees from which the surrounding grass has been worn away by the feet of cattle, and those situated on the borders or banks of streams, dykes, &c., when the soil is dry and friable, will be found the most remunerative. When the pupa digger enters on new hunting-ground, let him endeavour to attain an eminence which commands a survey of the surrounding fields, &c. Having accomplished this, let him cast a scrutinizing glance around. Should a lofty oak or a stately poplar be seen rearing itself in *solitary* majesty in the middle of a field, let him rejoice ; and, having hastily descended from his not "bad" eminence, let him at once proceed to it, regardless of hedge and ditch. If there be a nice dry sod, ensconced in some snug corner, formed by the roots, he can scarcely fail of success. Insert the trowel, *in this instance*, about eight inches from the trunk, to the depth of four. Turn up the sod and lay it on the ground. Look then at that part of the trunk from which the sod has been removed, and, if you cannot see, feel gently with the hand for any cocoons which may adhere. Then take the sod in the left hand and tap it softly with the trowel, and the pupæ which form no cocoon, or a very weak one, such as *Aprilina*, *Prodromaria*, &c., will drop

out. If the sod be composed of very loose, dry earth, simply shake it. Lastly, tear the roots asunder for Bombyces; if, however, the roots be strongly matted together there is little or no use in doing this. Before leaving the tree, see if there be any nooks or crannies formed by loose bark, in which case break it off with the hand, if possible; if, however, this cannot be done, wrench it off with the trowel, observing that it should not be inserted further than is *absolutely* necessary. It is astonishing into how small a hole or crevice a caterpillar will creep. If, therefore, an insect such as Megacephala, which spins up under the bark, be wanted, these little nooks must be carefully and *cautiously* examined. If moss be on the trunk or roots, tear it gently off, and search both the moss and the trunk. When these operations are ended the tree may be looked upon as "done for." In digging *round* a tree, by which I mean one whose roots do not form any angles, it is not necessary to insert the trowel deeper into the earth than three inches, or further from the trunk than four. With regard to woods, I can add nothing to what appeared in my first paper, from which I make the following extract:—"It is in vain to examine the *dense* portions; it is equally vain to dig at the *roots* of trees in such localities, with few exceptions; and you will rarely find anything, unless upon trees of a considerable growth. The thick moss which collects about the trunk and roots is the part to be examined. 'Bombyces' are generally (almost invariably) found under the moss which covers the spreading roots, and not on the trunk. The best

localities in woods are the borders and open places; and it is curious that such places, when elevated or facing the North, seem to be the most productive." [This observation, *viz.*, "facing the North," subsequent experience leads me to apply to all pupa digging. The vast majority of pupæ will be found on that side of the trunk which faces the North. This circumstance I attribute to the fact that in this situation they are less exposed to sun and rain. We all know that exposure to the sun is fatal to pupæ, and therefore an infallible instinct leads the larva to select the shadiest side. I believe that rain or damp is equally injurious to them, and that therefore they choose the northern side as the driest. I am well aware that some will differ from this opinion; but however doubtful the cause, the effect is certain; and so satisfied am I on this head that I go first to the northern side, and if it present an unfavourable appearance I, as a rule, leave the tree. As having some bearing on this point, I may mention that the insects themselves, when at rest on the trunks of trees, are almost always found on the northern side. In the former part of this paper, when speaking of *Dictæa* and *Palpina*, I mentioned, as the most likely places for finding the pupa, poplars and willows bordering upon streams, and especially the dry sods formed on the sides facing the stream. It is, however, wholly useless to examine trees in this situation when the roots and trunks are liable to be submerged by the overflowing of the stream. In such cases there is usually a water-mark, below which a pupa never will be found. An unerring instinct seems to warn the

larva of its probable fate, should it venture below this water-mark.] Touching hedgerows, I must so far modify my former wholesale condemnation of them as to say that I found two pupæ of *Ocularis* in such a situation this autumn. It should be borne in mind that in condemning hedgerows I condemn the *trees*, not the hedgerows. As Mr. Douglas justly remarks, in his highly interesting and instructive little book, the 'World of Insects,' p. 116, "Pupæ must be there," *i. e.*, in the *banks* on which the hedgerows are. I shall most thankfully receive any information as to the *modus operandi* in this case from those who have tried it. I imagine that *Noctuæ*, and not *Bombyces*, will generally be found in such situations. [Since writing the above I find that the pupæ of *Xerampelina* and *Gilvago* may be taken in such situations, the former at ash, the latter at wych elm. When *large* trees are in such places, there is frequently congregated about the roots a quantity of dry rubbish, consisting of bits of stick, dead leaves, &c., mixed with light earth. The larvæ are very fond of spinning up in this stuff, or just below the earth, and it should therefore be carefully examined. Observe—In turning up sods, earth or rubbish, the trowel should never be inserted *parallel* with the tree, but with the *point* of it *facing* the tree. Also—When the trowel is once inserted, do not take it out, but press it up at once to the tree. If the trowel be only inserted say half way, and the sod loosened, not unfrequently pupæ will fall down; and the second insertion of the trowel will inevitably result in the severing or crushing

of them. Again—When the trowel has been driven up to the trunk, great care must be exercised in removing the sod from it. If you can do so without *pulling* it off, so much the better; if not, do it as gently as possible, since larvæ often spin up among the roots of the grass, and the violent wrenching off of the sod will crush them.] In the occasional records of insects taken in the pupa state, I observe the frequent use of this expression, “Pupa, by *raking*.” What is the meaning of the term “raking?” [In reply to this question Mr. Gregson, of Liverpool, forwarded a communication to the ‘Zoologist,’ p. 5432. It would appear from it that raking is a method employed to obtain perfect insects, not pupæ, though some may occasionally be found. It is not necessary therefore to say more on this head. Subsequently a communication appeared in the same work, p. 5538, from Mr. Edleston, of Manchester, from which I make the following extracts:—“In this district many thousands of chrysalides are annually procured from the roots of poplar, &c.: with the exception of one *Chaonia*, I am not aware of a single rarity bred; certainly none ever fell to my share. . . . The great point in favour of digging, even in a barren district like this, is that it enables the collector to employ his spare time in the winter and spring months, instead of being idle. Judging from my own, and the result of others’, diggings, I have not the slightest hesitation in saying the system must rank far below the usual methods of procuring insects; for instance, compare the results of a few nights’ attention to sallow blossoms, if



*Instabilis*, *Populeti*, &c., are wanted, or a stroll into the woods at night with a lantern in October and November, and again in spring: he must be an extensive proprietor of boxes if not fully satisfied with abundance of common insects in the finest condition. A trowel is never used in this district for digging, but a far more effective instrument, in the shape of a small three-pronged garden fork, with the prongs bent downwards, requires less *exertion* (the italic is mine) than a trowel in pulling up grass, sods, &c." I desire to make a remark or two on these extracts. There can be no question, of course, that in a "barren" district, pupa digging, like other methods, must be comparatively inefficacious; nor is it to be denied that some localities are much more productive than others. But, if I understand Mr. Edleston rightly, he implies that pupa digging is far inferior to sugaring, ivy, sallows, &c., &c. If so, I would remark—1st, that not a *single* *Bombyx* and very few *Geometræ* can be obtained in any of these ways; 2ndly, that females are rarely procured; and 3rdly, that of those insects which *are* captured, a considerable percentage are more or less injured and rubbed. As regards the comparative value of these methods and pupa digging, I would also refer my readers to the foregoing list of insects captured by myself in the latter way. Again, I must entirely dissent from the opinion, or rather assertion, that a small three-pronged garden fork is a "far more effective instrument" than a trowel. In one sense, that of destroying pupæ, I have no doubt it is. Mr. Edleston complains of the "exertion" required to pull

up grass, sods, &c., with a trowel. I am afraid he does not exercise sufficient "patience." Pulling up the sod is a very small part of the business. It is the patient, careful *examination* of the sod which constitutes pupa digging. I have a strong suspicion that it is the absence of this careful examination which produces the absence of pupæ. I am the more inclined to this view from observing that of the twelve species (omitting *Megacephala*, which spins up in the bark) enumerated as being commonly taken, two only—*Dictæa* and *Bidentata*—make a webbed cocoon, while the remaining ten merely enter the earth. Now, the pupæ which are in webs require the patient, careful examination above alluded to, while those which are merely in a cocoon of earth simply require the sod "to be well shaken, and they are taken." From this fact I draw a conclusion unfavourable to the *industry* of the Lancashire pupa diggers, provided always that the insects occur there. Mr. Edleston says that *Chaonia* has once been taken in this way. That species therefore occurs in his district. If *Dodonæa*, *Trepida*, *Ocularis*, *Xerampelina*, or any other good insects are found in Lancashire in any stage, and there are suitable trees, I think I may undertake to say that I will find more than *one* pupa, and if Mr. Edleston will honour me by reading and acting upon the suggestions contained in this paper, I think *he* will too.]

There is no use in trying hard, sticky or clayey ground; but the following hint will be found valuable: always *replace* the sod when you have done with it, or at

least the débris. When first taken up the sod may be so hard as to render it impossible for the caterpillar to penetrate it; but if, after being loosened by the pupa digger's manipulation, it be restored to its place, the larva, which in the original instance would have wandered away to some more convenient spot, will now find one ready made, and will almost certainly make use of it. This has been evidenced to me in the most unmistakable manner, in proof of which I may adduce the following example:—One day in June, 1855, I came to a most unpromising-looking oak. Observing a little angle, I inserted the trowel, and found the soil as hard as a board; nevertheless, I turned up the sod, shook it, and, having found nothing, loosely replaced it. In the following September I returned to the same tree, and, having unsuccessfully dug round it, came to my little (it was not more than three inches each way) sod, and raised it with anxious hand, when, lo! to my delight and astonishment, *five* pupæ of *Notodonta dodonæa*, all joined together in a little cluster! It is obvious that the above plan will be of no use during the winter months, but can only be made available while the larva are feeding, *i. e.*, in the late spring and early summer months. It will then be said, "You dig all the year round?" I answer, certainly: September and October are the most *productive* months, it is true; and August and September will be found the best time for the autumnal species; but that is no reason why the other months should be neglected. Of course I dig much more sparingly during the spring and summer, at which

period insects may be taken in the larva and imago state; but I seldom go out without my trowel; and I can confidently recommend the collector in want of any particular tree-feeding Bombyx or Noctua to prepare a comfortable home for the larva, in the manner given above.

When the ground is very wet do not try *digging*. Rather examine moss, loose bark, &c.

With regard to the question, which will probably be asked by my readers, "Which are the most *likely* trees?" I answer that general directions on that head will be found scattered through the paper; and I would only add in this place that it appears to me useless to try any trees but those of considerable growth, and that when the trunks or roots of such trees are thickly matted with ivy no pupæ will be found. But the uncertainty on this point is truly extraordinary. In my first paper I gave an instance; I now subjoin another. In the neighbourhood of Brandeston is a park, belonging to the Duke of Hamilton, which is filled with fine old timber oaks, and is a grand hunting-ground for the pupa digger. On one occasion I came to a meadow, adjoining this park, in which were about sixteen oaks, all fulfilling the necessary requisites for "likely" trees—old, filled with angles, and a dry soil. Out came the trowel, the box was prepared, and I began with number one. I dug for about two hours; at the expiration of that time I looked into my box, and found the result to be three *Instabilis*. There remained one tree, which did not seem to offer any advantages over the others;

yet at that one tree, in a corner about the size of a good large plate, edged with loose grass, I took the following, *viz.*, three *Trepida*, *seventeen* *Dodonæa*, three *Prodromaria*, seven *Hirtaria*, and two or three dozen *Cruda*, *Gothica*, *Plecta*, &c. This is a simple *fact*, and in reference to it I would ask, "Can any one assign even a plausible reason for so singular a circumstance?" The same thing, though in a less degree, occurs every day, and seems to set at nought anything like fixed rules. Lastly, I wish to express my thanks to Mr. Gordon ('*Zoologist*,' 5537) for reminding me of a locality omitted by me, *viz.* the tops of moss-covered stumps in woods, plantations, &c. Though not perhaps very productive, yet, as Mr. Gordon observes, pupæ and larvæ may occasionally be found in such situations. All that is required is simply to remove the moss and examine it, as well as the bared surface of the stump. To sum up, pupæ may be found almost anywhere and everywhere, under moss on large stones and boulders, in the decayed stumps of old trees, behind the loose bark on palings, between dead leaves, under moss on banks, &c., &c.

If this paper be of any use in enabling the collector to fill up some of the blanks in his cabinet with his own hands (and who would not rather do so with his own hands than with those of others?), I shall feel well repaid; and any letter addressed to me shall be willingly and promptly attended to where further information may be desired.

That pupa digging is much on the increase I infer from several circumstances, among which I may mention the comparatively frequent record of insects captured in this way. Surely the most desponding must be nerved to renewed efforts when he reads that *Bicuspis*, *Ilicifolia*, *Fluctuosa* and *Conspicillaris* have rewarded the enthusiastic pupa digger.

In confirmation of the above opinion, I here give an extract from the letter of a highly esteemed correspondent, Dr. Bree, of Colchester:—"I met some young boys, a day or two ago, digging round some trees. To my horror I found that they had read of the —— (modesty forbids my giving the adjective here added) Mr. Greene in the 'World of Insects,' and were exterminating all my game. They had got about a dozen under an elm tree!" I hope Mr. Douglas may be as much pleased with this circumstance as I was.

I hope it will be borne in mind by my readers that the remarks, hints, &c., contained in this paper, are not intended as incontrovertible dogmas, but merely as the results of my own experience and observation.

And now I will conclude with one, literally *one*, word of advice to the incipient pupa digger, and it is this: PATIENCE!\*

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\* Since the above remarks were written (1862), pupa digging has largely increased; and many insects, comparatively rare, especially among the Bombyces, have become common.

*Apsley Road, Redland, Bristol, 1870.*

## INSTRUCTIONS FOR COLLECTING BUTTERFLIES AND MOTHS.

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I offer these few "instructions" to those who, commencing the pursuit of Entomology (Lepidoptera), are more or less ignorant of the various modes of capturing, setting and preserving insects. I wish it to be most *distinctly* understood that I do not claim for them any originality on the one hand, or, on the other, any superiority over other methods. This confession, will, I hope, disarm hostile criticism. I must also add that I by no means profess to exhaust the subject, since I have no doubt that there are other excellent plans with which I am unacquainted. One other preliminary remark, and I proceed to business. These instructions only apply to the Rhopalocera, Sphingidæ, Bombyces, Noctuæ, Geometræ and Pyrales, as I have never collected the "Micros."

Lepidoptera, as is well known, pass through four separate stages of existence—the egg, the larva, the pupa, and the imago. They may be captured in each of these stages.

EGG.—The eggs are of course deposited on the various trees, shrubs, plants, flowers, leaves, &c., on which the larva is afterwards to feed. Owing to their minute size, it is almost impossible to find eggs laid on low-growing plants, and I should not recommend the attempt. They may, however, after a little experience, be easily detected on the flowers and seeds of various conspicuous plants. I may mention, in particular, *Angelica sylvestris* (wild Angelica), growing in woods; *Clematis vitalba* (common traveller's joy), *Galium* (bedstraw), *Linaria vulgaris* (yellow toad-flax), *Lychnis dioica* (campion), *Pimpinella Saxifraga* (burnet saxifrage), *Silene inflata* (bladder campion), *Solidago Virgaurea* (golden rod), &c. I have principally found the eggs of different species of the genus *Eupithecia* on these plants, but the whole of the genus *Dianthæcia* may be taken on the various kinds of *Silene* and *Lychnis*. As far as I can gather from my own experience and that of others, the eggs of *Bombyces* and *Geometræ* are those generally found, especially the former. I have myself found, or heard of others finding, the eggs of the following species, *viz.* *Smerinthus ocellatus* on willow, *S. Populi* on poplars, *Sphinx Ligustri* on privet, *Chærocampa Elpenor* on *Galium*, *Macroglossa Stellatarum* on robin-run-the-hedge, *Trichiura Cratægi* on twigs of hawthorn, *Dicranura furcula* on willow, *D. vinula* and *D. bifida* on poplars, *Ptilophora plumigera* on maple, *Ptilodontis palpina* on poplars, *Notodonta camelinæ* on various trees, *N. cucullina* on maple, *N. dictæa* on poplars, *N. dictæoides* on birch, *N. dromedarius* on birch and hazel, *N. ziczac* on poplar and willow, *N.*



trepida on oak, Cymatophora Or on poplars, Tethea subtusa on poplar, &c. The only practical way, so far as I know, of finding eggs, is to examine the young *shrubs* of the different trees. A twig or small branch is taken in the hand and turned round, so as to get at the under side of the leaves, which must be carefully examined. The eggs are almost invariably deposited on the *under* side of the leaf. The only exceptions known to me are the genus Dicranura. *D. furcula*, *bifida* and *vinula* all lay their eggs on the *upper* side, and being black they are easily detected. I have most frequently found eggs on such shrubs as are isolated in open places in woods, on or about the banks of railway cuttings, barren places in general, and in hedgerows bordering on woods. The great, and I think I may add almost the only, advantage of egg-hunting is the escaping those odious ichneumons which, in the larva and pupa state, so often blight the collector's legitimate hopes. I have heard, however, that the eggs themselves are sometimes stung. If this be true I can only say "it is nipping one's hopes in the egg (bud)." Upon the whole I do not think egg-hunting very productive, but it may still while away an hour or two.

LARVA.—This stage of insect life opens out a wide and extensive field of operations. There is, I believe, scarcely a tree, shrub, plant, or flower, which has not its caterpillar or caterpillars. Even the holly, laurel and deadly nightshade are a pabulum; nor is an ass the only donkey that eats thistles. The following are among the

best methods of finding them:—*beating*, *sweeping*, *searching* and *night-work*. First, *beating*. The operation is simple, but laborious. The implements required are—an umbrella, a stout walking-stick with a hooked handle, and a strong arm. An umbrella of the “Gamp” material and dimensions is the best. If it be a *tree* which is to be thrashed, open the umbrella and place it on the ground. Then grasp the branch with the left hand, and apply the stick vigorously to its back. Examine carefully the contents, which will be found to consist of an *olla podrida* of dead leaves, earwigs, spiders, larvæ of sawflies, Cimicidæ, &c. Should you, on this first examination, see anything you want, take it of course. If not, turn the umbrella *gently* upside down, or, I believe I should say, downside up, to get rid of the rubbish, and then look again carefully. The contents should not be turned out roughly, or *too soon*. The shock is serious to delicate and contemplative larvæ, and they require some time to recover their legs. If therefore the contents are turned out too soon, they will drop out and be lost. Very small larvæ may be taken up by moistening the tip of the middle finger. Larger ones will drop into the box by placing its edge near them and tilting them in. In all cases care should be taken to handle them as little and as gently as possible. The only objection to beating is the number of curious insects that manage to get down your back. It is also well, when engaged in this operation, and the face upturned, to keep both eyes and mouth shut, lest a fat earwig or an odoriferous Cimex should drop into one or the

other. If it be a *shrub*, collect a number of twigs in the left hand, and proceed as before. If it be a *flower*, either beat it with the stick into the umbrella, or, with the flower in one hand, beat it against the ribs; or gather a handful and do the same. The hook is useful for laying hold of and *shaking* a branch. Some collectors employ a sheet instead of an umbrella, to what purpose I cannot imagine.

*Sweeping* is the method employed to obtain larvæ which feed on low-growing plants and flowers, and which in consequence cannot well be beaten into an umbrella. A very good implement for this purpose is a common bag-net. The net must be made of strong calico or holland, about a foot and a half in depth, and must be sewn on to an iron hoop about the thickness of a quill pen. The circumference of the hoop should not, I think, be less than thirty inches. The hoop must then be fastened to a short handle. The lighter the instrument, consistently with stability, of course the better. With it you sweep backwards and forwards among the herbage, flowers, &c., stopping occasionally to examine the contents.

*Searching*. By this I mean looking for larvæ with no other instruments than the eye and the hand. It is astonishing how expert the collector may become in this respect by a little practice. The most successful larva hunter in this way, with whom I am acquainted, is the Rev. H. Harpur Crewe, and whatever little skill I may have myself is mainly due to him, and I gladly take this opportunity of saying so. In "searching" for

larvæ, shrubs and saplings are better than trees. Take hold of the twigs or small branches, and turn them up as already described in looking for eggs, and look carefully down the midrib of the leaves, where, or on the stalk, the larvæ of Geometræ will generally be found, laid flat or rigidly extended. The larvæ of the Bombyces and Noctuæ, on the contrary, will usually be found exercising their masticatory powers, or undergoing the process of digestion, on the edge of the leaf. None but those who have actually experienced it can realize the delicious sensation of seeing a noble Trepida, or Ocellatus, or Ligustri, proudly throwing back its head as if indignant at being disturbed, or shaking it to and fro as if in mute remonstrance, and appealing to be left alone,—an appeal which, so far as I am concerned, I can confidently say has never been responded to. I am reminded here of an anecdote which I read some years ago in ‘Kirby and Spence,’ of a gardener who “was quite disconcerted by the self-sufficient air of these larvæ, remarking that he had never seen any other caterpillars hold their heads so high.” Larvæ may also be obtained by simply *shaking* a branch. If this be not done too strongly, the larvæ, being disturbed, will drop off, at the same time suspending themselves by a thread, when they will easily be seen. Many larvæ, such as the genera Clostera, Tethea and others, when hatched, immediately spin two leaves together, and feed between them. As they grow larger, they continue this habit, *i. e.*, of spinning the leaves together. They do not seem to feed much during the day; but when, towards

evening, the cravings of hunger become importunate, they creep out, and, having demolished the adjoining leaves, return in the morning to their nest, if I may call it such. It is to be observed also that they change their skin between the leaves. Now it is almost, not to say entirely, useless to try and find these larvæ by beating. If you are searching *shrubs*, you will soon see if two leaves are spun together. You can, in this case, either partially open them to see if there be any caterpillar, or simply cut off the two leaves with a pair of scissors (which, with a sheath, should always be carried in the waistcoat pocket), and examine them at home. In the case of *trees* I have found it an excellent plan to look up at the leaves against the sky (which, if it have no other effect, is almost certain to make you sneeze), when the larvæ, if there, may be seen coiled up between them. A long stick with a hook is a necessary implement to draw down the branch when beyond reach. In this manner I have taken in plenty the larvæ of *T. subtusa*, in whatever part of the country I have been living. It is generally considered an uncommon insect, but I believe it is so only from the fact that many collectors are ignorant of the right way to search for the caterpillar. Again, should you observe the *edges* (for as a rule the larvæ of moths do not attack the centre) of the leaves of any shrub, flower, or plant, notched, you must carefully examine it. I need scarcely remark that the pellets of excrement, whether lying on the ground or on the leaves, are a certain sign of the neighbourhood of larvæ. It is a good plan to get *under* a shrub or small tree, and

look *up* at the leaves, on the under side of which caterpillars will frequently be seen lying extended at full length. Great care should be taken in boxing them, as, though some adhere firmly to the twig or stalk, others drop off at the slightest touch or shock. Larvæ may also be found by turning up the *dead* leaves of many plants, as primrose, dock, plantain, mullein, &c., &c., hibernating under moss on trunks of trees, behind loose bark, under stones, in stems of various reeds and grasses, in fact anywhere.

*Light.* Little requires to be said under this head. A very large proportion, probably a considerable majority, of the larvæ of Noctuæ feed only by night, concealing themselves during the day in various out-of-the-way places. They may, as has already been observed, be occasionally found under stones, &c.; but the easiest method is simply to take a lantern as soon as it is dusk, and search banks, hedges, hedgerows, shrubs, flowers, anything in short which presents a reasonable prospect of success. Much, very much remains to be done in this way by the practical collector, as a vast majority of the larvæ of Noctuæ are as yet unknown, at least in this country. I may instance the genus *Agrotis*, in which are twenty-two species. I should think that not more than one-third (if so many) of the larvæ are known in this country. It is true that in Stainton's 'Manual of British Butterflies and Moths' descriptions are given of a considerable number, but, with one solitary exception (Mr. Logan, for *Lucernea*), they are all by *foreign* entomologists; and how little reliance can be placed on these

foreign descriptions I, in common with many others, can certify to.\* The larva hunter must be supplied with an unlimited number of pill-boxes, minus the pills. Tin boxes (size optional) with perforated lids are also very useful. When I go upon a real caterpillar expedition, I generally wear two light coats with side and breast pockets. Should the expedition prove successful, these gradually swell out until the coat assumes the form of a modified crinoline. One, two or more larvæ may be placed in the same box (according to size), provided always they are taken off the same plant or tree. The fewer that are placed together in a box the better, as they become restless and are apt to injure each other. A box to himself should always be given to a good caterpillar: by the word good I mean one rare anywhere, or one which is so to me. Some of the food should of course be placed in each box. Some larvæ are carnivorous, and, if known to be so, must obviously be kept separate. I myself only know of two, *Scopelosoma satellitia* and *Cosmia trapetzina*. The latter of these is a truly bloodthirsty? creature, and will almost allow itself to be torn asunder rather than leave a caterpillar it has once laid hold of. I am not aware of any further instructions to be given as to *finding* larvæ; I proceed therefore to consider the *rearing* of them. And first with regard to rearing from the egg. This is undoubtedly

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\* Since the above was written, owing to the exertions of Messrs. Newman, Hellins, Buckler, &c., our knowledge of the larval state has vastly increased.

rather tedious work, and requires much care, patience, and perseverance; but to the true lover of nature nothing can be more interesting than to watch the gradual development and increase of the little larva—the moulting of the skin; the increased intensity of the colours, or their total change consequent on that moulting; its slow or rapid progress; its manner of eating, &c., &c. Though it is probable that larvæ, when in confinement, do not pursue exactly the same system as when at large, yet in this way we doubtless obtain a tolerably accurate acquaintance with their habits in a state of nature, and thus facilitate our chance of finding them. Before entering upon the subject of rearing, this would appear to be the right place for saying a few words about obtaining eggs by “pairing,” *i. e.*, by endeavouring to induce insects, when bred in captivity, to pair. With some species this is easily done. Nothing more is required than to place the male and female together in a box covered with gauze. Amongst others I may instance, as almost certain to pair without any difficulty, *Clostera curtula*, *reclusa*, *anachoreta*, *Trichiura Cratægi*, *Pœcilocampa Populi*, *Dicranura furcula*, *bifida*, *vinula*, *Amphydasis prodromaria* and *betularia*, &c. On the whole, however, the majority of species seem very unwilling to pair when in captivity. The simplest plan seems to be to place them in a roomy box, and leave them to their own devices. A lump of white sugar moistened may be put into the box, though I do not see much use in doing so. Some very interesting and pleasantly written remarks on this subject will be found in vol. ix.



p. 165, and vol. x. p. 46, of the 'Entomologist's Weekly Intelligencer,' under the signature of "A. B., Brighton." I should certainly not recommend the young collector to try this mode of compulsory pairing with a rare species (unless he have as many as he wants), as there can be no doubt that many will come to grief; and perhaps after all he will fail in attaining the desired end, and—"a bird in the hand is worth two in the bush." But, supposing eggs to be obtained, from whatever source and by whatever means, I shall now consider the best way of rearing them. When I say the *best* way, I wish it to be very clearly understood that I merely mean the way which *I* have found the best, without at all meaning to insinuate or assert that there may not be a better. The most useful cages (if I may so term them) I know of for very young larvæ are those circular tin boxes, or canisters, which contain, or used to contain, "Cassell's Coffee." Any box, however, of similar size or shape, will answer as well. Take, then, a small bottle (this may be obtained at any chemist's), stout in the body, with a narrow neck (the narrower the better). Fill this bottle with water up to the shoulder, and place in it a sprig of the flower, tree, &c., on which the larva is to feed. Then take some cotton wool, and, rolling it round the stalk, fix it tolerably tight in the neck of the bottle. This is to prevent the larvæ creeping or falling into the water, in which case they come to an untimely end. Next take the bottle and place it in the centre of the canister, surround it about half way up with fine pulverized or sifted earth, and on this place a layer of moss.

This had perhaps better be done *before* putting in the plant. In addition, when the larvæ are very young, I take a piece of white paper exactly the size of the canister, and, cutting out a small hole in the centre, slip it over the neck of the bottle before putting in the sprig and the cotton wool. N.B. The object of this is to prevent the little larvæ being lost in the moss. It may be asked, Why put in moss at all? This will be seen hereafter. The sides of the canister, if *smooth*, should be rubbed round with a little wet earth on the tip of the finger, or else otherwise, if the larvæ should fall off, they will be unable to crawl up again. Being thus prepared, place your eggs on the sprig. In a canister of the size alluded to above, *viz.*, about four inches diameter, you may safely place a dozen and a half. Then cover the canister with some fine gauze, and the first stage is complete. Supposing the eggs to hatch immediately, you should examine them every morning. This of course can easily be done by simply removing the gauze. I may remark here that a tin lid punctured with fine holes will save much trouble in tying and untying the gauze covering. If the young larvæ are progressing favourably, minute little pellets of excrement will be seen lying on the white paper. When the food becomes dry or is nearly consumed, place a finger of the left hand on the mouth of the bottle (to prevent its being disturbed), and with the other hand gently pull out the twig. Put in a fresh one, with the cotton wool, as before, rolled round it; and then replace the larvæ. This can readily be done by gently tapping the twig,

or just touching them, when in general they will drop off. When larger, the leaf on which they are feeding may be cut off. After the first (or at any rate the second) moult they must be separated. We will follow, for the present, say six left in the original canister. If they are the larvæ of a moderate sized Geometra, they need not be removed any more. After the second moult the paper may be removed. Then will be seen the advantage of having the moss and mould, for nothing more is required now than to supply the larvæ with fresh food occasionally; and when full fed they will go into the moss or earth, and form their cocoons or spin up, as the case may be. In removing the dry leaves, in addition to a careful search for the larvæ, they (the leaves) must be examined to see if the larvæ have spun up between or *upon* them. The larvæ of the whole of the pretty genus *Ephyra* spin up in this latter way, fastening themselves like a butterfly, with a thread on the leaf or twig. In the case of the larvæ of *larger* moths, of whatever Order, after the second moult I distribute them into separate boxes. I find nothing better or simpler for this purpose than the common chip boxes made to hold toys. They are cheap, and can be obtained of various sizes. I cover the bottom of this box (as above) with fine earth about an inch in depth, and on it a layer of moss, which had better be well-loosened and torn into shreds. The top of the lid being knocked out, and the frame covered with gauze, all is ready. A bottle is filled with water, &c., exactly as already described. It will be plain, however, that a bottle with the food in it

cannot stand *upright* in such a box. It must therefore be *sloped* as far as practicable, and supported by something to prevent the water from running out. Be very careful always about the cotton wool. In a good large chip box eight or ten ordinary-sized larvæ of Bombyces or Noctuæ may be kept together. In the case, however, of the "giants," as the Sphingidæ and some of the Bombyces, or where I have a large number of larvæ, I have what I call a "larvarium," *viz.*, a very large box, say three feet square and about the same in depth. Proceed as before with regard to earth, moss, &c. The edges of the top of this box must be smoothly shaved to suit the lid, which is like the frame of a slate, the slate being knocked out. This is then covered with gauze. In a box of this size small *branches* may be held in bottles of water, and two or three dozen larvæ safely housed. If placed in a cool room, with plenty of air, they will grow almost as large as if in freedom. It is a most convenient and simple habitation, as nothing is required but to take off the lid, and renew the food when necessary. It is a really pretty sight to see fifteen or sixteen *Notodonta trepida* feeding in such a cage. The number of larvæ to be associated together must obviously be left more or less to the judgment of each individual collector, according to the size of the boxes or cages he employs; but one general rule should not be lost sight of, *viz.*, that the more room they have the better. If there be an exception it is found in the genus *Eupithecia*. Almost any number may be placed together, without any apparent injury. They are most

delightful little creatures to rear, giving no kind of trouble. I may add that, if in the neighbourhood of the flower on which they feed (the vast majority feed on the flowers and seeds of various plants, not trees), there will be no necessity for the "bottle," as they will go on feeding contentedly as long as a seed, or I might almost say a husk, remains. I am sorely tempted to make a digression here, and dilate upon the pleasure of rearing Eupitheciæ. However, I will content myself with strongly recommending my readers to try for themselves. In the 'Entomologist's Annual' for 1861 and 1862, and in the 'Zoologist,' will be found elaborate and accurate descriptions, with the food-plant, time of appearance, &c., of no less than thirty-five species, from the pen of the Rev. H. Harpur Crewe, to whom *alone* belongs the credit of having brought to its present satisfactory state our knowledge of the earlier stages of this truly interesting genus. Let me add that no one is more ready and willing to impart information. Some larvæ will require a stronger covering for the cage than gauze; such are *Dicranura vinula*, *bifida*, *furcula*, *bicuspis* (if you are fortunate enough to find it), *Diloba cæruleocephala*, *Cossus ligniperda*, and some others. These larvæ have powerful jaws, and make short work of gauze. Extraordinary stories are told of the feats of *Ligniperda* in this way. One gentleman writes that he put a larva in a cigar-box, and, having placed it on a piano, left it there. During the night it gnawed through the bottom of the box and the top of the piano; and when he went to look for it in

the morning, it was gone on a voyage of discovery into the inner regions. Another still more remarkable instance is given in the eighth volume of the 'Zoologist, p. 2897:—"I placed half-a-dozen caterpillars of the goat-moth in a glass jar, with sawdust and a piece of willow, and covered the mouth with sheet lead, which was perforated with an awl to admit the air. Three of the caterpillars were to-day crawling on the floor; and on examining the jar I found they had effected their escape by gnawing the lead, having enlarged two of the perforations sufficiently to enable them to pass out of their prison. I have replaced the lead with wire gauze, which I expect will puzzle them." Were it not for the unimpeachable authority (the late Professor Henslow) on which this story is given, I could scarcely have credited it. From what has been said it will appear that *Ligniperda* is a tough customer. For the ordinary wood-boring larvæ, however, a stout square box will do, with a lid or frame covered with wire gauze. The wire gauze may be bent over the edges of the frame, and fastened down with small tacks. I have a box of this kind, the inside of which is dotted over with the cocoons of the various species of *Dicranura*. Other larvæ, as *Acronycta megacephala*, *tridens*, *Psi*, *Diloba cæruleocephala*, &c., are very fond of spinning up in these empty cocoons. It will be observed that, in the case of the larger larvæ, the excrement rapidly becomes mouldy. This may now and then be removed, though, as far as my experience goes, it does not appear to cause any injury. With regard to hibernating larvæ, I am afraid I cannot give

many directions. It is troublesome work. Some require no food, as *Iodis vernaria*, which feeds on Clematis, *Angerona prunaria* on various plants, *Arctia fuliginosa* on ragwort, &c., and other species. In this case I leave them to themselves, in a cage full of moss and the dried plants on which they feed. Many hybernating larvæ, especially among the Noctuæ, must be fed throughout the winter. I have done but little (comparatively) in this branch of rearing larvæ, but from that little I gather that the majority of those which hybernate feed on low-growing plants, and not on trees. However this may be, some even of those which feed on trees will, when in captivity, take to low-growing plants during the winter. The most acceptable of all plants seems to be *Polygonum aviculare*. The plan I adopt is very simple—merely a moderately sized box covered with gauze. In it are placed sods of the food-plant. These must of course be occasionally renewed, great care being taken that the little larvæ are not thrown away with the old sod. The finding the larvæ is perhaps the most troublesome part of the business. I have read descriptions of various kinds of elaborate apparatus for carrying larvæ through the winter; the boxes to have the bottoms perforated with holes; then a layer of gravel, &c., &c. All this appears to me simply gratuitous trouble. I have never found anything more required than a box prepared as above. There is not the slightest necessity for putting the box out of doors. I can speak positively on this subject. It is perhaps as well to put it near an open window, though I have not found it by any means indispensable. An

airy room is sufficient. I have succeeded in rearing in this way *Arctia fuliginosa*, *Epunda lichenea*, *Iodis vernaria*, &c. When, in the early spring, the larvæ begin to feed rapidly and grow large, they must of course be separated, as already directed. If the collector be living in the neighbourhood where the insect occurs, it is perhaps an unnecessary trouble to carry them through the winter, as the larvæ may be found at large in the spring months, by some of the methods already adverted to. Whatever care and pains be taken, it is obvious that "Nature" must be the best nurse and care-taker. I am in the habit *now* of removing the *pupæ* about a fortnight or three weeks after the larvæ have gone down or spun up. I do not assert this to be the best plan; but whether it be so or not there can be no manner of question but that they should be looked at every now and then. I say this while smarting under the recent consequences of neglecting to do so; for no later than the spring of the year 1862, upon examining my cages, I found that the greater part of my most valuable *pupæ* had been devoured by the larva of (as I was afterwards informed) *Tinea pseudo-spretella*. I never was fond of *Tineæ*: ever since, I have hated them; and unfortunately my hatred is constantly kept at fever point, for I cannot get rid of the reptile. I have *boiled* the moss, the earth and the cages, and killed the insect whenever I could lay hold of it, which is no easy matter (N.B. I shall be happy to send a "fine series" of it to any one who will pay the postage), but with comparatively little effect. I now therefore remove the *pupæ* as soon as I



can do so with safety. The period which elapses before the larva turns to a pupa varies with different species. As a rule ten days will be found sufficient for those which *pass the winter* in that state. I have found that of those species which make their cocoons in *spring*, and of which the perfect insect appears in the *autumn*, the great majority remain a long time in the *larva* state before turning. These must of course be left alone at any cost. I may mention the following as coming, from my own knowledge, under this category, *viz.*, *Hadena Protea*, *Miselia Oxyacanthæ*, *Epunda lichenea*, *Cirrhcædia xerampelina*, *Xanthia citrago*, *silago*, *cerago*, *aurago*, and others. As bearing on the subject of looking occasionally at your pupæ, I make the following extract from the 'Intelligencer,' vol. vi. p. 14:—"Slugs and Worms.—I have just made a memorandum to bake all the earth and moss intended for breeding-cages, and so to exterminate the slugs and woodlice, which, small when first introduced into the breeding-cages, grow large and fat through the winter by feeding on the pupæ. I have known a slug crawl in a straight course more than a foot up the side of my cage to get at a chrysalis, and then feast on it till there was nothing left but the empty skin. They will also devour whole broods of young larvæ." The above danger may be obviated, so far as the earth is concerned, by passing it through a five sieve, as already directed. Upon the moss I pour boiling water, which is an effective exterminator.

If I want to describe a larva unknown to me, I separate it, and, having made the best description I can, I

put it (the description) in the box where the larva is feeding, and afterwards with the pupa. Here I wish to urge upon the young collector the practice of taking these descriptions. I do not wish to disguise that it is both troublesome and difficult. But by doing so we not only advance our knowledge, but we have the pleasure of imparting that knowledge to others. I have been enabled to add many insects to my collection by reading the descriptions of larvæ, their food, habitat, &c., which from time to time have been published. I am aware that it is the selfish practice of some to keep their knowledge to themselves, especially in the case of rare species (which, so long as they continue so, are invaluable in filling up gaps); but let my young readers eschew such proceedings. Mr. Newman, the Editor of the 'Entomologist,' will always gladly open the pages of that periodical to these descriptions. In describing a larva Mr. N. requests his correspondents to "call the six thoracic legs, not prolegs, but simply 'legs,' and the abdominal appendages 'claspers.'" It must also be remembered that when referring to the "segments" the "head" is the first.

In breeding, the young collector must be prepared for frequent disappointments. A considerable proportion—I am afraid I must almost add, a majority—of the larvæ taken at large, will be found to have been stung by ichneumons. According to my experience the genera *Notodonta*, *Dicranura* and *Eupithecia* are most subject to the attacks of these odious pests. I have seen three or four dozen emerge from the body of one single un-

happy *Eupithecia*. It is indeed difficult to understand how the unfortunate caterpillar can continue to exist with such a host gnawing at its vitals. It is sometimes a painful, at others a disgusting, and at all times a disappointing spectacle to see the internal feeder make its exit through the skin. In the case of *Ephyra pendularia*, for example, the larva, when full grown, instead of turning into a pupa, assumes a sickly appearance, the colours fade, and the larva, attaching itself by the claspers to a twig or to the gauze, stretches out at full length. This lasts for a day or two, when the anal extremity of the body may be seen to swell or bulge out, and, speedily splitting, the perfectly formed cocoon of the ichneumon is seen. Nothing is left of the original caterpillar but the shrivelled skin. In other cases the (apparently) apodous grubs, three or four in number, will eat their way out, and, clinging round it, will form their cocoons on what remains of the poor larva. In many instances, however, especially among the *Bombyces* and *Noctuæ*, they manage to become pupæ, and the mischief is not known till, in the place of the anxiously expected moth, a ferocious ichneumon makes its unwelcome appearance. This is always done by sawing a circular hole through the capital extremity of the pupa. The rasping sound produced by the jaws of the enclosed ichneumon during this operation may be plainly heard, and may be termed the death-knell to the collector's hopes. It frequently happens, however, that the presence of an ichneumon in the pupa may be detected long before the insect emerges, for the shell will after a while burst, and disclose

another pupa, *viz.*, that of the enemy. Again, when the perfect insect of a butterfly or moth is about to emerge, it is well known that the posterior segments of the pupa become elongated, through the efforts of the imprisoned insect to escape. Should this occur in a chrysalis which is to *pass the winter* in that state, within some days, or even weeks, after its turning, you may be certain an ichneumon is there. If opened at once, the larva will be found; if a little later, the soft imago. But to return to the young collector's disappointments. From what has been just said it will be plain that larvæ hatched from the egg offer much the best chance of successful rearing. But numerous perils, even in this case, have to be encountered and surmounted between the cracking the egg-shell and assuming that of the pupa. Some of the brood, especially when very young, will die in moulting their skin; others from various diseases to which caterpillar flesh is heir. Though, to use correct medical phraseology, the prognosis and diagnosis of many of these diseases are known, unhappily a proper course of *treatment* yet remains to be discovered. Such diseases are—cholérine, muscardine (whatever that may mean), the growth of Fungi or vegetable parasites on the bodies of the larvæ, &c. These may possibly originate from over-crowding, want of sufficient air, or damp; but very little, if anything, seems to be known about them. The most unaccountable, however, and at the same time the most irritating, thing is to see the larvæ die off, when they are full fed or nearly so, without any apparent cause or reason. I will instance two cases that

have recently occurred to myself, so that beginners may see that the "old hands" are often disappointed as well as the young ones. Last year (1861) a friend sent me a number of eggs of *Epunda lichenea*. As the larvæ were to hibernate, I prepared a box for them, and supplied them with groundsel and chickweed. With some little trouble I carried them through the winter. In February and March they fed up rapidly and well, and towards the end of April I had about fifty fine full-grown, healthy-looking larvæ. I was daily expecting them to go down, when from some, to me at least, mysterious and unknown cause, they began to die off one by one, until only twelve remained: these became pupæ. The other case was that of the eggs of a *Eupithecia* sent me by Mr. Crewe, last May. These hatched in due time, to the number of about forty as well as I can remember. They have been feeding up to the present date (end of September). During that period, however, first one and then another dropped off, and on the 26th of that month the last died, not even *one* having turned to a pupa. This is of course discouraging, not to say disheartening; but the Entomologist will act wisely in adopting two of Jacob Faithful's mottoes—"No use in crying," and "Better luck next time." I think I have now said all that is likely to be of service, or to interest, on the subjects of finding and rearing larvæ. It only remains for me to add under this head that I hope the foregoing instructions may be of use to the *beginner*. As he advances he will find that "Necessity is the mother of invention,"

and will doubtless strike out new, and very possibly better, methods for himself.

PUPA.—Copious directions under this head are already before my readers. I, in common with others, have often been asked what is the best way of *preserving* pupæ. It is very difficult to give any good or *safe* advice on this point. In a little book by Mr. Richard Shield, called ‘Practical Hints respecting Moths and Butterflies,’ is a description, which I copy, of a box for rearing the pupæ of *Micro-Lepidoptera*:—“Obtain one or more boxes of any convenient length or breadth, but not less than six inches in depth (either divided into compartments or not), and fitted with a lid, having a large space cut out of it to within an inch of the margin; this open space to be covered with either close-wove wire, or old calico affixed with thin glue. In the bottom of the box, or of each compartment, bore with a centre-bit one or more holes, about two-thirds of an inch in diameter; cover these with pieces of perforated zinc, tacked down; place on the bottom of each box or compartment moderately sized pebbles or sea-gravel, to the depth of about half an inch, and on this again, to the depth of two inches, the earth on which to lay the pupæ, composed of garden mould, silver sand, and thoroughly rotten wood from the heart of an old tree; on this, after being made smooth, distribute your pupæ in such a manner, according to their size, that, when covered, none are more than half an inch below the surface, and cover the surface of the mould with a layer

of moss about half an inch thick. The inside of the box should be rough, and the box itself should be raised on pieces of wood, or have pieces of wood fixed to the bottom in such a manner that it may stand clearly above the floor. By this arrangement you may damp your pupæ with impunity, as it is impossible for them to become saturated with stagnant water, owing to the bottom drainage, and the moss at the top prevents undue evaporation by absorbing a certain quantity of moisture, and thus striking a medium between the two extremes of wet and drought." I have given *in extenso* the description of this very elaborate apparatus, as some may like to try it. It may very possibly be *necessary* for the successful rearing of the Micro-Lepidoptera, and will doubtless serve also very well for larger pupæ, if the collector be disposed to take so much trouble. At the same time I feel bound to say that, in my judgment, it is not required. A box of any kind, provided it be not less than six inches in depth, answers the purpose. It should have *rough* sides, and of course a gauze-covered lid. I do not know why Mr. Shield recommends "close-wove wire." A thin coating of fine sifted garden or any other mould may be laid on the bottom of the box, and, if you like, some moss upon it. Only be careful first to *boil*, and then *thoroughly* dry, the latter. For all the larger pupæ—meaning, by this, Sphingidæ, Bombyces and Noctuæ—as far as I can see, nothing more is required than simply to lay them on the moss, and then—leave them alone. For the smaller pupæ I have, during the last two years, adopted a different plan, which

I would at least recommend as worth trying. I procure a number of lids of *tin* boxes, or shallow white jam-pots, in which, having taken the pupæ out of their cocoons, I simply place them. My idea in doing so is that the *coolness* is of advantage, and I have certainly succeeded, since I employed this method, in rearing a larger proportion than heretofore. I put all the pupæ of the same species in one of these lids or jam-pots, with a label having the name (if I know it) of the insect. I am thus enabled to form a tolerably accurate idea both of the quantity and quality of what I have. The especial merit which Mr. Shield seems to claim for his apparatus is that you are thus enabled "to damp your pupæ with impunity." Possibly. But, whether right or wrong, I have long since decided in my own case, *not* to damp pupæ. I have already endeavoured to show, in another place, ('Zoologist,' 8008), that, in my opinion, pupæ in a state of nature do not require moisture. As some of my readers may not see that periodical, I will venture to make a few extracts from that communication. It was made in reply to a question asked by the Rev. E. Horton, "Are pupæ killed by floods?" :—"Mr. Horton considers that this question may have some bearing on the disputed point as to whether pupæ in confinement should or should not be damped. I agree with him. At least it suggests the inquiry. In former years, as Mr. Horton rightly observes, I felt doubtful on the subject; but later experience has convinced me that, on the whole, it is better *not* to damp them. On the supposition that in their natural state pupæ require and have moisture,



some collectors have felt themselves bound to try and supply it, and in doing so have experienced much difficulty in applying it in such a way as, on the one hand, not to give too little, or, on the other, too much. I am, however, most decidedly of opinion that this supposition is incorrect, and is not warranted by facts. There is one fact which every skilled pupa digger must have observed, *viz.*, that in the vast majority of cases pupæ are found on the northern or eastern sides of the trees, *i. e.*, the sides least exposed to rain. Moreover, so far from the larvæ choosing damp or moist places, the reverse is the case, as every pupa digger knows. I am so satisfied now on these points that I rarely trouble myself to examine the moss, or dig, except on those sides or in dry places. From these well-known facts I infer, nay conclude, that pupæ in a state of nature do not necessarily require moisture, or at any rate, very little." There is doubtless a humidity in the open air which may be of service to them, but, as that perhaps cannot be obtained in-doors, we must be content with a good airy room. Some pupæ, however, *must*, I believe, be kept moist, as various species of *Leucania* and *Nonagria*. I cannot venture to give any advice as to the best method of keeping them so. In fact, before dismissing the subject, I may remark that there is no part of collecting in which it is more difficult to give advice, or in which the beginner will be more called upon to trust to his own wits and experience, than that of the best way of preserving pupæ. If it be desired to "force" them—that is, to make the perfect insect

“put in an appearance” before the usual time—it may be done by putting them in a green-house or hot-house, if you have one. If not, I have found it a very successful plan to place them (in a box with a little earth and moss) on the chimney-piece in a room where a fire is kept constantly burning. It has been thought by some that this tends to *cripple* the insect. I have never found this to be the case. It must, however, be borne in mind that if you want them to “pair,” in order to obtain eggs, you must not force them, as in this case the food-plant would not be ready. I may, perhaps, observe that if the pupa be taken out of the *cocoon*, it is a good plan to place it on its “face.” If laid on its back or side, it will not unfrequently happen that the moth, having cracked the shell, will be unable to get rid of that part of it which contains the legs. This will inevitably result in a “cripple.” It may be a fancy only on my part, but I think that this catastrophe is less likely to occur when the pupa is placed, so to say, “on its legs.” If the pupa is *not* removed from the cocoon, I cut out a little circular bit, some short time before the expected appearance of the moth, so as to enable it the more easily to creep out. If the pupæ are left undisturbed in the moss or earth, these proceedings are of course unnecessary. Though, as already observed, I am myself an advocate for removing pupæ, it is but fair to confess that, in doing so, one increases the likelihood of cripples, from the fact that they thus want that natural *purchase* which is supplied to them when buried in the earth, or spun up in moss, &c. The choice of the two methods must be left to the

discretion of the collector, only observing that if the former (the removing them) be adopted, the pupæ should be left on a *rough* surface.

IMAGO.—In the remarks which follow under this head, as to catching, setting, preserving, &c., &c., I have drawn from three sources—the observations scattered through the pages of the ‘Zoologist,’ ‘Intelligencer,’ and other works on Natural History; the observations and hints of friends; and my own personal experience. I have done so that, where there are two, three or more methods of doing the same thing, the beginner may choose that which strikes him, and that I may not appear to lay down my own opinion as infallible. At the same time, where I think my own plan the best, I have not scrupled to say so. I must also ask the indulgence of my readers, if, in what follows, I appear at times *discursive*, since, where there are so many points to be considered, it would be difficult, not to say impossible, to preserve a strictly connected arrangement.

I shall consider, first, *localities* for insects in the perfect state, commencing with the butterflies, or day-flying species. Some are *rare*, that is, uncommon *everywhere*, as *Pieris Daphidice*, *Argynnis Lathonia*, *Lycæna Acis* and *Vanessa Antiopa*; others are *local*, that is, confined to a particular district, county, or even field, but in comparative abundance there; such are *Papilio Machaon*, *Erebia Cassiope*, *Erebia Blandina*, *Lycæna Arion* and *L. Actæon*. Others are common everywhere, as *Satyrus Janira*, *Vanessa Urticæ*, &c., &c. Again, it is to be

observed of butterflies *in general* that different species, whether common or uncommon, are found only in localities of a certain *description* or *kind*, beyond which or without which it is vain to look for them. Thus, for example, some species are to be found only in *woods* or the borders of woods, as *Limenitis Sibylla*, *Apatura Iris*, *Leucophasia Sinapis*; others in marshes; others in mountainous, chalk or heath districts; others in fields and meadows. It would be impossible, in such extensive Orders as the Bombyces, Noctuæ and Geometræ, to give the separate localities for each species; but as the "butterflies" are only sixty-five (sixty-four if *Polyommatus Artaxerxes* be merged) in number, and as they are generally the Order first attacked by the enthusiastic beginner, I will, as far as I am able, draw out here a list of the *kind* of localities they frequent:—

Woods or borders of woods—*Pieris Cratægi*, *Leucophasia Sinapis*, *Satyrus Ægeria*, *S. Hyperanthus*, *Limenitis Sibylla*, *Apatura Iris*, *Vanessa C-album*, *Argynnis Paphia*, *A. Aglaia*, *A. Adippe*, *Melitæa Selene*, *M. Euphrosyne*, *M. Athalia*, *Nemeobius Lucina*, *Thecla Betulæ*, *T. Quercus*, *T. Rubi*, *Lycæna Arion* and *L. Argiolus*.

Fens and marshy places—*Papilio Machaon*, *Melitæa Artemis*, *Polyommatus Hippothoë*.

Dry hilly meadows—*Arge Galatæa*, *Satyrus Semele*, *S. Tithonus*, *Chortobius Pamphilus*, *Vanessa Cardui*, *Lycæna Adonis*, *Syricthus Alveolus*, *Hesperia Paniscus?* *H. Comma*.

Mountainous districts and moors—*Erebia Blandina*,  
*E. Cassiope*, *Chortobius Davus*.

Generally distributed throughout lanes, meadows, &c.,  
 &c.—*Gonepteryx Rhamni*, *Colias Edusa*, *C. Hyale*, *Pieris*  
*Brassicæ*, *P. Rapæ*, *P. Napi*, *P. Daplidice*, *Anthocharis*  
*Cardamines*, *Satyrus Megæra*, *S. Janira*, *Vanessa Ata-*  
*lanta*, *V. Io*, *V. Antiopa*, *V. Polychloros*, *V. Urticæ*,  
*Argynnis Lathonia*, *Thecla W-album*, *T. Pruni*, *Polyom-*  
*matus Phlæas*, *Lycæna Alsus*, *L. Alexis*, *L. Ægon*, *L.*  
*Agestis*, *Thanaos Tages*, *Hesperia Linea*, *H. Sylvanus*.

Chalk—*Lycæna Adonis* and *L. Corydon*.

*Melitæa Cinxia* and *Hesperia Actæon* are found re-  
 spectively in the Isle of Wight and Lulworth Cove, Dor-  
 setshire; but I do not know what particular kind of  
 locality they frequent.

It is "long, long ago" since I collected *butterflies*,  
 having obtained all the species, except three or four;  
 but it is probably the happiest period of the collector's  
 entomological career. Then *everything* is rare; and I  
 look back with something very like regret to the time  
 when I used to pin, with pride, a number of *Satyrus*  
*Janira* into the crown of my hat, and think it a good  
 day's work, or gloat over a specimen of the "Silver Y."  
 But, once more to business. I need scarcely remark  
 that bright, sunny days are the days for butterfly-  
 hunting. There are no baits or attractions for them  
 but flowers, and if captured at all it must be by dex-  
 terity of hand, or sheer speed of legs. There are, I  
 believe, two kinds of net commonly employed for this

purpose. The one consists of a hoop or ring of iron (sometimes cane), about three feet in circumference; if of iron, it should be as thick as a pipe-stalk. It may, however, be made as large or as small as the collector wishes. The *larger* it is, the better chance of entrapping the insect; the *smaller*, the more easy to wield. To this ring is attached a bag-net, about two-and-a-half feet in depth, made of green gauze. Some prefer white: in my judgment green is the best. To prevent the edges from being frayed, a strip of stout calico should be sewn round the hoop, and the gauze fastened to it. The hoop must next be screwed into a stick (the lighter the better), and the instrument is complete. For all ordinary purposes a stick three feet long is amply sufficient. For some of the high-flying butterflies, as *Apatura Iris* and *Thecla Quercus*, a much larger handle will of course be required. For *Geometræ*, which may be found in the *daytime* by beating hedgerows, trees, shrubs, &c., a much smaller net, which can be easily wielded with one hand, will be found very serviceable. The net in this case may be two feet in circumference, a foot and a half in depth, and the handle about a foot. With the ordinary net described as above, I suppose the anxious and excited beginner to be in a wood, about eleven A.M., on a bright summer's day. It is little use trying for butterflies before this hour. He walks slowly down one of the ridings; his eyes everywhere; the net firmly grasped in both hands. Suddenly something, shining gorgeously in the sun, sails past him, and settles on a flower or shrub some half-dozen yards in

advance of him. "It is *Argynnis Paphia*, fresh from the chrysalis!" With stealthy step and bated breath, and trembling with excitement, he creeps nearer and nearer, his eyes glued to the glorious creature, as, with expanded wings, it basks in the sun. Just as he gets within distance, however, there is an ominous folding of the wings. (most collectors will know what I mean) preparatory to flight. Rashly he makes a strike. He is one inch short of the mark, and the next moment *Paphia* is over the tops of the trees. But if better fortune attend him, a dexterous sweep, and a quick turn of the net with the wrist, and the prize lies imprisoned at the bottom, where for the moment we will leave him. Again, to vary the scene. I see a strange, and at first sight an unaccountable, spectacle! It is that of a young man rushing frantically through a field of clover under a burning sun. In his right hand is held aloft, and brandished like a banner, a bag-net. His hat is gone, his coat-tails are streaming behind him, and from the aforesaid coat-tails proceeds a strange and mysterious rattling, as of pill-boxes. About two yards in front of him is a bright orange-coloured butterfly. His eyes are fixed with un-deviating steadiness on that butterfly. It nears a lofty hedge. One mighty effort,—a vigorous sweep of the net,—the butterfly sails calmly over the hedge, and the young collector falls flat on his face! These little catastrophes will happen, and not unfrequently; nor is the slight, perhaps, but inevitable ruffling of the temper, produced by them, much calmed down by the encouraging remark from a *cool* and unsympathizing

bystander of "Go in and win!" just when you have lost. But, supposing the butterfly safely housed, try and get him into the *corner* of the net. Above all things, avoid being in a flurry. I know it is a trying thing to see a beautiful specimen fluttering in the net, and to fear that it is injuring itself while so doing. But be assured that being in a hurry will not mend matters. Never attempt to lay hold of a butterfly while it is *fluttering*. When it rests, and its wings are raised up over its back, then dexterously seize it through the net by the legs, and give it a good squeeze. This will do very well for large butterflies; but I shall have a good deal more to say on this matter hereafter.

The other net, to which reference has been made, is called a clap-net. As I am not familiar with either the make or use of it, I shall quote the description given of it by Mr. Newman, in his 'Familiar Introduction to the History of Insects.' He says:—"The clap-net is the grand weapon of the Entomologist. This is a large piece of muslin, four feet long and nearly three wide, supported on two light rods, which pass along a border made of brown holland or other strong substance, bend towards each other at an obtuse angle, and meet at the top of the net. One of these rods is held in each hand, the handles being the parts uncovered; the net is fixed to each rod by means of a piece of tape, which passes through a hole made in the rod, and is tied firmly in a bow. The rods of the clap-net are each composed of five pieces united by ferules; when taken to pieces, and placed in the net, the latter may be folded in a very



moderate compass, slipped into a brown holland case, and put in the coat pocket. For this kind of net both green and white muslin are used, but white is much the best, as the small insects are more readily distinguished on it [I do not agree with Mr. Newman on this point]; green muslin, however, has the merit of being less conspicuous, which under some circumstances is an advantage. . . . This net is the best for pursuing butterflies and moths on the wing; the hunter tries to get the net under the object, and strikes upwards, closing the rods at the same time. A loose bag is formed, by a fold of the muslin, across the bottom of the net; this prevents anything from getting out." Mr. Newman does not give any directions as to how the *collector* is to get the insect out; neither can I.

Either of these nets is very good. I prefer the former, probably for the simple reason that I have always used it, and have become accustomed to it.

It is essential to a successful butterfly expedition that the day be warm and sunshiny, though an intensely hot or very sultry day is by no means the best. Butterflies are rarely on the wing before eleven A. M., or after four P. M. The most likely localities, *in general*, are—open glades and ridings in woods, and especially flowery meadows in or on the borders of them; lanes; fields, particularly clover; heath; chalky districts, &c.

With regard to *moths*, including under that head the Sphinges, Bombyces and Noctuæ, they, like the

butterflies, may be classed as rare, local and common. Many of the Sphinges fly by *day*, and are captured like butterflies. Such are Procris Statice and P. Globulariæ, the genera Anthrocera, Sesia, Sphecia and Trochilium. Macroglossa Stellatarum is also a day-flyer, but is by no means easily captured. The larger Sphinges are generally taken in the larva state, excepting perhaps Chærocampa Celerio. The young collector should carefully look out for what are called "Clear-wings," *i. e.*, the different species of Trochilium, Sesia, &c., for they so closely resemble bees, wasps and ichneumons, as easily to deceive an inexperienced eye.

There is only one way of taking Bombyces (I mean the *perfect insect*) which offers a reasonable prospect of success. This will be spoken of hereafter. They may, however, occasionally be found in the daytime by beating, or settled upon the trunks of trees in woods. I have no hesitation whatever in saying that the two *best* methods of procuring Bombyces are pupa digging and larva hunting, and these are the two methods I should recommend, not only to the beginner, but to all collectors.

With regard to Noctuæ, speaking of *day* hunting, little, comparatively speaking, can be done. The assiduous collector will, indeed, not unfrequently be rewarded by finding good insects settled on the trunks of trees in various localities. N.B. The northern and north-eastern sides are the favoured localities.

In the Geometræ much more (perhaps more than at

any other period) may be done during the day. They are very fond of settling on trunks, which, when in woods, should be carefully examined. It is astonishing how accurately, after a little practice, the eye will learn, even at a considerable distance, to detect the presence of a moth on a tree or elsewhere. Geometræ, moreover, are much less *exclusive* in their habitats than most other insects. They may be found almost anywhere—indoors and out of doors, in hedges, grass, trees, shrubs, heath, flowers, meadows, &c. On a dull day, when there are no butterflies out, or you don't want them, take a light stick and the small net described above. Beat the hedges, trees, &c., and as the moths fly out you can easily capture them. I must, in passing, urge upon the beginner the necessity of thoroughly searching a locality. The reasons for this are obvious:—1st. The food-plant may be rare, or only in scattered patches, and consequently the moth will be more or less confined to those spots. 2ndly. The atmosphere, even in the daytime, has a great influence upon insects, at one time inducing sluggishness, at another activity. In the former instance beating is almost useless, while in the latter a tap will set them flying in all directions. It is plain therefore that assiduous and constant beating, even in an apparently unproductive locality, is desirable. 3rdly. There can be no doubt that many species have fixed hours for emerging from the pupa, and rare insects have been found drying their wings where, an hour or two afterwards, no amount of beating or

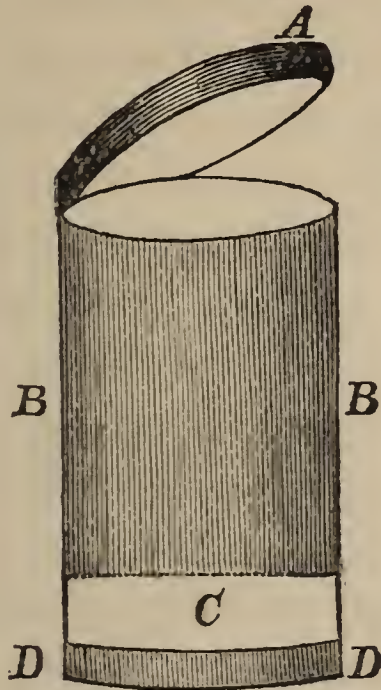
searching would detect them; for it may, I think, be laid down as an almost invariable rule that an insect, as soon as it has thoroughly dried its wings on a trunk, stalk, &c., will then creep down and hide itself in the surrounding herbage. 4thly. From some cause or causes at present unknown, an insect will be plentiful to-day, and wholly disappear to-morrow. Many and many a beginner (myself among the number) has been deceived in this way. "Oh, that's a common thing! I can take it at any time." How often has this been said! But a few days afterwards a friend perhaps writes and says, "I should feel much obliged for some specimens of ~~A. ruficornis~~, as I hear it is common with you." Accordingly, next morning you take your net, and, full of benevolent intentions, you arrive at the favoured locality, bringing an unusually large collecting-box, or a number of pill-boxes, for the purpose. But the insect has disappeared! In vain you thrash the trees, or kick up the herbage; in vain you cast a searching and scrutinizing look above, below, around. Not even a wasted specimen is to be seen. On your return home you sit down to the unpleasant (I speak from experience) task of writing to your friend to say that you are very sorry you cannot send him the insect *now*, but you hope to take it again next year, and will be sure to remember him. But, my young friend, when next year comes, you may be a couple of hundred miles away, or the insect may not appear in its old haunts. Of this latter occurrence we have a very remarkable instance in the

case of *Erastria venustula*. It is on the authority of no less a person than Mr. Henry Doubleday. "On the 29th of June (1845), whilst walking with a friend through a heathy part of the forest, I observed several specimens of this pretty little species flying over and alighting upon the common fern: not having any entomological apparatus with me, except a couple of pill-boxes, I only secured two specimens. The next day I again visited the spot, but could not see a single individual. Mr. Bentley informs me that his father captured this insect in our forest more than forty years ago; but I believe no one has since met with it in Britain, except myself; at least I am not aware of any other captures." ('Zoologist,' iii. 1085). Observe, forty years had elapsed between Mr. Bentley's and Mr. Doubleday's capture of this insect. Nor is this all. Mr. Doubleday took his specimens in 1845. The insect then again disappeared, and was not re-discovered till 1860,—a period of fifteen years. Many like instances might be brought forward (as *Micra ostrina*); but this will be sufficient to show that we should not "put off till to-morrow what may be done to-day."

To return to the subject of beating. When a moth is *in* the net, the next question is how to get it *out*, and this is by no means so easy a matter as at first sight might appear. The way in which this is commonly done is by "pill-boxing." A box large enough for the purpose is inserted into the net, and the moth, being beguiled into it, is transferred to the coat pocket. *How* this operation of getting the moth, when in the net, into

the pill-box is best done, I must leave to others to explain. It is a method I have never adopted, for several reasons. Should my readers, therefore, be disposed to select it, I must leave the manipulation to themselves. The following plan I *strongly* recommend, as the easiest, safest and most expeditious. Procure three or four tin boxes of the following description:—The shape must be *oval*. Breadth, longest way, two-inches and six-eighths; shortest, two inches. At one end is a lid made to open and shut easily, by means of a flexible hinge. At the other end is a similar lid. About an inch and a quarter from this lid have inserted a tray pierced with a dozen or so of holes, about the size of an ordinary knitting-needle, and the box is complete. The depth of the entire box, including the false bottom, may be four and a half inches. When about to use it get eight or ten laurel-leaves, and bruise them with a hammer to nearly a pulp. Put this pulp into the false bottom, and close the lid firmly. It is perhaps as well to make a mark by which the lower lid may at once be distinguished from the upper. Having your moth in the net (the net being held in the left hand), with the right hand cautiously insert the box, with the upper lid raised about an inch and a half or a little more. The box must be held in the following manner:—The lid is held up by the thumb, the forefinger rests lightly *upon* the lid, while the box itself is held by the remaining fingers, the lower part of it resting against the wrist. If the insect be at rest, get the *edge* of the box *under* it. When this is done, move up the box until it touches the insect. In

ninety-nine cases out of a hundred it will jump backwards, *i. e.*, into the box. Now is your time. Press the



lid down, and the business is done. The accompanying little diagram may help to an easier understanding. A, the lid raised for the purpose of capturing; BB, body of the box; c, space for the laurel-leaves; D, bottom lid; dotted line, pierced tray to admit the fumes to ascend. The advantages of this plan are many. It is *easily* done, a little practice making perfect. It is *quickly* done, and it prevents the possibility of the insect rubbing itself or fluttering about. If the laurel-leaves (which had better be renewed every second, or at farthest every third, day) be fresh, the stupifying effect is almost instantaneous, and in a few seconds the insect may be turned out on to the hand and examined. If too much rubbed, or if not wanted, it may be thrown away, with the comforting assurance that it will soon

recover again, if not kept too long in the box. If it is wanted, I shall explain hereafter the subsequent steps necessary to be taken. If the insect is fluttering about the net, it will be better to wait till it settles. When, however, you have become *accustomed* to use the box, you will find that it may easily be incarcerated, even when flying. A box of this kind will answer for all *butterflies*, as well as for Sphinges, Bombyces, Noctuæ, Geometræ and Pyrales. I do not, of course, include the very large ones. I know of no plan for these (if in the net), except a good squeeze under the thorax. You must do this as well as you can.

We may now suppose the day drawing to a close, and with it we bid farewell to the butterflies. On warm, dusky summer evenings, moths of all Orders begin to fly. The first to appear, generally, are the Geometræ. From about eight till a little after nine they may be captured with the net, as they flit about the hedgerows, or open places in woods. The Bombyces and Noctuæ, being such rapid flyers, are not easily captured in this way, unless hovering over or settled upon some favourite flower. Mr. Brown, of Burton-on-Trent, recommends the following plan, *viz.*, "to choose the margin of a wood well hedged, and the ditch filled with herbage, by the side of which I walk, holding in my left hand a small pocket lantern, with a bull's-eye glass, secured by a ribbon round my neck; and in the other hand a bag-net. The moths will ever and anon make their appearance from among the trees, and will skirt along the hedge; and if the lantern be turned towards the wood, they may



be struck with the net the moment they appear within the illuminated disk. By this means I have caught many species which could not be allured by a stationary lamp." ('Zoologist,' i. 178). Another method is, to fix a large white sheet across a riding in a wood, and to place on one side one or more lanterns. I have only once seen this plan tried, and on that occasion it was a failure; but it was a bad night, and no moths were flying. I can easily suppose it a most excellent trap, for the glare of light on a dark night is prodigious. When the dazzled moth settles on the sheet, he or she can be boxed at once.

It is scarcely necessary to say, however, that the great attractions for moths (Noctuæ) are "sweets," whether natural or artificial. The following list of some of their favourite flowers is taken from the 'Zoologist':—

*Honeysuckle*.—"In the neighbourhood of Ely, where *Chærocampa Elpenor* and *C. Porcellus* are more plentiful than they are here, I have taken several specimens of each from this plant, with a few of *Sphinx Ligustri*, *Cucullia umbratica* (in abundance), *Plusia Iota* and *P. Chrysitis*."

*Jasmine and Valerian*.—"Among others I have taken from it *Chærocampa Porcellus*, *Trochilium Tipulæformis* and *T. Myopæformis*, *Hecatera Dysodea*, &c."

*Bladder Campion*.—"I have taken from it *Noctua triangulum*, *Dianthœcia carpophaga* and *D. capsincola*, *Aplecta advena*, &c."

*Reed*.—"From the blossoms of some reeds growing

by the side of a small plantation near Ely, I captured, on the 19th and 21st of October, specimens of *Orthosia Lota* and *O. macilenta*, *Glæa spadicea*, *Miselia Oxycanthæ*, *Nonagria crassicornis*, &c.”

*Barberry*,—“the golden blossoms of which are remarkably attractive to *Hadena plebeia*.”

*Raspberry*,—“which is very attractive while it lasts, and is visited by *Aplecta advena*, &c.”

*Tansy*.—“An especial favourite with the genus *Plusia*.”

“The common *sage* is very attractive in some seasons.

“The *pink* is also an attractive flower.”

“In addition to Mr. Gaze’s list, I have found the following flowers and shrubs attractive to moths, *viz.*, the French and African marygolds, the white verbena, sweet scabious, all the thistles, the common laurel, &c.” (*Zool. passim*).

In addition to these I may name, from my own experience, *gooseberry trees* when in flower, *syringa*, *ragwort*, *petunias*, *privet* and *nettles*. I know of no shrub more attractive than *syringa* when in full blossom. It and the lime tree, under similar conditions, will, on favourable nights and in favourable localities, absolutely swarm with insects. It appears difficult, at first sight, to understand what attractions *nettles* can present to moths. That they do attract, however, I have had ample proof. It is the *leaves*, not the flowers, which they frequent. Whatever be the cause, on certain evenings throughout the summer and autumn, nettles, in ditches or waste places,

will be found peopled with moths. A bull's-eye lantern is necessary. With this you examine the leaves, and on favourable nights the moths will be seen either crawling about, or imbibing the nectar, whatever that may be. Here the "tin box" will be found invaluable. It is no joke, I fancy, "pill-boxing" a moth among nettles. With the tin box both leaf and moth can be secured together with one hand. It is difficult to avoid getting stung even in this case, but you are much less likely to be in this way than in the other, to say nothing of only *one* hand being endangered. In a small orchard, bordered with a quantity of nettles, close to my house at Brandeston, in Suffolk, I took myself, in one year, fine specimens of the following thirty-eight species:—*Epione vespertaria* and *E. apiciaria*, *Ellopia fasciaria*, *Acidalia imitaria*, *Timandra amataria*, *Cidaria psittacata* and *C. miata*, *Leucania conigera*, *L. lithargyria*, *L. comma*, *L. impura*, *Xylophasia hepatica*, *Apamea gemina*, *Miana strigilis*, *M. fasciuncula*, *M. furuncula*, *M. literosa* and *M. arcuosa*, *Agrotis suffusa*, *A. Segetum*, *A. exclamationis* and *A. corticea*, *Noctua Augur*, *N. C-nigrum*, *N. plecta*, *N. triangulum* and *N. festiva*, *Orthosia Lota* and *O. macilenta*, *Anchocelis rufina*, and *A. pistacina*, *Xanthia cerago* and *X. silago*, *Heliothis marginatus* (once), *Hypena rostralis* and *H. crassalis*, *Pyralis glaucinalis*. I have been thus particular about "nettles," as I am not aware that any one, excepting myself, has paid any attention to them. The above list will show how much may be done by those who don't mind a little stinging. There

are not many "rarities" in the list, it is true; but beginners must "begin at the beginning."

A privet hedge in full bloom is a wonderful favourite, and should never be neglected. In the miserable summer of 1860 I was at Ringwood, in Hampshire. Just outside the town, bordering the high road, was a fine hedge of this kind. Whatever moths *were* out that summer came to the privet hedge, and nothing else. Sugar was of no use at all. It was interesting to watch with what unfailing regularity the moths, led by the appetizing odour, came sailing over the fields or the road, and settled down. Some do this at once, while others are restless and apparently fastidious, creeping from one flower to another till they find one to their liking. On this hedge I took two splendid specimens of *Triphæna subsequa*.

*Petunias* and *verbenas* seem to be the weak point in the characters of those rare and beautiful insects, *Deilephila Galii*, *D. lineata*, and *Chærocampa Celerio*.

I have reserved to the last the two most famous *natural* baits for moths, *viz.*, *sallows* and *ivy*. The *sallows*, when in bloom, must be examined with a lantern, or, if you have a companion, he may hold a sheet or the clap-net under the tree while you shake it. The moths will fall helplessly down, and may be boxed at leisure. For my own part, I do not think *sallows* are to be compared with many of the shrubs already named. Very few insects are out at the time when *sallows* are in bloom. The greater part, nevertheless, of the genus *Tæniocampa* may be taken in this

way, and in it are some decidedly scarce species, as *T. opima*, *T. leucographa* and *T. Populeti*. The commoner species are much more easily and satisfactorily taken by pupa-digging. I do not at all deny that other species may be taken at willows, but they are mostly autumnal species which have hibernated; consequently their appearance is not improved. It is, however, an important consideration that, in general, insects do not pair till after hibernation. Thus, eggs of many rare species are procured from these wasted females, as *Croceago*, *Rubiginea*, *Petrificata*, and *Conformis*. Next, as to "ivy bloom." An old wall or ruin, covered with ivy in full blossom, is as attractive to the collector of moths as to the moths themselves. Of all outdoor methods of capturing insects, this is, to me, the most exciting, not excepting even "sugaring." My first introduction to "ivy bloom" was many years ago, at Almondsbury, near Bristol. Near the house in which I was staying were walls upon walls burdened with ivy, and laden with its fragrant blossoms. I had only one night at it, but it was a favourable night, and I shall never forget it. As the lantern was slowly passed along, first one and then another pair of eyes gleamed and shone in the light, like gems. *Phlogophora meticulosa* reigned supreme in point of numbers; then there were *Calocampa vetusta* and *C. exoleta*, looking not unlike sausages; the delicate *Xylina semibrunnea* and *X. petrificata*, besides many common species *ad libitum*. To a beginner, as I then was, it was indeed a glorious and exciting spectacle. In addition to the

two last-named, the great prizes at ivy bloom are *Camptogramma fluviata*, *Agrotis saucia*, *Hoporina croceago*, *Dasycampa rubiginea*, and some others. All the autumnal Noctuæ, and some Geometræ, frequent the ivy: and I think I may safely say that as an attraction it is unequalled; while in bloom, sugar is of scarcely any use if applied in its neighbourhood.

There are several ways of *capturing* insects at ivy. My own plan (when the ivy is within easy reach) is simply to examine it with a lantern in the left hand, while in the right I have the tin box. If I see an insect I want, I get it into the box in the manner already described, *i. e.*, place it under the insect, and tilt it in. If, as will not unfrequently happen on ivy, the insect is sluggish, and wont be persuaded to drop into the box, I enclose both the insect and the spray on which it is feeding. When you expect insects to be plentiful, you should have *at least* two of these boxes with you. If the laurel leaves are quite fresh, you may allow three or four moths to be in the box together at the same time, as they will not injure each other, unless the box be knocked about. To prevent this, and at the same time to increase the stupefying effect of the poison, as I capture each moth I put the tin box into my trousers pocket. About every three minutes or so, if the insects are abundant and my boxes are full, I place the lantern on some convenient place (if I have a companion he holds it), and then turn the moths out on to my hand. Selecting such as I may want, I pin them at once with a very fine pin; and stick them in the collecting-box. If

any scruple be felt at leaving them alive and pinned, it may be obviated by killing them on the spot (as described hereafter) with oxalic acid. For this purpose I carry in my waistcoat pocket a small well-stoppered bottle and a steel pen.

Another plan is "pill-boxing." If the collector be alone, he must, in this case, have the lantern suspended round his neck, and (I suppose) fastened in some way, to prevent its swaying about. He then walks sideways, like a crab; and when an insect is seen he takes the pill-box in his right hand and the lid in his left, and inveigles it into the box, which is put into the coat-pocket. I give this method of operation subject to correction, for I have never tried it. Both methods have their advantages and their drawbacks. The objection (which I readily allow) to my plan is that it takes up more time. But, on the other side, it has the advantage of leaving one hand free, which is a great desideratum. This of course cannot be the case in the other plan, as it is obvious that *both* hands *must* be employed in pill-boxing. Again, while it is not to be denied that time is taken up in turning out, pinning and killing the insects, there is this counterbalancing satisfaction—you *know* that they can't be *spoiled*. Now, in pill-boxing it is allowed that *some* are almost sure to knock about, and so injure themselves. Consider also the feverish state in which you are kept lest that "Rubiginea" or that "Petrificata" is spinning about in the pill-box! The state of the case, then, seems to be this:—by pill-boxing you obtain probably *more* insects, but with an increased risk of

injury; by tin-boxing probably *fewer*, but with the agreeable conviction that such as they were when you boxed them, such they will remain. To save future repetition I may observe that these remarks apply equally to "sugaring," of which I shall have to speak shortly.

When the ivy is *beyond* reach, another method, differing from either of these, must be had recourse to. I give an excellent and simple one, first shown to me by my much-esteemed friend Mr. Birchall, than whom I do not know a more enthusiastic or indefatigable collector. The lantern, which should be a small one, is fixed on the top of a stick, three or four feet long, as the case may be. A *little* below the lantern is fastened a small bag-net, shaped so as to fit closely to a spray. With this implement in the left hand, you examine the ivy beyond reach. Whenever a desired moth meets your eye, all that is required is simply to *tip* it into the net with a stick held in the other hand. It can then be taken out of the net by one or other of the methods above. This will be found an almost indispensable instrument when the ivy is collected about trees, especially if they are in hedgerows.

One other plan must be adverted to, only, however, at once to condemn it. I mean that of *beating* the ivy. Nothing can be more suicidal. For the sake of one night's captures you irremediably destroy your preserves. It is the fable of the "Goose and the Golden Eggs." Let me therefore advise the beginner to have nothing to do with it. It would probably not do



much harm to *shake* the ivy, provided it be not done too strongly.

*Sugaring.* This is the last of the *outdoor* methods of capturing insects. We have considered most of the *natural* baits for attracting moths. Sugaring, I need scarcely say, is an *artificial* substitute for them. I believe we owe the discovery of it, or at least its application, to Mr. Henry Doubleday. In writing this little work professedly for beginners, I am reminded of the time when I was myself one, and when I had the pleasure of first making his acquaintance. Though Mr. Doubleday will probably never read these pages, I cannot lose this opportunity of expressing my grateful remembrance of his kindness and generosity. As to his invariably courteous and gentleman-like (adjectives by no means to be applied to *all* naturalists) style of correspondence, his readiness to give to beginners the benefit of his great experience, and his liberal *gifts* of insects, I feel confident that, among those who know him, there are not two opinions.

I now proceed to give the various receipts for preparing and using sugar. I believe the first notices of the use of sugar were contained in the 'Entomologist,' a work which I have made many efforts, for years past, to procure, but as yet in vain.\* I must therefore content

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\* This was written in 1862. The 'Entomologist,' first appeared in 1840, but was discontinued after two years; it is this volume that is out of print. Its publication was resumed in 1864, and has been continued monthly to the present time.

myself with extracts from its successor, the 'Zoologist.' The earliest notice I find to my purpose is from the pen of Mr. Douglas, who says:—"The 'Entomologist' and the 'Zoologist' have each contained several notices of captures of moths by means of sugar, but there has been no account of the method of using it; and from the communications of some of my correspondents, I am inclined to believe that it is not generally understood by country entomologists. A brief direction may therefore be of service, and be the means of making many captures during the ensuing summer. The strongest brown sugar, known as 'Jamaica foots,' is mixed with hot water to the consistence of treacle, or somewhat thinner, and a small portion of rum added and stirred in; the composition is then laid on the trunks of the trees, in favourable situations, with a painter's brush. I have found that it is better to make long and narrow streaks than broad patches. Many species do not like to wet their feet, and sit and sip the nectar modestly and at a distance: others are not so careful, but rush readily on their destruction. The sugar should be put on the trees at dusk, before the moths fly; for I have repeatedly observed that if used afterwards, not nearly so many will come. With a lantern suspended from the neck, and thereby preserving an upright position during every movement, the collector may visit the trees several times during the evening. The greater number of moths will be found during the first hour, but some species are only taken late at night. Most of them may be taken very easily by holding a pill-box

under them, into which they will fall, and remain quiet till the next day [?], but some are not so quiet [observe]. Some persons boil the sugar and water, and think it an advantage, but I have not yet tried it. Of the efficacy of the addition of the rum I am sure, having more than once seen one collector use it, and another at the same time sugar without it, when the former would obtain double the number of Noctuæ." (Zool. ii. 399—400).

In the same periodical Mr. Gregson writes as follows:—“ I find from reading your note on capturing moths with sugar, and also from several letters I have received questioning me as to my success, that there are still a number of sceptics respecting that most useful plan. I hope the following observations will in some degree tend to dispel the doubts entertained by those who have not yet succeeded. Like many others who have since succeeded, I was disappointed at first; but disappointment in what I knew others practised to good purpose only stimulated me to fresh endeavours, which were eventually crowned with success. I was told to take sugar without regard to what sort, and I took what was in use in the house at the time, never for a moment supposing that it was at all requisite to take any particular sort. It was fine white sugar, a mixture of East India, made up to look as white as possible for sale. On paying more attention to this I found it had little or no smell, consequently could not be very attractive to moths. I therefore got some from the lower side of an East India hogs-head; it was very dark brown, and smelled very strong

of rum : I then tried my experiment on a length of rails round a plantation, using first the fine sugar, next the same mixed with honey, and lastly the dark brown, at distances of about twenty yards apart; the result was, on my return to the brown I got one *Cerigo Cytherea*, and missed another specimen which had not quite settled to his supper. Retracing my steps, I found on the brown sugar and the honied sugar six specimens of *Graphiphora* (*Noctua*) *baja*, three of *Xanthia flavago* [this must be an error], three of *Agrotis valligera*, two of *Actebia* (*Agrotis*) *præcox*, five of *Agrotis cursoria*, besides a number of common *Noctuæ*; but I did not take a single specimen from the fine white sugar, though I could see numbers of moths flying past it. From observations made since then, I find that, though I have taken a few from fine sugar, they have invariably been common species; and the numbers on the brown have been five or six, to one on the white. Hence I presume that the reason so many have not succeeded has been that they have used sugar without any smell. Mild, balmy nights are very good, but a calm night and a mizzly rain (generally termed about here a *Scotch mist*) are sure to repay any one who does not fear a wet jacket or soiled boots." (Zool. ii. 800).

One other extract will, I think, be sufficient:—"From the different degrees of success which some of your correspondents seem to have met with, in their endeavours to capture *Noctuæ* by means of sugar, and from having succeeded myself in every attempt during the present and past month, I beg leave to offer a few remarks on

the subject. In the first place I would say a word upon my method of making this alluring bait. Instead of mixing the sugar with water, I invariably substitute *beer*. Having mixed the sugar and beer, I boil it, let it cool, and bottle it for use. Before I use it, however, I add a small quantity of rum, which I believe to be the most attractive part of the composition. It is better to add the rum at the time of using the mixture, as when kept any length of time the scent will evaporate. Vinegar, I fancy, will be found to be nearly as effective as rum. Some of your correspondents appear to attribute their want of success to the *quality* of the sugar used. When neither rum, beer nor vinegar form part of the ingredients, I think there can be no doubt that the coarser and stronger smelling sugars are the best, but where these are used in sufficient quantities the whiter and more refined sugars will answer every purpose. I one evening used two mixtures, one made of the darkest and strongest smelling sugar that can be procured, the other with sugar of the best quality, with scarcely any scent. I added an equal portion of rum to each, and the result was like the rum and sugar just mentioned: I was unable to perceive that one was more attractive than the other, both being visited by numbers of moths. I cannot help thinking that want of success more frequently arises from the state of the atmosphere than from the mixture used [I am entirely of this opinion]. Mild, damp evenings, before and just after rain, are sure to reward the entomologist for his trouble. Windy nights are generally bad, although I have once or twice had

tolerable success on a breezy night, when the wind was blowing from the west or south-west, and the night was otherwise warm. If the wind blows at all strongly from the east or north, there is no chance of taking anything good; cold, raw nights are also to be avoided. If the trees upon which the bait is laid are in a situation exposed to the wind, should there be any, it is best to put the mixture on the side which is so exposed, as the scent is thus carried farther. Should the wind be rather high, some should also be placed on the opposite side of the trees, as, when once attracted to the spot, moths will more readily settle on the sheltered side. Instead of putting on the sugar in stripes, I find the better way is, if the tree is not very large in circumference, to lay it on thickly in a circle round the tree; it then runs down in narrow lines, and is thus more conveniently sipped by the greedy moths. Should the tree be of very considerable bulk, it can easily be laid on in the same manner on portions of the tree." (J. Pemberton Bartlett, Zool. iii. 1087).

Two short notices from the 'Intelligencer' will conclude my extracts. "I was collecting last summer with a young friend who used aniseed instead of rum for his sugar; it is very attractive to moths." (Intell. i. 111).

"The following method of sugaring has been found to answer well: instead of brushing the sugar on the bark of the trees, get some pieces of coarse rag, mix up your bait and steep them in it; let them remain till they are well saturated, when they may be pinned up wherever you wish, and when done with, put them away for the next

night. One batch of rags will last for a length of time, sugar being added when required. *Rotten* apples, when sliced and pinned to trees, appear to attract moths nearly as much as sugar." (Intell. ii. 45).

I cannot add much to these extracts, but I would urge the especial attention of my readers to Mr. Bartlett's admirable directions. It may, I think, be gathered from these and similar communications on the subject of sugaring, that the *quality* of the sugar is not of much importance, provided there be some very strong and attractive scent or perfume. This may be readily accounted for. The main intention of sugaring is to *attract* moths. When once there we may be tolerably certain that they will not stop to inquire whether it be "brown" or "white," "Jamaica foots" or "East India." The *attracting* power evidently consists in the intensity and diffusiveness of the scent. This will also explain the comparative inefficacy of sugar, when its influence is counteracted or overbalanced by the superior fragrance of some neighbouring flower or shrub. I entirely agree with Mr. Bartlett in thinking that successful sugaring depends more upon the quality of the *night* than of the *sugar*; but *if* the night be favourable, then I feel equally satisfied that success depends upon the attractiveness of the scent. The composition I have generally employed myself is simply treacle and a little rum. Anything may be sugared—trees, palings, posts, leaves, flowers, and even walls. A favourable "sugaring" is an amusing as well as an exciting spectacle. The squabbles between *Xylophasia polyodon*, *X. lithoxylea*, *X. hepatica*, and

*Triphæna pronuba*, for the possession of a choice "drop," are truly ludicrous. They push each other and tumble over one another, till one, overcome with, I am sorry to say, "drink," falls helplessly to the ground, when his place is instantaneously supplied by another. When the collector has obtained a good series of the above-named four insects, he will then begin to find them an irritating pest, for they not only "shove" off the good ones, but make short work of the sugar, in which they are ably assisted by earwigs, slugs, &c., &c. I have found the body of an "Orange Underwing" filled to repletion with the composition. It is also truly interesting to watch a moth imbibing a drop of sugar. If a bold insect, he is in no way discomposed either by the light or your observation, but will go on sipping away, looking at you out of the corner of his bright eye, as if to say, "Ah! I am a common thing! I know you are not going to box *me!*" The rapidity with which a drop will disappear before a *Xylophasia polyodon* or a *Triphæna pronuba* is surprising. Some insects, as the beautiful *Thyatira Batis* and *T. detersa*, are very shy, not settling down at all, but, with quivering wings, take a rapid sip, and are off the moment the light falls on them. Others, as *Xylophasia polyodon*, &c., come down with a "plop," and set to work at once. For *capturing* I must refer my readers to the directions already given under the head of "Ivy bloom."

I have not been very fortunate myself in taking any very rare insects at sugar, but the case has been different with others who have been in more favoured localities.



I do not think my account of sugaring would be complete without a list of at least some of the scarce insects that have been taken by it. In it will be found nearly all the newly-discovered species. It is to be observed also that some insects are *only* taken at sugar, as *Catocala promissa* and *C. sponsa*, commonly known among the *habitués* of the New Forest as the "Crimsons." The following species, new to Britain, have been discovered, within the last twelve years, by means of sugar, or, if not actually *discovered*, taken almost exclusively by its means, *viz.*, *Leucania vitellina*, *L. extranea* and *L. putrescens*, *Nonagria concolor* and *N. Elymi*, *Agrotis Ashworthii*, *Noctua sobrina*, *Glæa erythrocephala*, *Phlogophora empyrea* and *Hadena peregrina*.

Among the species which are still either very rare, or made *comparatively* common by sugar, the following are especially worthy of notice:—*Cymatophora ocularis*, *Diphthera Orion*, *Synia musculosa* (?), *Leucania obsoleta* and *L. straminea*, *Nonagria geminipuncta*, *N. neurica* and *N. Hellmanni*, *Laphygma exigua*, *Heliophobus hispida*, *Mamestra abjecta*, *Agrotis lunigera* and *A. Ripæ*, *Triphæna subsequa*, *Noctua ditrapezium* and *N. subrosea*, *Tethea retusa*, *Euperia fulvago*, *Hadena satura* (?) and *H. rectilinea*, *Plusia orichalcea*.

Besides these, multitudes of the commoner species are annually taken at sugar, and on the whole, though I have not been very successful at sugaring myself, it must, I think, be acknowledged as the best way of obtaining *Noctuæ*. The beginner, however, must not be surprised at finding many "barren" nights, not to

mention wasted specimens. This latter is, in my opinion, the chief objection to the plan.

With "sugar" we end the outdoor methods of capturing insects, if we except "gas-lamps"—which sometimes furnish rare insects—and lighthouses. It is, however, scarcely necessary to do more than mention these. Before we go "indoors," nevertheless, there is one other point to be considered. As my readers have been reflecting upon the various methods detailed above of capturing insects, the question has probably occurred to them, "How am I to carry them home?" I have already hinted at the way in which this is usually done, *viz.*, putting the insects alive into pill-boxes, and carrying them in the pocket. My own plan is, to pin and kill them at once, and then put them into a "collecting-box," which I proceed now to describe, not in my own words, but in those of Mr. Brown, of Burton-on-Trent. I do this because I think his plan the best with which I am acquainted:—"I found that whenever I pinned small moths in an ordinary chip collecting-box, they invariably, on warm days, became too much stiffened to allow of their being set in a neat and pleasing manner; nor would the relaxing-box restore their pliancy sufficiently to prevent them from springing back again when thoroughly dry. And to put each specimen alive into a separate box requires time, fills the pockets inconveniently, many of the specimens will die and become stiff, and all will damage themselves considerably by flying about, the boxes in which they are placed being constantly rolling over and

over whilst in the pursuit of other game. [I would observe here that though these remarks of Mr. Brown apply especially to the *small* moths, they are nevertheless applicable, in a greater or lesser degree, to *all*.] The thought at length occurred to me to adapt the botanical *vasculum* to entomological purposes; and to this end I made a small japanned tin box, about nine inches long, six inches wide, and one and three-quarters deep. [By having the box *double* this depth, both sides might be corked, which would be a great advantage, as enabling the collector, without any inconvenience to himself, to bring home double the number of insects]. In the bottom of this tin box I put a thin sheet of cork, securing it by means of several tin points projecting from the sides. I then filled the box with warm water, and let it stand several hours, until the cork was well saturated with moisture, when, the superfluous water being poured off, the box was ready for use. Under the *bottom*, and also upon the *hinge* side, are two tin loops, through which, when I reach the hunting-ground, I put two straps; one of these I pass round my neck, and the other round my waist, thus securing the box upon my breast, with the lid opening from below. Here fixed, it leaves both my hands at perfect liberty, and does not cause any impediment to swift pursuit of insects on the wing. I used this box the whole of last season, and, after a long day's chase in the hottest weather, I have never failed to bring home the smallest moth through which a fine pin could be passed, as flexible as if just killed; in fact, I have frequently

kept moths perfectly pliant in this box, until they have been covered with a fine flourishing crop of Fungi. I have also a smaller box, made on the same principle, to put into my pocket when taking only a short walk. When not in use I keep water standing in them, so as constantly to have them ready for the chase. This kind of box is by far the best, for relaxing dried specimens of insects, of any I have tried; and for this purpose, as well as that for which I had it at first constructed, I cannot sufficiently recommend it to the notice of entomologists." (Zool. 1843, pp. 177, 178).

I entirely concur in Mr. Brown's concluding remark, and I warmly recommend this collecting-box.

*Light.* When the collector has folded up his net, taken his last round at the sugared trees, and returned home with, let us hope, full boxes, there still remains one method of capturing insects, not less productive, and certainly not less exciting, than any of the preceding, *viz.*, that of attracting them by *light*. I can only find one correspondent of the 'Zoologist' who describes the apparatus he employs for this purpose:—"My attracting apparatus consists of three gas-lights, with fifteen hole argand burners. One of these is affixed to the outside of a balcony, at an altitude of twenty feet from the ground, and protected by a lantern (somewhat like a gas-lamp) which has a reflector at the back; in the room which opens on to this balcony is another light, which is kept within about two inches of the window; this also has a reflector behind it; the third is in the room below the balcony. I consider it very essential there should be

a light outside the building, since one inside a room has but a confined sphere of action compared with one completely outside." (H. T. Stainton, Zool. vi. 2030).

This exceedingly costly, extensive, and, to most collectors, wholly impracticable *illumination*, is, I may safely say, entirely unnecessary.

Two composite candles, placed on a small table near a window, are amply sufficient.\* If there be two windows in the room (which should be an *upper* one), I place a candle at each. On the little table are the following requisites, *viz.*, one or two corked collecting-boxes, a little tray full of fine pins, a small bottle with a saturated solution of oxalic acid, a steel pen, and three or four of the tin boxes, with freshly-bruised laurel-leaves. Close at hand, ready for instant use, must be the bag-net. On very still nights the window may be opened both at the top and the bottom. I raise the lower part of the window, however, not more than a foot. I then sit down with a book, outwardly calm and collected, but inwardly full of excitement and expectation, and—WAIT! While doing so I will make a little digression.

There is a curious circumstance which, so far as I am aware, has not been recorded; it is, that there seems to be an interval, *viz.*, from a little after nine to about half-past ten, during which moths appear to cease *flying*. Whether it be that they are undergoing the process of

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\* A correspondent recently suggested a moderate lamp. A stronger and more diffusive light is thus doubtless obtained, but the risk of *breakage* would be great.

digestion, or recruiting their energies, I know not; but the fact, at least in my experience, remains. From half-past eight to about half-past nine they may be seen flying over and about the flowers, shrubs, &c., attractive to them; but at the end of that time they almost entirely disappear. When this has been the case I have returned home and tried the light at once, but in vain. This I have done over and over again. I have repeatedly sat at the open window for an hour or an hour and a half without seeing a single moth.

And now to return. From what I have just said it will appear that there is not much use in trying to attract moths by light before eleven o'clock.

Well! I am reading an intensely interesting chapter, when suddenly one or other of the three following incidents takes place. I hear a fluttering (which produces a corresponding fluttering on my part) on the ceiling; or a sudden and startling tap on the window; or something glides past me, and drops gently and softly on the book itself, where it settles itself, with the apparent intention of going to sleep,—sad emblem of that sleep which is shortly to be for ever! In the first of these cases I look up, and lo! a large brown moth careering wildly against the ceiling. In an instant the net is grasped, and then begins a frantic chase to capture it, a matter by no means so easily or speedily accomplished as at first sight might be thought. The ceiling is *scraped*, with no result but that of a quantity of whitewash falling into your eyes. Then the moth, alarmed, quits the ceiling, and flies about the room with a deep (and oh! what a

pleasant sound it is) hum. The net is whirled backwards and forwards, upwards and downwards, till at length a fortunate sweep—and he is in. I then hold the net up against the light, and speedily tin-box him. In the second case I look at the window, and there, peering at me through the glass with his gleaming eyes, sits another moth. The tin box is seized, and the arm put outside with the box in the hand. It is cautiously and gently moved up. It touches him! There is a skip backwards, and in a moment he is secured. Here the *tin box* is indispensable. It would be impossible to pill-box an insect thus situated, whereas with the tin box, the moth (of course if within reach) is captured with the greatest ease. In the third instance the moth, if it remains quiet, is skilfully impaled at once and killed. If, however, I see that ominous quivering of the wings which betokens immediate flight, I tin-box him. The *book* is now cast aside, and, as the insects come tapping at the window or flying into the room, hands, arms, legs and eyes are fully occupied. Some make known their presence at the window by a loud and indignant tap, and the noise made by a large moth, as *Arctia caja* or *Smerinthus Populi*, coming full bang at the glass about one or two o'clock in the morning in a retired country place, where everything is as still and silent as the grave, is no joke to the already sufficiently excited nerves. Others alight quite gently, and lie with extended wings against the glass, as the various species of the pretty genus *Eupithecia* and many of the *Geometræ*. Others will

crawl in, and, fixing themselves on the inside of the pane, remain quite motionless all night, as *Cilex spinula*. Others will betray their presence by a loud humming in the room. It is difficult, till you have actually experienced it, to understand the emotion produced by this sound. Others again will, unfortunately, dash fiercely in, and make straight for the candle. It would be a good plan to have glass shades, were it not for the almost certainty of their being broken in striking at the insects. This is the only way, so far as I know (which presents a reasonable prospect of success), of capturing Bombyces in the perfect state. These are in general the most noisy and obstreperous, especially the males. Conspicuous for its frantic gyrations is *Bombyx neustria*. It is almost impossible to capture it. It will fly into your face, down your coat-sleeve, into the candle, anywhere in fact except into the net, which it seems to avoid as if by magic. It is curious to note the effect produced upon this violent and excitable little creature by the action of the laurel-leaves. In half a minute it will drop to the bottom of the box, utterly prostrate and helpless. The contrast between its late frantic exertions and its present death-like repose is sometimes almost ludicrous. Though I have said that "light" seems to be the best way of attracting Bombyces in the perfect state, yet I do not think *much* is to be done. The following are the best insects I have taken in that Order by this method, *viz.*, *Lithosia aureola*, *L. griseola*, *L. Stramineola* and *L. Quadra*, *Arctia fuliginosa*, *Demas Coryli*, *Dicranura furcula* and *D. bifida*, *Ptilodontis*



palpina, *Notodonta camelina* and *N. dictæa*. Most of these I have only taken rarely, however. There is one moth, nevertheless, which is a true pest at light. I mean *Arctia Menthastri*. I have seen at least fifty in the room at one time. It is impossible to get rid of them. You have no sooner thrown one out of the window than it instantly returns in company with half a dozen more; nor is it an uncommon occurrence to have your candle extinguished three or four times in the course of the evening by their unwearied efforts at self-immolation.

The *time of year* at which to commence the employment of light is about the end of June, and it may be profitably used to the middle or end of August. During that period multitudes of *Noctuæ* and *Geometræ* may be taken, and among them some that are by no means common. The following comparatively rare or local species I have myself taken at different times and places:—*Acronycta Aceris*, *Apamea connexa*, *Xylophasia sublustri*, *Neuria Saponariæ*, *Heliophobus popularis*, *Cerigo Cytherea*, *Luperina cespitis*, *Mamestra anceps* and *M. furva*, *Miana arcuosa*, *Caradrina Morpheus*, *Agrotis corticea*, *Spælotis augur*, *Orthosia macilenta*, *Dianthœcia carpophaga*, *Aplecta advena*, *Hadena adusta* and *H. contigua*, *Pericallia Syringaria*, *Ennomos lunaria*, *Corycia temerata*, *Numeria pulveraria*, *Eupithecia sobrinaria*, *E. subfulvaria*, *E. centaurearia*, &c., and *Emmelesia bifasciata*. The best insect, however, which I ever took at light, indeed one of the best insects I ever took in any way, was *Agrotis cinerea*. I captured seven

specimens in one night. Unfortunately it is one of those species which has a *penchant* for the candle, and, with the exception of two, they were consequently more or less injured. About one o'clock in the morning the collector's room presents a truly curious, not to say formidable, appearance. It literally *swarms* with insects. I say *insects*, for almost every Order is represented. There are gnats, flies, beetles, bugs, fleas, centipedes, ichneumons, midges, spiders of every size and shape, earwigs, &c., &c. One feels at times almost bewildered. What with the ceaseless hum of insect life, half a dozen moths perhaps on the window, another half-dozen apparently knocking out their brains against the ceiling or careering through the room, while others are whirling about in dangerous proximity to the light, the collector is often at his wit's end. But this renders it only the more interesting, and it certainly is to me the most exciting and delightful way of capturing insects.

On favourable nights the moths will begin to appear a little before eleven, and will continue to do so, in gradually increasing numbers, till two or even three in the morning—in fact, till daybreak. As to what *are* favourable nights, it seems as difficult to lay down any fixed rules for light as for any other method of attracting. Damp, mild, sultry and dark nights, without wind, are generally the best. I have found that just before and just after a thunderstorm is a period at which moths are almost sure to be abundant. A nearly invariable prognostic of good nights is the assembling of numbers of small midges on the window-panes soon after the light is

exhibited. They are the almost certain forerunners of Lepidoptera. In this, as in every other method of capturing insects, much patience and perseverance are essential to success. On some nights moths will swarm, on others very few come, perhaps none at all. If there be the least frostiness in the air the case is hopeless. But there is one great advantage in "light" which is also peculiar to it: you can read, or otherwise employ yourself, when insects are few and far between. The collector, supposing him to commence at half-past ten, must not be disappointed if he does not see a moth for the first half-hour, or even hour. If, however, nothing comes by twelve o'clock, I regard it as a bad job. I speak in the present tense, but during the last three years I have been obliged entirely to relinquish this plan of capturing insects, as, owing to the almost total absence of even the commonest species in my present neighbourhood, I have found it a mere waste of time and energy.

In connexion with light, I may add that it is a good plan (especially by way of a little variety) to lean out of the window (the candles being placed behind you) with the bag-net. Not unfrequently you will see moths sailing up towards the light, and may catch them in the net before they enter the room. One advantage of this method is that many moths come only to take a look, as it were, at the light, and then fly off again. I cannot explain the reason of this, but I know it is truly tantalizing.

One other remark. It is well known that on *moonlight* nights moths forsake sugar, ivy, flowers, &c., and

wholly disappear. The same is true of light. When the moon comes out it is a signal for all properly disposed moths to go to bed, and the best thing for a collector is to do the same.\*

I have now set before my readers, as fully and circumstantially as I am able, all the best known and most generally used methods of capturing insects. When I say "all" the best known, I mean, of course, all known to me. But sufficient, I think, has been said to put the beginner "in the way;" and as he proceeds many little ingenious methods will probably occur to him, which, when he becomes an "old hand," he will perhaps, in his turn, communicate to the "young beginner."

I proceed now to the question of "killing." There are few points on which so great a difference of opinion exists among entomologists as this. Ten or twelve years ago there was a controversy carried on in the pages of the 'Zoologist' on the question of the amount of pain which insects were capable of feeling. It is not, of course, my intention to enter into that controversy here. I shall only say that I have long since convinced *my own* mind that insects feel *pain* (in the common acceptation of the term) in only the slightest possible degree. But, while holding this opinion, I am equally satisfied that, in whatever point of view we regard the question of feeling or not feeling, we shall be on the *safe* and *humane*

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\* The so-called "American Moth Trap" appears, from various communications addressed to the 'Entomologist,' to be, what I always supposed it would be, a "humbug."

side in employing the speediest and most efficacious method of destroying life. I shall now, therefore, give some of the methods employed by 'different entomologists for this purpose.

*Rev. F. O. Morris's method.*—"There is nothing so good as chloroform." ('Naturalist,' viii. 220).

*Chloroform*

*Rev. H. H. Crewe's method.*—"I cannot at all agree with Mr. Morris in his recommendation of chloroform as the best and speediest method of killing Lepidoptera. I have tried it over and over again, and have invariably found it turn the insects so stiff and rigid that it is impossible to set them out properly, to say nothing of their coming to life again in nine cases out of ten. I have no hesitation whatever in giving it as my own firm opinion that the strongest liquid ammonia is by far the best I know. Have a close-fitting tin box made, with a false perforated zinc bottom, and a lid at each end. Dip a small piece of sponge, about the size of a nutmeg, into the ammonia, and put it into the false bottom end. Into the other end put your moth or butterfly; leave it there half an hour, or it will very likely revive. If you have not a killing-box, a common jam-pot covered over with a square of glass will do just as well, and perhaps better. You must not kill your insect, if bred, till it has been out of the pupa an hour or two, as the wings are limp, and the ammonia will spoil them, and, what is more, the insect is apt to eject a quantity of pink fluid, into which it will flap in its death throes, and ruin itself. There are a few [?] insects which must not be killed with

*Ammonia*

ammonia, as it takes away or deadens the colours; they are, however, so few [?] that they are soon known, and do not at all invalidate [?] the efficacy of the receipt. [Mr. Crewe gives a list of no less than *twenty-six* species which must not be killed with ammonia]. The ammonia must be kept in a *tightly stoppered bottle*, as in hot weather it is very restless, and does its best to drive the stopper out. When travelling tie a piece of wash-leather over the stopper, unless you wish your clothes to be saturated." (Nat. viii. 261).

*Mr. Morris in reply.*—"I must caution the entomological public, those at least of them who are as yet *in statu pupillari*, against adopting Mr. Crewe's recipe of the ammonia, in so far as he recommends it in preference to chloroform. . . . I grant that it (chloroform) does make them rigid and stiff, but I deny that there is any impossibility whatever in getting them right again. . . . A clumsy hand will no doubt fail. . . . All you have to do is to get all the fingers of the left hand cleverly under the wings at the thorax, and so get round them and press them straight back, or rather up, the right hand holding the insect firm by a pin through the thorax, and you will either hear, or, if I may so say, feel a crack of the muscles, after which all is right and plain sailing. Even without this, putting the moths into the relaxing-box for a night will often do much towards a remedy. [However efficacious chloroform may be for *killing* an insect, it plainly is not the *speediest* method for enabling the collector to *set* his insects, by Mr.

Morris's own showing. I must also dissent from his assertion that the muscles are so easily broken; and even if they are, it is a plan which I cannot for a moment recommend to the beginner]. With regard to the stopper being apt to fly out of the ammonia bottle, and requiring to be tied down, the same takes place with chloroform, when, at least, the chloroform is good. The best place to get it good is Apothecaries' Hall." (Nat. viii. 283).

*Mr. Chapman's method.*—"My experience has caused me to decide in favour of chloroform and a saturated solution of oxalic acid, the former only to quiet the moth, the latter to kill it. A camel's-hair brush dipped in chloroform will settle half a dozen moths, by inserting a little in each box and closing it tight again. In half a minute you can pin and kill them quite comfortably. I use a sharp-pointed quill, which I prefer to a steel pen [I differ here] for pricking in the solution, &c. Mr. Crewe admits that ammonia would spoil many species, and enumerates twenty-six which must not be killed with it, and for these exceptions recommends what I think good for *all*. . . . The time lost in using the ammonia appears to me the great objection to its use. Mr. Crewe says, 'Leave the moth half an hour exposed to the ammonia,' &c. From his own experience, given in a previous number, 'a good dose *for two hours* did *not* suffice to take the lives of rhamnata and vetulata.' This loss of time would not suit a collector who had been out all day, and brought home a hundred specimens or more, all to

*Palmerston*

be pinned, killed, and set out the same evening." (Nat. viii. 285).

*Mr. Bree's method.*—“In my opinion the best method to kill Macro-Lepidoptera is ammonia.” (‘Intelligencer,’ ii. 69). Mr. Bree gives directions for its use, but as they are identical with those already given by Mr. Crewe it is not necessary to repeat them in this place.

*Mr. W. D. Crotch's method.*—“I use a box with a perforated bottom, and sliding tray beneath (an old paint-box does very well); in the top the pill-boxes are placed, each one being either notched triangularly in the rim of the lid, or stamped out with a small gun-punch through the bottom, and gauzed. Chloroform may then be poured into the lower tray, the top being of course closed, and half a minute will produce quiescence, or half an hour death, in any insect. For my own part, however, I prefer to place a little tartaric acid in a small saucer below, into which I pour a very few drops of a strong solution of cyanide of potassium; effervescence, with evolution of prussic acid, takes place immediately, and the impregnated atmosphere proves fatal alike to moths, beetles and bees.” (Int. vi. 37).

To this communication is appended the following note by the Editor, “Cyanide of potassium, being a deadly poison, is a dangerous thing to recommend for general adoption, more especially by young collectors.”

On a subsequent occasion Mr. Crotch describes various other methods, and the Editor asks, “Why adopt any



such methods, when laurel-leaves for Lepidoptera, and the same or hot water for Coleoptera, are amply sufficient?" I most cordially echo the question.

*Mr. Hawkins's method.*—"I first make a saturated solution of cyanide of potassium, or about one drachm of the cyanide to one of water, in a stoppered bottle. I then take some filtering paper, and dip it into a saturated solution of tartaric acid, and dry it. When I have a moth under a glass or in a box, I cut a small piece of paper about one inch square, if for a large moth, or less if for a smaller one, and immerse it half-way into the solution of the cyanide of potassium; then quickly pass the paper under the glass, when the moth will die almost instantly, though they will sometimes revive if the glass be removed too soon. If not quite dead, dip a needle in the solution, and pass it through the thorax at the insertion of the wings. . . . Great care must be taken not to inhale the vapour when the glass is removed, as it is highly poisonous. . . . The principal objection to this method is that it sometimes leaves the insect rigid." ('Zoologist,' viii. 2934).

*My own method.*—Take the tin box already described. Let the false bottom be supplied with freshly-bruised laurel-leaves. Put the moth into the box (I speak now of bred insects, or at any rate indoors) and close the lid. From half a minute to, at the outside, two minutes will be sufficient to thoroughly stupify the insect. Then turn it out on to the palm of the left hand, and pin it

Laurel  
leaves

Cyanide of Potassium

Laurel leaves

through the *centre* of the thorax with a fine pin. Take hold of the upper side of the pin with the thumb and first finger of the left hand. Put the *middle* finger of the same hand under the wings on the left side (that is, the *off* side), and gently push them up, leaving the finger at the same time pressed against the body. Then take in the right hand a steel pen, dipped into, not a *strong*, but a *saturated* solution of oxalic acid, and with it transfix the *near* side of the thorax, under the wings of course. You may repeat this two or three time with large moths. This is all. Nothing can be simpler, or more expeditious, and the moth will never stir again. When about to set the insect the fine pin (if unsuitable) may be removed, and the proper one substituted. Observe—*Every* moth should, in the *first* instance, be pierced with a fine pin, so as to render its removal, if necessary, easily practicable without spoiling the moth. The *first* insertion of the pin constantly requires to be rectified, especially if the insect has been pierced alive without employing the laurel-leaves. This may easily be done with bred Bombyces and Noctuæ, when lying asleep on the top or sides of the breeding-cage. It is not so safe with Geometræ. On the whole, however, I recommend the beginner, for some time at least, always to use the tin box before pinning the insect. In the case of very large moths a larger box must of course be used for stupifying.

I shall now state what I conceive to be objections to the above methods. The plans advocated by Mr. Hawkins and Mr. Crotch, I must dismiss summarily,

as dangerous, costly and unnecessarily complicated. That ammonia, as used by Mr. Crewe, is not the best agent, is, I think, proved, even on his own showing, not to mention the weighty objections brought forward by Mr. Morris and Mr. Chapman. The same remark applies to Mr. Bree. In my judgment Mr. Morris at once condemns his own plan of using *chloroform* when he says, "I grant that it makes them stiff and rigid." It is true he tells us how he *relaxes* them again; but what need of this extra trouble and delay when the insects may be as completely and expeditiously killed *without* their becoming stiff. I may add, in passing, that in my own particular case, I cannot stand the fumes of chloroform, as they inevitably induce sickness and acute pains in the head. This, however, would be no objection to stronger-headed individuals. Mr. Crotch, indeed, is so fond of it that he tells us, "I often take a good gulp of its vapour, and can fancy the shivering delight of many a youngster who might try it." Other objections to chloroform are its rapid evaporation and the difficulty (as allowed) of procuring it good. Mr. Morris recommends "Apothecaries' Hall." This is all very well for people who have money to spare, and don't mind sending for it whenever they want it; but it will not do for those to whom sixpence is an object, who are far from a town, and whose visits from the postman are few and far between.

Mr. Chapman's plan differs from my own only in this—that he employs chloroform instead of laurel-leaves.

The only objection I can find to my own plan, after twelve years' experience, is that two or three species are slightly injured by it, *viz.*, Pseudopterpna cytisaria, Geometra papilionaria, Iodis lactearia and Hemitheia thymiaria. The injury, however, is very slight, if not kept too long in the box. It is also to be observed that *no* care will prevent these four species from *afterwards* fading, however they may be killed. If bred at home, the best way is to pin them at once, and kill with the oxalic acid.

It has been said that laurel-leaves *stiffen* insects. I am wholly at a loss to understand this. In all my experience I have never known a *single* instance in which an insect, killed after my own plan, has been stiffened by the process. I have set a female Notodonta dictæa with ease eight-and-forty hours after death. It is very possible that an insect *left in* the tin box with the laurel-leaves might stiffen, but this is no part of my plan.

I am afraid my readers will think I have shown an undue leaning to my own method. I do not scruple to say that I think it *much* the best. It seems to me to meet all requisites. It is extremely *simple*; it is perfectly *effective*. The expense is almost nothing. There is only the original outlay of the tin box, and the cost of the oxalic acid. Four pennyworth of a saturated solution will last for two or three years. While thus advocating my own method, I hope my readers will try for themselves. It is for this reason that I have entered so largely into the subject.

*Setting*.—An insect, however fine, however perfect it may be, is irretrievably spoiled by bad setting. I take this as a postulate. The following are the chief particulars which constitute *bad* setting:—an unsuitable pin, being too large or too small; the pin being badly inserted, *i. e.*, leaning forwards, backwards or sideways; the wings being too much or not sufficiently pushed forwards; the wings on one side being higher or lower than those on the other; the antennæ and legs not arranged, but left to shift for themselves; and the body not being properly “laid out,” if I may use the expression. I must say I rarely see what I call a well-set insect; that is, I rarely see an insect which, when set, is not open to the charge of failing in one or more of these respects. Before I go any further in this matter let me *urge* upon my young readers, in the strongest manner, the duty of trying to master “good setting.” I do not for a moment insinuate that it is an *easy* matter, because it is *not* so. I am also quite ready to allow that some will never attain to such excellence in it as others; but surely this is no reason for not trying at all? I am sorry to say that, judging from the insects I have received, I am compelled to come to the conclusion that the *majority* of collectors pay little or no heed to good setting. The pin seems to be thrust hap-hazard into the insect—one wing up and another down; the legs invisible; the antennæ stretched out straight and stark from the head, or laid on the wings so as to be lost sight of; while the body looks one way and the head another. But it may be objected to me here, “What *you* think

*good* setting another may think bad or indifferent, or *vice versa*." Unquestionably. But there is some setting which all candid and impartial persons must at once pronounce to be *bad*. Probably every collector will, more or less decisively, have his own idea as to what *good* setting is; and it is equally probable that he will consider every other method inferior to it. I at once plead guilty to this charge in my own case, and cannot therefore blame any one who may differ from me. At the same time, however, it will not, I think, be denied by any that an insect set in the manner I have just described is not *well* set. The grand questions, then, to be answered are, — First, "When *is* an insect well set?" and secondly, this being settled, "How is it done?" The



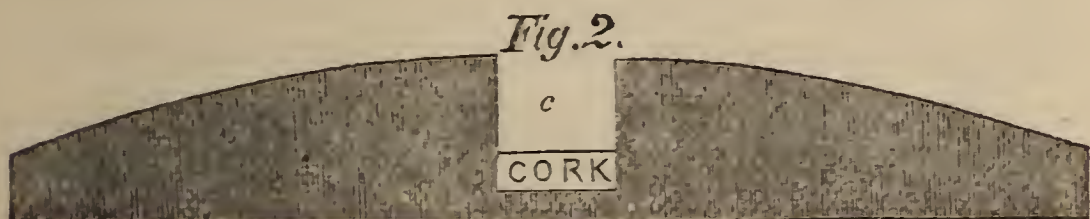
accompanying figure will answer the first of these questions, in my judgment. The second I shall now endeavour to answer, observing, however, that I do not speak here of the Micro-Lepidoptera. To any one or more, then, of my readers who may agree with me in thinking that the accompanying woodcut represents a *well-set* insect, and who may desire to know the *modus*

*operandi*, I give the following directions, which I hope may be intelligible.

Procure half a dozen boards of *soft deal*, a foot, or a little more if you like, in length. The *breadth* of the different boards must vary according to the size of the insects which are to be set on them. The *largest*, for such insects as *Acherontia Atropos* or *Sphinx Ligustri*, should not be less than six and a half inches. The *smallest*, for the insects comprised in the genus *Acidalia*, &c., may be two inches. In the centre make a *groove* (Fig. 1, *b*). The depth and width of this groove must



obviously vary according to the size of the insect. For ordinary-sized *Noctuæ* the depth should be *half* an inch,



and the width *three-eighths*. On the bottom of this groove, glue a thin layer of cork (Fig. 2, *c*), a little more than one-eighth of an inch in thickness. Commencing, then, at the edge of the groove, plane each side of the

board until it assumes the form of Fig. 1,\* taking the utmost care that each side corresponds in the amount of deflexion. This is all that is required for the setting-board. As I have already said, the depth and width of the groove will vary according to the size of the insect. This variation the collector will soon be able to decide for himself, observing always that it must be *wide* enough freely to admit the body of the insect, and *deep* enough to leave a *small* space between the board and the wings when the pin is thrust *through* the cork. But while the *grooves* must thus vary, it is quite different with regard to the *slope* of the boards. The *degree* of slope must be left to the fancy of each collector, but, having *once* settled it, it must be the same in *all* the boards.

The first, and perhaps the most difficult, part of good setting is to *pin an insect well*.

I had perhaps better make a little digression here about the proper pins. There are pins manufactured expressly for entomological purposes by Messrs. Edelsten and Williams, New Hall Works, Birmingham, who will forward a pattern paper with all the varieties of pins in use by entomologists: to each of these is attached a number, and the price per ounce. These pins may also be obtained of most respectable naturalists.

I *recommend* (nothing more) for the very large Sphingidæ No. 12; for the large Sphingidæ and Bombyces No. 13; for the Rhopalocera, the middle-sized Sphin-

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\* Or, if preferred, Fig. 2.

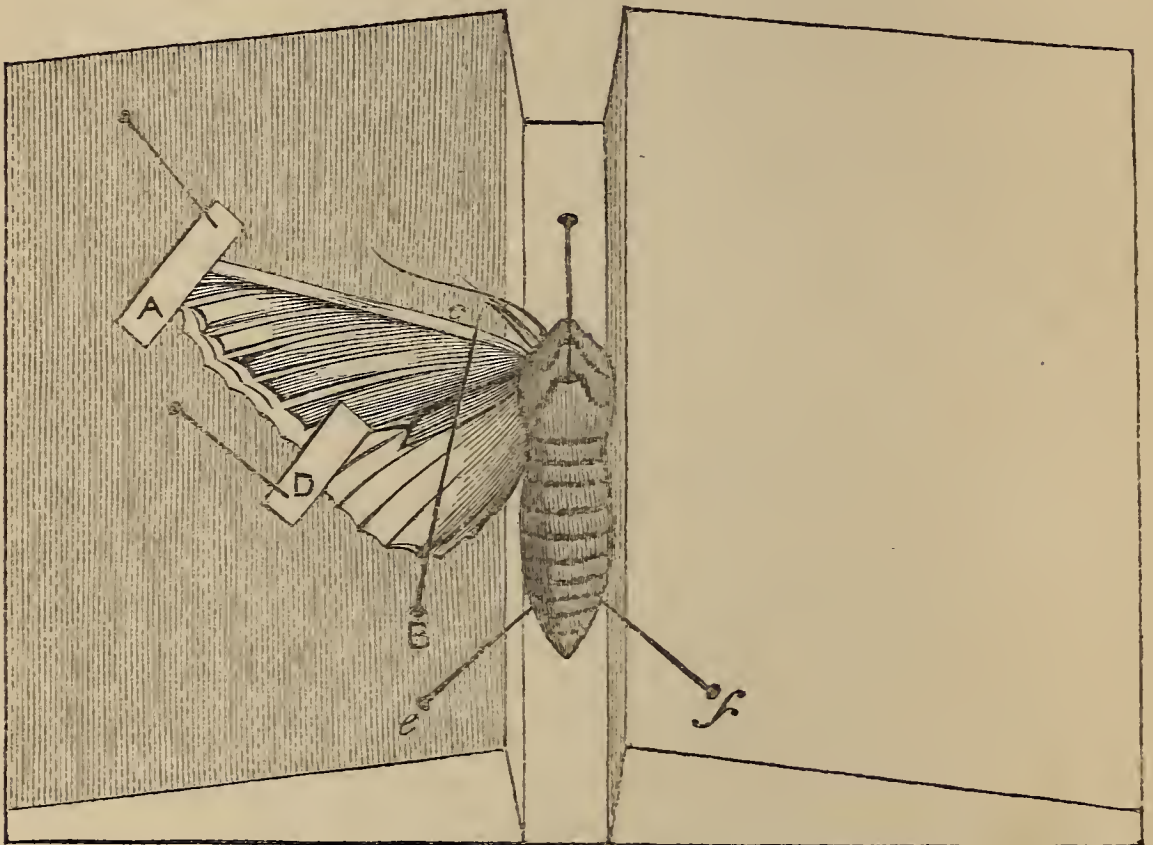


gidæ and Bombyces, all the Noctuæ, with very few exceptions, and the large Geometræ, No. 8; for middle-sized Pyrales and Geometræ, No. 7; and for the small species, whenever they occur in the above-named Orders, No. 10. On this subject there was a little passage-of-arms between myself and the Rev. F. O. Morris, in the pages of the 'Naturalist.' Mr. Morris objects entirely to the use of No. 7, and would substitute No. 13 *only* for Nos. 11 and 12 (I having formerly recommended the first of those numbers). I am quite willing to concede *here* to Mr. Morris that I think No. 11 is unnecessary; but I still adhere to No. 12 for such insects as *Acherontia Atropos*, &c. No. 7 I consider indispensable.

To return. It will be remembered by my readers that, in speaking of killing an insect, I recommended that, in the first instance, it should be pinned by a fine pin (I *always* use No. 7 for this purpose). Suppose, then, a specimen of *Notodonta dictæa* dead, and pinned thus:—Hold it underneath with the first finger and thumb of the left hand, and remove the fine pin. This can easily be done, if (as I am supposing) the insect has not been dead too long, by gently twisting it round. Take now a pin No. 8, and, the moth being still held as before in the left hand, *press up* the wings till their apices nearly touch over the back; insert the pin exactly in the centre of the thorax, where the fine pin has been removed. The head of the pin must slope a very little forwards towards the *head* of the insect. This will not be noticed when the moth is set. The pin should be clear of the moth, on the *under* side, three-eighths of

an inch. It is of *great* importance that the pin (the upper part of course) should not lean to either side. This constitutes the great difficulty in good pinning. To obviate this I hold the moth by the pin on the under side, and, keeping it steadily before my eyes, judge of

*Fig. 3.*



the position of the pin. Practice alone can make perfect in this matter. It is also a good plan to pin the moth into the groove, and push it down till the wings rest on the board. You can then judge tolerably accurately as to whether the pin is straight or not. Before proceeding, however, to arrange the wings, the insect must be raised a *little*, so as to leave a *slight* space

between them and the board. Having the moth situated in the groove, the *left* upper wing is to be pushed up to the required height (this depending on the fancy of the setter), by means of a pin or a needle placed underneath it. Holding the wing thus, take a little label (fig. 3, A) of stiff paper on the moistened tip of the middle finger of the left hand, and with it keep the wing fixed. Then take in the right hand another pin (B), and, still keeping the wing fixed by means of the label in the left hand, insert pin B into the board at point c, as in the figure, and press it *gently* down until it *compresses* and holds the wing firm. Pursue the same method with the other side. I should observe that as soon as the pin B holds the wing, the label on the apex of the wing is removed. The advantage of having the wings thus held by the pin is obvious. You are enabled to see whether the upper wings on each side are the same height, a condition inseparable from good setting. When this has been arranged to your satisfaction, take again the aforesaid label (A), and pin it on the apex of the wing, as in the figure. As soon as this is done pin B may be removed. The under wing is then pushed up to the required height, and fastened by a label, D. The other side is operated upon in a similar way. The chief difficulty which the beginner will have to encounter is the *pushing up* the wings—I mean without injuring them. This can only be overcome by constant and regular practice. It is also to be observed that the same difficulty must be met, whatever be the method of setting.

It is obvious that the *body* of the insect will *sink* unless supported. This is done by means of the two pins *e* and *f*. It is also a good plan to have a *third* pin inserted at the extremity of the anus. The first pair of legs should be lifted up from the groove, placed on the board, and, with the antennæ, fixed by pins. (*Vide* figure.)

The boards should be kept in a dry clean place, and carefully guarded from dust. The insects should be examined every morning, to see if the wings, antennæ, &c., have slipped. This must be done till the insect has stiffened.

Such is *my own* method, and, however complicated it may appear in *description*, it is in *practice* very simple.

Some years ago there was a correspondence carried on in the pages of the 'Intelligencer' respecting the different methods of setting. On the Continent insects are set perfectly *flat*. Very long pins are employed, in many cases needles, which are thrust through the insects very nearly to their tops. The gentleman who initiated the controversy alluded to was a foreign entomologist of eminence, Dr. Staudinger. His object was to persuade English collectors to adopt the foreign method. Only three or four, I believe, gave in their adhesion. I am not surprised at the number being so small. I have seen many collections abroad, and some at home, set in the foreign fashion; and I must say I cannot conceive a more hideous, unnatural or ungraceful plan. I never look at a continental specimen of an insect, perched up at the top of a pin or needle

about three inches long, and its wings perfectly flat, without being irresistibly impressed with the idea that it has been first *painted* on a piece of stiff cardboard, and then cut out and pinned. Every one to his taste nevertheless, and some of my readers may like to try it. I am, however, unable to give any directions as to the *modus operandi*. The insects should not be *finally* removed from the setting-boards until thoroughly dry. The length of time required to effect this will vary according to the state of the atmosphere, the size and sex of the insect, and the Order to which it may belong. They must be kept perfectly preserved from both dust and damp. For this purpose tightly-fitting boxes, with sliding trays to hold the boards or blocks, may be procured.

As I have already hinted, it is both a difficult and troublesome matter to set an insect *well*. Yet, even when this is accomplished to the collector's satisfaction, he must not suppose either that his work is over or his troubles at an end. When the insects are arranged in the cabinet or store-box, there are three enemies lurking in secret about them. They are grease, mites and mould.

*Grease*.—This is the word employed to describe the oily or fatty matter which exudes from the bodies of many insects. It first appears in blotches on the abdomen, and, if neglected, extends to the thorax, thence to the wings, and finally to the paper; thus spoiling both the insect and the appearance of the

cabinet or box. The *males* are *much* more liable to grease (verb) than the females. The following are among the insects which, sooner or later, are almost certain to become greasy, *viz.*, the "Clear-wings;" *Macrogaster Arundinis* and *Zeuzera Æsculi*; the genus *Hepialus*; the "Tiger" moths,—in fact, nearly all the *Bombyces*; many of the *Geometræ*, especially the genera *Selenia*, *Ennomos*, *Phigalia*, *Nyssia*, *Biston*, *Amphydasis*, *Hybernia*, *Eupithecia*, &c. Among the *Noctuæ* may be mentioned *Leucania*, *Nonagria*, *Hydrœcia*, *Heliophobus*, *Charæas*, *Cerigo*, *Triphæna*, *Orthosia*, *Anchocelis*, *Glæa*, *Xanthia*, &c., &c. It would, however, be endless work to name all the insects liable to grease. It is sufficient to say that, so far as my own experience goes, four out of every five amongst the *males*, in all the Orders, are so. The only genus, amongst the *butterflies*, which I have found subject to it, is *Vanessa*. When an insect is thoroughly—body, legs and wings—saturated with grease, it presents a deplorable appearance. All the brilliant colours and beautiful markings have vanished, and it becomes impossible even to distinguish the species. To restore an insect thus "greased" many plans have been tried and many preparations used. Among the latter are—benzole, naphtha, benzine collas (the best in my opinion), camphine, and rectified spirit of turpentine. The insect is, by some collectors, wholly immersed in the preparation; by others the preparation is applied with a camel's-hair brush. It is then partially dried on blotting-paper, and afterwards covered over with

magnesia or finely-powdered chalk. At the end of about twenty-four hours this is gently rubbed off with a camel's-hair brush, and the insect is found restored to its pristine beauty. Such at least is the result, as I have been assured by many eminent entomologists. I have not found it so myself. According to my experience the insect rarely possesses, after the operation, its original fresh and downy appearance; it is liable to become again greasy; and not unfrequently, especially in the case of the Geometræ, if wholly immersed, the wings will become hopelessly crumpled; at any rate, I have experienced all these misfortunes. I am of course quite ready to allow that these evil results may be due rather to my performing the operation badly than to anything intrinsically wrong in the operation itself. Repeated failures, however, in *removing* the grease to my satisfaction, prompted me to try whether I could not *prevent* it. I have adopted, for some years, with complete success, the following plan, and I recommend it with much confidence. To illustrate it, let us take a male *Notodonta dictæa*. When the insect has been on the setting-board a sufficiently long time to render the contents of the body firm and viscid (not *hard* or *dry*), remove it. Take a pair of sharp fine-pointed scissors, and cut from the under side of the body a small slip, *i. e.*, beginning at the extremity of the abdomen on the *left* hand side, cut up to the thorax; and having done the same with the right side, remove the slip thus made. Care of course must be taken not to cut too

deep. Take now a sharp penknife, and, inserting the point at the thorax, draw it gently down each side of the body. It will be found this can readily be done, if the contents are not *hard*. The interior, when thus loosened, can easily be picked out with the point of the knife, or a pin or needle. In very small insects, as *Dosithea*, *Eupithecia*, &c., instead of a knife a fine needle must be used, and great care and caution are necessary. In a moth, however, like *Notodonta dictæa*, the contents of the body will frequently come out in one lump. When this has been effected, break off the body within twenty-four hours, taking care that the *under* wings do *not* come off with it. If the body is left on for any length of time, the grease will run into the thorax, and your labour be in vain. Take now a very fine pin, and run it through one *side* of the empty body for about one-sixth of an inch. Let it remain thus for a few days until thoroughly hardened, and then immerse it in any of the above-named fluids for about six hours. Afterwards dry it on blotting-paper, which will in most cases be found sufficient, especially if the fluid employed has been benzine collas. The bodies may with great benefit be exposed to the *sun*. Very *feathery* bodies are, however, improved by covering them over with magnesia (not chalk) for a day, having previously dried them on the blotting-paper for about a quarter of an hour. The magnesia may then be *blown* off, or, if it should cling to the body (which, however, very rarely happens), it can be gently rubbed off with a camel's-hair brush.



After this process the body will be found wholly free from grease, and can be reunited to the thorax with a little strong gum. If kept for years it never will, or indeed *can*, grease; all *moisture* being gone, the pin can never be crusted with verdigris; and last, though perhaps not least, the contents of the body having been removed, and the *shell*, so to say, having been well soaked, the insect is comparatively safe from *mites*.

The object of running a pin through the side is—*first*, that by means of it the body can be removed from the benzine collas with a pair of scissors, without injury; and *secondly*, for the purpose of attaching a little paper label to it. The object of this I proceed to explain. It would obviously be a troublesome business to soak each body *separately* as it became ready. Having therefore, suppose, twelve pupæ of *Notodonta dictæa*, which emerge at different times during a fortnight, I clean each as it is ready, and, having broken off the body, attach to the pin a little paper label, numbered 1, 2, 3, &c., corresponding with a similar label attached to the insect. This is of course that each insect may obtain its own proper body. The number must be written in *pencil*, as, if in ink, it will be obliterated. The body will sometimes (for what reason I know not) be found filled with a dark fluid. In this case take a little roll of blotting-paper, and fix it in the body. This will absorb the moisture. Afterwards insert it in the benzine collas, as above. The method may appear a little

elaborate, but in reality it is as simple as possible. It demands a little trouble no doubt, also a little patience and practice. But the result more than repays you. It may perhaps be objected that this is "patching" an insect. If well done the operation will escape the most critical eye. Sometimes the body *contracts* a little after the interior has been removed. This, however, may almost always be obviated by not "operating" too soon, and by letting the body remain some days before immersion into the benzine collas.

I adopt this plan with all insects taken or bred by myself, and, as far as possible, with those received from correspondents. In this latter case the operation is much more difficult, owing to the *hardness*, and in some instances the *antiquity*, of the specimens sent. If the wings of the insect, when removed from the setting-board (in order to prepare the body), are not thoroughly dried or stiff, it must of course be replaced and reset, not forgetting to attach the label. The bodies of insects which have been taken at *sugar* will frequently be found completely filled with the composition. To remove this nothing is required but little rolls of blotting-paper, and it will not be found necessary to *immerse* the body. Sometimes, however, the composition will, after death, exude through and soak the body. When this occurs the body must be opened, and the composition removed with the blotting-paper. The body must then be broken off, and soaked for a quarter of an hour in boiling water, and afterwards thoroughly dried at the fire. Every trace of

discoloration will then have disappeared. Whatever credit may be given to these plans is due *solely* to myself, but I have no intention of taking out a "patent" for them. I shall be more than satisfied if my readers will adopt them, for I feel certain that the result will amply repay them.

While, however, thus confidently recommending *my own* plan, I think it right to give another, recommended by Dr. Wallace.

"Small greasy insects . . . . I soak entire in benzole.\* Of all large insects which may even be suspected of grease, having disarticulated the bodies from the thorax, and labelled according to the plan suggested by Mr. Greene—either of a year's capture or many years' collecting—I expose such (bodies) to the heat of the fire, on a cork placed at about six inches distance; and if the grease has previously run into the thorax, and spread over the wings, such parts must be further soaked, in the manner above recommended for the smaller insects. By exposure on a cork to the fire, the grease, being liquified and permeating the body, shows itself on the exterior, causing softening and a dark discoloration; if no such action takes place there is no amount of grease in the interior of the body, and no need to slit open the body as hereafter described. Simply soaking for a few days in benzole will remove the small portion of grease which may be deposited on the exterior of the insect.

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\* Procurable of Warner & Co., 55, Fore-street, E.C.

When discoloration and softening ensue, I slit open the body on the under surface and soak in benzole for twenty-four hours; then, taking say a hundred or more bodies, I boil them as rapidly as possible in about an ounce or more of benzole (adding a little from time to time) in a water bath, which may be easily composed of a saucepan containing water, in which is placed the covered jar containing the benzole and the bodies. In this process that portion of benzole which had previously soaked into the interior of the slit body, having been brought into close relation with the grease, so as to dissolve it, is very readily volatilized; bubbles of gas are seen to effervesce rapidly from the body, currents of boiling benzole rush into and out of the slit body, and the grease is literally washed out; . . . . if the body be soaked, and not boiled, the benzole in the interior of the slit body dissolves the fat; but, while drying, it percolates slowly through the substance of the body, and deposits again in the interior nearly the whole of the grease previously dissolved, that portion only being got rid of which, being on the exterior layers, is in immediate relation with a surrounding stratum of benzole. The quicker the boiling, the more readily is the grease washed out. . . . . The bodies are now removed from the hot liquid, washed with fresh benzole, dried on blotting-paper, and, if exposed again to the action of heat, will show no signs of grease. It will be found necessary to test a single body from time to time, the period necessary to extract all the grease varying according to the

rapidity of boiling, the strength and purity of the benzole, and the amount of grease in the bodies. The bodies are finally attached, each to its corresponding thorax, with Canada balsam, liquid glue or gum. I think I may safely state that insects thus treated will never grease again.”\*

It seems to me somewhat of an objection to the foregoing plan (if I understand it rightly) that Dr. Wallace does not *remove* the contents of the body, but only slits it open. This makes it *possible* that it may grease again: by my method it is of course *impossible*.

*Mites.* — When these little creatures get into the cabinet or store-box they make sad havoc. That distinguished entomologist, the late Mr. Haliday, gives the following directions for “killing and excluding” them: —“For the former purpose invert the drawer uncovered over a sheet of blotting-paper or cloth moistened with liquid naphtha, for one hour or more. Steam, or fumes of prussic acid cautiously applied, might be still more certain; but there may be special objections to each. Naphtha is safe, injures no specimens, and requires no apparatus. At all times take care that the drawers (and boxes) *close* accurately, and keep them in a *dry*

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\* In a private communication addressed to me by Mr. H. Doubleday, he speaks of the *danger* of this method, owing to the extreme inflammability of the benzole.

and *airy place*; let them be supplied with plenty of *camphor* in niches all round (or, if *boxes*, with pieces pinned firmly into them); keep a few small globules of quicksilver loose in each drawer [I do not advise this]. Go over all the drawers at stated periods of the year, replenishing them with camphor, and, if there be any suspicious appearances (*i. e.*, 'frass' under the specimens), employing the fumigation above named. Place no specimens obtained from other collections in your drawers without leaving them first for some time in the fumigating-box." These directions are excellent, and should be carefully followed out. A writer in the 'Intelligencer' says:—"I have found an invaluable cure (for mites) in Buffon and Wilson's (391, Strand) 'Moth Exterminator,' which is sold at one shilling a bottle. . . . The mode of application is to put a drop of this liquid on a piece of cotton wool, and place it in the place infested, and all signs of animal life will disappear." Another writer recommends a small pill-box head well secured, and filled with oil of tar, into which, at *the moment* of closing the drawer, a few drops of a strong solution of cyanide of potassium are to be poured. Mr. Stainton advises a composition of "equal parts of oil of thyme, oil of anise, and spirit of wine." Let a drop of this be placed on the under side of a highly infected specimen, and let a drop or two be placed in each corner of the drawer and box. This is the preparation I employ myself, and I think it is as good, and certainly as simple as any other.

*Mould.*—This, in my opinion, is the worst enemy the collector has to deal with. No precautions can *wholly* prevent it. Of course the *drier* the room and the situation of the cabinet or boxes, the less likelihood is there of the specimens becoming mouldy; but I have never been able entirely to exclude it. I know of only one remedy, which was very kindly communicated to me by Mr. H. Doubleday, in a letter to Mr. Newman. I give his own words:—“Every insect ought to be touched with a weak solution of bichloride of mercury in alcohol. . . . I believe insects *never* get mouldy when this is done.” Mr. Newman adds that another correspondent declares that “mould is impossible, if the cabinets are kept in a proper place.” I can only say I wish I knew what the “proper” place is.

*Cabinets and Store-boxes.*—When the insects are thoroughly dried it only remains to arrange them in the cabinet or store-box. I shall say no more on the subject of cabinets than this—that they should be made *entirely* of oak or mahogany. The drawers must be glazed, lined with cork, and grooves made round three sides to admit pieces of shred camphor, which will have to be renewed once or twice a-year. The dimensions of the drawers must be left to the fancy of each collector. In my own cabinet, which contains thirty drawers, the dimensions of each drawer are as follow:—area in the clear (*i. e.*, exclusive of the three grooves) sixteen inches and a half by fourteen

and three-quarters. Depth, in the clear (*i. e.*, exclusive of the cork), one inch and a quarter. Many, probably, of my readers, however, will be unable to afford the cost of a cabinet, at any rate at first. In this case store-boxes must be procured, which should be of the size and shape of an ordinary backgammon-board. Great care must be taken that, when shut, the two sides fit closely and accurately, so as to exclude as far as possible all dust, mites, &c. The box must be lined with cork, a quarter of an inch thick. This is then covered with white paper (not too thick, or it will turn the points of fine pins). For the same reason, it is better that the paper should be affixed to the cork with *paste*, not gum or glue.

*Arrangement and Nomenclature.*—With regard to arrangement and nomenclature, I believe the vast majority of collectors adopt both one and the other, as contained in Mr. H. Doubleday's 'Synonymic List.' This work is a monument of patient industry and laborious perseverance. No collector should be without it. It is printed on one side only, for labels. The price is only eighteen pence, and Mr. Newman (9, Devonshire-street, Bishopsgate, London) will send it post free for that sum.

*Number of Specimens and Manner of Placing.*—The number of specimens to be placed in the cabinet, and the manner of placing them, must evidently be optional. I do not think, however, that the number



should ever be less than *four* at the least. I have adopted the following method of arrangement, which my readers can follow or not, as they like. The general principle of it is this,—that each drawer shall be divided *horizontally* into two, three, or any number of *equal* parts. These are crossed by perpendicular lines, the width between them varying of course according to the size of the insects. Now, suppose that there are in a drawer ten such *upright* divisions. These being multiplied by three, we have thirty spaces, all equal in *length*, though varying of course in *breadth*. Commencing at the left hand top of the drawer, I place, in the middle of the division, the *generic* name, fastening it with a little thin paste, and a fine pin at one end. Then follow the insects, until the allotted space is filled; and next the *specific* name, which is attached as before; and so on with the next. Whenever a genus (having more than one species in it) *ends*, the next *generic* name is placed immediately under the preceding *specific*. By this method a (to me at least) very pleasing and symmetrical effect is produced, and by running the eye *across* the drawer the name of an insect is discovered at once. The perpendicular lines must be marked out first, from top to bottom, with a pencil; I mean, of course, ruled. In marking out these lines, the following precautions must be taken. Supposing row No. 1 is intended to contain *three* species. Then the *largest* specimen must be picked out; I mean the largest specimen which will occur in that row when

it is filled up. Place this specimen at the top, and mark out, with a pencil dot, the required width. Proceed in the same way with the next and the next row, until the drawer is filled. For example, suppose your first row is intended to contain the three following species: — *Agrotis velligera*, *A. puta* and *A. suffusa*. Now, *A. suffusa* is the largest species, and of course the largest specimen of *it* must be chosen. Place it as directed. The three species for the *next* row will be *A. saucia*, *A. segetum* and *A. lunigera*. Here *A. saucia* will be the largest species. Proceed then with it in the same manner, and so on to the end of the drawer. The distance *between* the specimens when thus laid side by side must be optional. I place them as close as I can, short of overlapping. The *horizontal* line is marked out by a dot only in each division to show where the names are to come. In using this plan, however, it will be obvious that, as some insects are larger or smaller than others, fewer or more specimens will be required to fill the spaces. This I don't mind. I readily allow also that I have not been able to carry out this plan *completely* in *every* drawer. Sometimes the species will come rather awkwardly. However, not to dwell too long on this matter, I have adopted this method (with some exceptions) in the Bombyces, Noctuæ and Geometræ. In the two former I have divided my drawers into *three* and *four* horizontal sections; in the latter, into *three*, *four* and *five*. In all these cases I find that from six to twelve specimens are sufficient to fill up the spaces. In one

or two drawers I have divided the first half into three, and the second into four, sections. There are one or two other little difficulties and objections, which I do not enter upon here, for two reasons—*first*, if my readers, or any of them, do *not* adopt my plan, it is unnecessary; and, *secondly*, if they *do*, they will soon find them out for themselves, and, I doubt not, soon overcome them, as I have done—to my own satisfaction at least.

It only remains for me to say a few words about “relaxing” insects and transmitting them by post, and upon entomological books, &c.

*Relaxing.*—When an insect has been badly set, or not set at all, it must be relaxed. This is very easily done, in various ways. Mr. S. Stevens says, “I procure about a dozen shoots, with the leaves, of laurel (the younger the better), put them into a coarse bag or cloth (shot-bag I use), bruise them well with a wooden mallet till the bag becomes quite moist; then put it into a jar, or other wide-mouthed glazed vessel, and stick the insects on the top of the bag, which [the jar, I presume] must be tied over with a bladder, or secured in some way, so that it is perfectly air-tight. Twenty-four hours are generally sufficient to relax most insects; but one great advantage is, that if they remain a week or ten days in the laurel they are not in the least injured, so that they can be set out at any convenient opportunity; it also completely destroys

the mites or mould, if the specimens happen to be infected; and it will be found to have many very great advantages over the old plan of damp sand and flannel. I was in hopes, from experiments I made on two or three green species, that the colours would not fly, but I since regret to find, on further trial, that *Papilionaria*, *Vernaria* and *Cytisaria* are considerably changed by it." (Zool. iv. 1343.) The following is my own very simple plan:—Get a vessel of any kind, and half fill it with water. Place in the water anything that will stand steady. The top of it must be a couple of inches above the surface of the water. Take then a piece of cork and soak it. Having partially dried it, stick the insects on it, not letting the wings or body (if possible) touch it. Then place the cork on the block, or whatever it may be, in the water, and cover over the vessel with a damp cloth. I have relaxed insects with the utmost ease in this way, in periods varying from six to twenty-four hours. There is one hint about re-setting an insect which is valuable. Relaxed insects, when re-set, are very apt to spring back, especially in damp situations. The way in which I have obviated this is by putting a small portion of liquid glue under the wings, at their junction with the thorax. Gum will not do, as it does not adhere. A pin with the head cut off, and fixed into the feather end of a quill pen, is as good as anything for applying the glue. Care must be taken not to put too much glue, else it will stick to the setting-board and spoil the insect. When an insect has been relaxed (according to my

plan) and re-set, I place it for a quarter of an hour or so before the fire, at about a yard distant. This is to remove any moisture which may possibly remain, and which would render the insect liable to mould. I may just add that an insect set with the liquid glue will be ready to be removed from the setting-board in twenty-four, or at most forty-eight, hours.

*Transmission of Insects by Post, &c.*—Insects may be sent through the post with tolerable security, if proper precautions are taken. In order to save postage the boxes should be as light as possible, consistent with strength. The more *convex* the box, the greater the strength. Chip or pill-boxes should only be used when it is desired to employ an expensive method of destroying insects. If of sufficient depth, the box should be lined with cork at the top and bottom. The insects should be *firmly* fixed in the cork. If there be a specimen which will not hold firmly, don't send it at all: it is almost sure to injure both itself and its companions. Place pins transversely across the bodies. If the bodies are unwieldy, it is as well to place a third pin at the extremity of the anus. Some persons put a little cotton wool under each specimen. Having closed the box, tie it as *tightly* as possible. I believe this to be one of the most essential requisites for a prosperous journey. Then roll the box in cotton wool. *Don't spare it.* It may perhaps cause an extra penny in the postage, but surely it is better to give that than run the risk of having your insects

destroyed.\* Let me, then, repeat to my younger readers, *don't spare* the cotton wool. Next wrap it up in black glazed calico, and fasten it with sealing-wax. Some persons *sew* it, but this is unnecessary, unless you are anxious to take a few lessons in that useful accomplishment. Lastly, tie a label to the box, and the operation is complete. The label, of course, contains the address and stamps. If these directions are carefully attended to, insects will, in the great majority of cases, travel quite safely. In passing, let me say, don't send greasy, mouldy, mitey or damaged specimens, unless you have previously notified to your correspondents that they are so. I cannot refrain here from making an extract or two from a letter, addressed some years ago to the Editor of the 'Intelligencer.' The writer had been accused of keeping a correspondent's box. In his reply to the charge he describes four boxes (with their contents), one or other of which he says must be the one alluded to. The portraiture of boxes 3 and 4 is one of the most amusing things of the kind I ever read. For its accuracy in *other* instances I can confidently vouch from a very considerable experience: — "No. 3 box containing a miserable Pyrale, with pin-holes through its scaleless and fringeless wings (described in the promissory note as a 'fine bred specimen of *Stenia punctalis*'); for this a long series of several species

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\* Boxes can now be sent, per "pattern post," for one penny or twopence, according to size and weight.

is requested, as the correspondent's series is 'three rows of each insect.' No. 4 large box containing fragments of various species, several bodies, and antennæ not only broken off, but missing; these insects (which are entitled to respect on account of their venerable appearance and undoubted foreign origin) have been liberally anointed with some greasy liquid for destroying mites." I have enjoyed many a hearty laugh over this description, and I trust that my readers may do so likewise; but let me earnestly caution them against imitating such unworthy and disreputable conduct.

*Transmission of Larvæ and Eggs by Post.*—Larvæ may be sent by post in tin boxes, in company with some of their food. Unless, however, they are very small or quite young, it is a dangerous experiment, as they will bite each other, and the confinement is more or less injurious. The best plan for transmitting *eggs* is, I think, to put them in a quill, and fasten each end with a bit of cotton wool. They can then be forwarded in an envelope. Or they may be put in a *flat* pill-box, which must itself be put into another. I recommend the quill.

*Entomological Books, &c.*—Of these may be named Westwood and Humphrey's 'British Butterflies and Moths,' an expensive work, and somewhat out of date. Morris' 'Butterflies and Moths,' a book I cannot speak highly of. Stainton's 'Manual of British Butterflies

and Moths.' The objections to this work are, the extreme brevity of the descriptions, the frequently inaccurate description of the larvæ, and the too often delusive statement that "the young collector may confidently, or reasonably, expect to obtain" such and such insects "during his first or second year." It is, however, a useful book in many respects, and the Lepidopterist should certainly not be without it. But, beyond all comparison, the best work is one recently completed, by Mr. E. Newman, and entitled 'An Illustrated Natural History of British Moths.' It contains, with a few exceptions, all the recently discovered insects. The descriptions of the *perfect insects* are full, and as clear as it is possible to make them by word-painting, while those of the *larvæ* are drawn up with a care and minuteness almost too elaborate. But the marvel of the book is the woodcuts: they are truly *wonderful*, and, though not coloured, yet, in the vast majority of instances, I venture to think that the veriest tyro will at once recognize his insect, upon comparison with the figure. Not less remarkable, considering its excellence, is the price of the book. I have no hesitation in expressing my opinion that it is by far the best elementary work on the British Lepidoptera, and no collector should be without it. I may add that Mr. Newman is at present engaged on 'An Illustrated Natural History of British Butterflies,' issued in monthly numbers. I have not yet seen a number, so am unable to speak as to its merits. Lastly, I recommend to



my readers 'Newman's Entomologist,' and the 'Entomologist's Monthly Magazine.' These two periodicals are issued every month, and contain interesting records of captures, descriptions of larvæ, exchange lists, &c.

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### GENERAL OBSERVATIONS.

I shall now bring this little work to a close with two or three general observations.

"Mere collectors" is a phrase which I have often heard and read. It is used as a term of contempt. Why? Is there anything *contemptible* in a poor or a rich man's making a collection of some of the most beautiful and wonderful of God's creatures, even though his object be only to please his eye? Is there anything *contemptible* in a poor man, after he returns from a hard day's work, taking down his boxes or glass cases, and admiring his insects, even though they be not scientifically arranged? Is there anything *contemptible* in the sight of a number of mechanics, or men even of a humbler grade, gathered together while they examine each other's collection, and recount where that "beauty" was taken, or how that "rarity" was discovered? I only wish we saw such spectacles more frequently. When I hear scientific magnates, so called, speaking sneeringly and slightingly of "mere collectors," I am tempted to

inquire, "What benefits have your *scientific* investigations conferred upon yourself or upon others? Do you feel that your mind has been enlarged by investigating the anatomy of a *flea*? or is the social and moral state of mankind improved and advanced by the circumstance that a celebrated naturalist devoted some of the best years of his life to discovering the number of muscles in the body of a caterpillar?" I do not for one moment wish or mean to depreciate true scientific acquirements. I am only desirous to defend from *contempt* those who do not possess them. The "mere collector,"—if by that term be meant one who enjoys the *act* of collecting insects; who derives satisfaction from watching their habits and transformations; who employs his leisure hours in arranging them, even though it be unscientifically; and who, when all is done, looks with pleasure at his collection, or points it out with pride to a visitor,—the "mere collector" has my heartiest good wishes, for I fear I am little more than this myself. Observe, I am far from wishing to *restrict* my readers. If you feel that you have the time, the means and the ability for going deeper into the subject, by all means do so; but when you have ascended some dozen rungs of the ladder, don't look back, with a smile of pity, upon those who are at the bottom, and say "mere collectors!"

Let me at the same time caution you against a too eager desire of accumulating specimens. And this leads me, by an insidious gradation, into the delicate subject of *exchange*. In laying it down as a general

principle that I decidedly *approve* of exchange, I am aware that I express an opinion adverse to that entertained by some entomologists. It would, however, I think, be a *serious* omission, in a work of this kind, to avoid all mention of such a subject as this, or to shrink from stating plainly my views on it. Those views, let it be remembered, are the views only of a single individual, and are put forward merely as representing my own private and personal opinion. I lay it down, then, as an axiom, that no one *objects* to receiving insects in exchange (or in return, if the word "exchange" is disliked) for insects sent to a friend or correspondent. Am I wrong in adding that when A sends B a nice box full of good local insects, he (A) entertains a "lurking hope," not to say expectation, that B will send him (A) something in return, though nothing has been *said* expressly to that effect? How many can lay their hand upon their heart and say, "Not guilty, upon my honour"? Now, is there anything to be *ashamed* of in entertaining this expectation? If there be anything to be ashamed of, it consists in this, in my opinion, that A fears to *express* what he hopes or expects. Is there anything to be ashamed of, I ask again, in the expectation itself? I venture to express a very decided opinion that there is *not*. For example: I go out after *Xerampelina*. I spend perhaps six hours (I have often done this) in one day, and bring home two pupæ. Working in this laborious way (and let those who may doubt the labour only *try* it) I obtain perhaps

twenty pupæ by the end of the season. I kill, pin, set them out, and clean the bodies. Soon comes a letter from a comparatively unknown collector to this effect, "I hope you have been successful with *Xeram-pelina* this year; I shall feel much obliged for a specimen or two," &c. If I *do* send them, am I, or am I not, entitled to expect a return? Is it unreasonable? If it *be*, why is it? It is absolutely useless to din into my ears the oft-repeated platitude, "those who *give* most will *receive* most." I *know* the contrary. Rather more than five years ago I made a *free* offer of some uncommon insects, as *Dodonæa*, *Trepida*, &c. I received hosts of applications. I supplied with two or more specimens upwards of twenty-four of my correspondents. From that day to this I have never heard from *one* of them—*i. e.* voluntarily. Were I to proclaim that I had *Bicuspis* or *Sphegiformis* to *give away*, I should probably hear by return of post. This remark, be it observed, does not apply to my *friends*, nor to all my correspondents. Among these latter I could gladly mention some shining exceptions, were it not that they would probably be unwilling to have their names brought forward in so public a way. Farther—I consider it an unanswerable argument in favour of exchange that, without it, very few can hope to make a collection, unless of the most limited kind. How is a Northern collector to obtain Southern insects, and *vice versa*? How is a poor man, or a man of business, residing in Suffolk, to procure the "Lulworth skipper"? How is the Devon-

shire labourer to obtain *Lithosia Muscerda* or *Agrophila sulphurea*? The answer clearly is, by exchange, and by exchange alone. It is quite true that the gentleman who has ample leisure and a full purse may pack up his carpet-bag or portmanteau, and take a first-class express ticket, as soon as he hears of some new or rare species turning up. But I suspect that leisure and money are among the *desiderata* of most entomologists. It is also true that there are others who, though they have no *leisure*, have *money*, and consequently can either buy, or employ men to collect for them. But the same objection meets us. Naturalists, as a rule, are not *rich* men. So strongly persuaded am I, not only of the propriety, but of the necessity, of exchange, that I should welcome with joy a "monthly" wholly devoted to it.\* As to the manner of exchange, the relative value of insects, &c., &c., such matters must be left to the individuals concerned. Of course I am aware that, by some, these views will be met by the usual epithets, "mean," "illiberal," "peddling," "derogatory to Science," and so forth. I am supremely indifferent on this head. When it has been proved that that which is permitted and done without hindrance or prejudice in every other pursuit or occupation, is in this case alone unjustifiable or objectionable, I hope I shall be "open to conviction." In default of such proof,

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\* 'Newman's Entomologist,' price sixpence, now exactly meets this requirement.

I shall continue to be a warm advocate of "exchange." But, when exchanging, do not attempt to deceive or "take in,"—do not take advantage of the inexperience of a *beginner*,—do not send bad specimens without previous notice,—in a word, "Do unto others as ye would others should do unto you."

One other observation. When collecting we must be prepared to encounter a little ridicule from the unconcerned or astonished spectator. No one likes ridicule,—at least *I* don't,—and I confess that, when fully equipped I don't court observation, but avail myself of the least-frequented bye-ways to reach my hunting-ground. That eminent Arachnologist, the Rev. O. Pickard-Cambridge, gives a most amusing account of his emotions on seeing a rare spider running on the pavement in one of the most crowded thoroughfares in Edinburgh:—"The passers-by would occasionally stop, probably wondering what the tall parson could be about picking up and bottling small black specks off the pavement ~~which~~. made me feel uncomfortable, for I confess that I always do feel just a little so, for a moment, when a spider has to be captured under public gaze. To care absolutely nothing for what people think (and sometimes say) on such an occasion, is a difficult lesson to learn thoroughly. Some entomologists of my acquaintance will walk through a town, net in hand, with the utmost indifference; but, for my own part, I much prefer secreting the implements of the craft in my pocket until far from the gaze even of an enlightened

British public." Talking of an *enlightened* British public reminds me of a little incident that occurred to myself. I had been pupa-digging for some hours at the roots of various trees. I won't name the place or the county. During the whole time I observed a man standing at a respectful distance, and watching me as I went from tree to tree. Being well accustomed to such supervision, I thought little of it at the time, but shortly afterwards I was informed by a brother clergyman that, as soon as I left, the man hastened home, procured a large spade, and forthwith commenced "digging" on his own account at the trees, not for *pupæ*, but for *money*, which, as he supposed, I had been hiding! Nor is the surprise caused by our proceedings always confined to the genus *Homo*. I remember, on another occasion, being "out" with a brother naturalist, on a pupa-digging expedition. Our occupation was pursued under difficulties, for, it being a steady down-pour of rain, an umbrella was held in the left hand, while, with the right, the trowel was worked, as best we might. I had been digging, for nearly a quarter of an hour, at one tree, under the shelter of the umbrella. Upon standing up to relieve my aching back, I found myself surrounded by a double "cordon" of sheep and cows. The inner circle was formed of the sheep, the outer of the cows. The solemn, open-mouthed wonder of the sheep, and the grave, dignified astonishment at my proceedings expressed in the faces of the cows, was one of the most ludicrous sights I ever witnessed. The ridicule of the

uninitiated and ignorant is, however, very much less than it was twenty years ago, when, as a boy, I began to collect "bootherflees" in the ancient city of York. This is doubtless to be attributed partly to the spread of education, and partly to the vast increase of entomologists since that time.

Before launching my little bark on "entomological waters," I wish to say that, in the composition of my portion of this work, I have kept *one* object steadily in view—to make it thoroughly *practical*. I have not been careful to employ polished or refined language, much less have I attempted anything approaching what is called "fine writing." I shall not, through any affectation of modesty, scruple to say that I think it will be found useful to the "beginner," for it contains the results of many years experience of myself and other *practical* collectors.

To end a book well is perhaps as difficult as to begin and carry it on well; but I trust my readers will agree with me in thinking that no better or fitter words could be found to conclude a work of this nature, than those of the Psalmist, "O Lord, how manifest are Thy works! in wisdom hast Thou made them all; the earth is full of Thy riches."



## A CHAPTER ABOUT COLEOPTERA.

BY EDWARD NEWMAN.

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IT is always injudicious to depreciate the work of one's own hands: many apposite, though trite, proverbs might be cited in support of this, and yet a love of truth compels me to acknowledge how incompetent I feel myself to the task I have undertaken, and how much better the task might have been performed by others—for instance, by the indefatigable Power, the most painstaking Janson, the amiable Waterhouse, the enthusiastic Crotch, the philosophic Wollaston, and very many others who are yet rising towards that eminence in the science of Coleopterology which the gentlemen I mention have attained, and which is not now, even if it ever were, an object of my ambition. It was not until every reasonable effort had been made to get a better man, that I reluctantly undertook the task, and that I consented to reiterate those instructions which in my earlier days were supposed to be of service to others still younger than myself in beetlecraft. It is for such as these I write, and should my lucubrations fall into the hands of experts, let them by all means teach their own better way—it is no part

of my design to close any avenue to knowledge; and should some profound critic say to me, "Thou hast no practical acquaintance with the modern art of beetle-hunting," and add, in the words of the poet,—

"Scribere recte sapere est et principium et fons,"

I would delicately remind such critic of a difficulty he might possibly himself experience even from excess of knowledge—the difficulty of rendering himself intelligible to those less learned than himself; for of a truth, in the words of the same sagacious poet, who seems armed at all points,—

"Difficile est proprie communia dicere."

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COLEOPTERA, or beetles, are to be found everywhere, not only from the topmost twigs of the tallest trees to the very surface of the earth on which we tread, but above the trees,—far, far above the tree tops, even in the air itself: far, far below the surface of the earth, even in those deep caverns, dank and dark, which seem so thoroughly designed for avenues of another world. Only look up into the blue empyrean on a summer's evening, and you will see the swallows and the swifts floating in all manner of curves, and circles, and segments of circles; they are hunting for beetles: those lofty regions of air are their "happy hunting grounds," replete with game, filled with

beetles, poetically, but not quite truly, "shard-borne;" they are borne by the wings, for which the shards or elytra serve only as a protection. Why the upper regions of air should be filled with little beetles is a question which may perhaps be much easier to ask than to answer; and yet the answer may be found in that migratory impulse which compels a change of residence: the little beetles soaring to regions of which they never formed an idea, or descending in showers on some far distant lands, are but types of the swallow, and the crane, and the locust, which migrate in a more showy and attractive manner,—in a manner, indeed, which forces itself on our notice,—and that phenomenon which appears to human eyes merely a reckless waste of life on Nature's part, is in reality a means by which she disperses, and thus preserves, her multitudinous creatures. Again, we mortals, short-sighted as we are, cannot understand why beetles should be shut up for ever in those dungeon caves, into which no ray of sun-light can ever enter, where eyes are of no use, and where wings would be simply an encumbrance: yet so it is; those wondrous caves have a beetle fauna of their own, eyeless and wingless, and doomed to what we should call an existence as wretched as the most skilful tyrant could devise: it is not so; it is only our philosophy that is at fault; there is no mistake in the arrangements of an Allwise Creator. But it is neither in the boundless realms of air nor deep in the bowels of the earth, that the entomologists I now address must seek for beetles.

Flowers, leaves, bark and wood of living trees abound in beetles; the bark and wood of dead and dying trees; the carcasses of dead animals: there is no better trap for beetles than a dead crow or a dead mole, or, by the river's side, a dead dog or dead fish; every fungus, living or dying, abounds in beetle life; and so does the dung of animals—of horses, cows, pigs and sheep. In the granary; in the baker's shop; in the malt-house; in cellars; under faggot-stalks; in the earth at the roots of trees; in gravel-pits and sand-pits; in moss; in mud; in water; under stones; at the roots of grass; everywhere.

Seeing then that beetles are so ubiquitous, there need be no difficulty in collecting them; and the simpler the instruments employed the less trouble will there be in procuring them, and the less expense in keeping them in repair: a walking-stick, an umbrella, and a wide-mouthed phial, are the three great requisites, but each, as we shall see, is susceptible of improvement. However, let us begin at the beginning. Furnished with these three implements, you sally forth into the fields. It is May or June: the hawthorn is covered with bloom; open your umbrella and invert it under the most floriferous bough you can find; you must hold it as close as possible, and under as much blossom as possible, and then you give the bough a smart rap with the walking-stick, and in an instant there descends a shower of white petals and living things, beetles, intermixed with spiders, earwigs, harry-long-legs and caterpillars. Sit down instantly, take the

still out-spread umbrella in your lap, take the cork out of your bottle, and, picking up the beetles as fast as you can, transfer them one by one to the bottle. Some will attempt to fly, others to run, and will scramble out of the umbrella if they can, but you must endeavour, by a celerity of manipulation, to restrain their well-intentioned attempts at self-preservation. Bottle everything at first, even *Lagria hirta*, that somewhat soft-bodied, brown-winged gentleman, that falls with every stroke of the walking-stick; bottle even that, and take it home to examine. Next try some other tree or shrub, especially juvenile aspens and abeles; hazels and birches and oaks. Aspens and abeles are particularly fond of throwing up offshoots or suckers in unexpected places, in roadways, open spaces, &c., and some beetles feed exclusively on their young leaves. Many leaf-beetles live entirely on leaves; their eggs are laid on them; their caterpillars are hatched on them; their chrysalids are glued to them; and the beetles themselves are well content to reside on them during the whole of their beetle-existence. I have often seen a young aspen so crowded with green beetles that they almost hid the leaves: just tap it with your walking-stick and see what a shower of gems falls into your umbrella! and so with willow-herb, only that the residents on willow-herb are brilliant blue.

Here then we have taken the first step in beetle-hunting, and now for improving the implements. In the first place, let me invite your attention to the

colour of the umbrella: an ordinary Gamp is usually made of very sombre colours, dark green or dark brown: now these colours are not well adapted to show off a small brown beetle or a small green beetle, often no bigger than a pin's head; and I therefore recommend a white umbrella, or, if you consider such an implement rather too showy and attractive,—and I am willing to admit that on beetling excursions one need hold out no inducement to outsiders in order to attract their attention,—then a kind of compromise may be made by having your umbrella lined with white calico or some similar material, leaving the exterior in full possession of its usual unassuming colour. I feel desirous to enforce the axiom that, when on beetling excursions, it is undesirable to take any superfluous steps that may attract attention, for there are few things more trying than the company of those who do not sympathize with your proceedings. The rightly disciplined mind may bear with the remarks of a dozen national-school boys, however uncomplimentary, or even aggravating, but when a stately rector or some “very clever and scientific” medical man asks, with politely condescending and patronizing air, “what are you doing?” and turns away with deeply injured feelings when you tell him the exact truth, it is hard indeed to bear. One does not like a conversation in which one has exerted his best abilities to please and to give information—one does not like, I say, such a conversation to be wound up in this fashion, “Young man, the next time a gentle-

man asks you a civil question I hope you will return a civil answer: you *may* have been at school, and *may* have learned to read and write, but you were never taught manners." If you had told some glaring untruth,—for instance, that the beetles were intended for food, or for fishing, your querist would have gone away perfectly satisfied, but as you have told the unobtrusive truth, that they are to be gummed on cardboard, arranged in rows, and labelled with Latin names, he is persuaded you are "poking fun at him," and resents it accordingly.

Next, as regards the stick; I have considered it only as a "threshing machine,"—let us now convert it into a "sweeping machine." "Find out," says Mr. Douglas, in his 'World of Insects,' "a descendant of Tubal Cain, who has ability to work neatly in brass; get him to make a figure Y with brass tube, the trunk two inches and a half long and five-eighths of an inch diameter; and each arm two inches and a quarter long and three-eighths of an inch diameter. Into one of the small tubes put a tightly-fitting cane and bend it until it meets the other small tube and forms a pear-shaped ring. In carrying, this ring may be rolled up so that it will go into your hat; then get a lady friend to make a bag net of book-muslin, rather larger than the ring, thirty inches long, and cut so that it shall hang perpendicularly from the handle tapering from the opposite point of the circumference, but rounded at the bottom, not going to a point; round the top of this muslin net must be a band of brown

holland into which the cane can slide easily." Slide the net on the cane and fit the two ends of the cane into the two smaller arms of the brass Y, and then fit your walking-stick into the larger tube or trunk of the Y. As soon as these arrangements are complete, and the cane and stick firmly fitted in their respective tubes, you have a sweeping-net of the most convenient size and shape. With this light and convenient net you can sweep the grass that grows by the road-side everywhere, taking care to avoid the brambles and briars. You have already been astonished at the number and diversity of objects procured by beating: you will I think be more astonished when you see "the green myriads of the peopled grass." The only difficulty and drawback to this mode of collecting is the plethora of captures; unless you examine your net continually you will find it half filled with a mass that no labour will disentangle; snails and grasshoppers, spiders and vaneer moths, earwigs and beetles, leaves and flowers, will be kneaded together in a hopeless conglomerate: the beetles will suffer the least, happily for them—their case is a hard one!! *Joke*

Still another use for the stick: a second net may be made of the material called cheese-cloth: this may be fashioned into a net like that already described by Mr. Douglas, and with a similar band of brown holland: then procure an iron hoop of a circular form and furnished with a tube or trunk, as in the case of the sweeping-net; into this the stick must be fitted, and you are then furnished



with a fishing-net. This again produces a myriad of novelties: every river, every brook, every canal, every pond, every ditch, every puddle, is replete with beetle life, and however great this diversity, you will find that each form is familiar to the masters of the science: in naming Lepidoptera we possess one guide and authority, Mr. Doubleday: in naming beetles we have many, and we find that Mr. Wollaston, Mr. Waterhouse, Mr. Crotch, Dr. Sharp, Mr. Janson, Mr. Rye, and many others, tread close upon the heels of Dr. Power, and divide with him the honours of naming Coleoptera.

Let us next turn our attention to decaying or decayed bark and wood: no sooner has a tree submitted to the irresistible attacks of age, and has thus become incapable of continuing its kind, than Nature enforces her mission of removing it from the face of the earth: wood-boring beetles immediately fall to work, penetrate the bark and the wood, and complete the destruction which old age had began. Now another implement is required, a chisel or screw-driver may answer the purpose, but it is better to be provided with an instrument made specially for the purpose; a very strong piece of iron wire should be firmly fixed in a handle, and its end should be bent almost at a right angle and ground into a sharp point. With this instrument the decayed bark of any tree may be ripped off, the wood itself torn to pieces, and the beetles which are feeding beneath the bark exposed and picked out.

To beetles is also entrusted the task of removing offensive substances left on the ground and to carry them beneath the surface. This applies to all dead bodies, and especially to the excrement of animals. No sooner is an animal killed than the carrion beetles and burying beetles make it their especial resort: the vulture does not more speedily perceive the death of a camel or a horse in the desert, than does the carrion beetle the demise of a bird, a mole or a mouse: they wing their way to it by night or by day, and mining into the interior, remain there concealed from sight as long as the unsavoury repast endures, devouring some and burying the rest. Here again the umbrella and the walking-stick may be called to our aid: if a dead crow be found on the surface of the ground, he must be held up by the leg and beaten over the outspread umbrella until the dead has given up its living tenants; some of these are large and beautiful, intensely black and barred with the brightest orange; others are small and apparently insignificant, but all are known and classified, and all valued by the collector, either as rarities or as filling a vacant place in his cabinet, and thus making his series complete. But the excrement of animals is perhaps the most attractive lure for the world of beetles: the droppings of horses and of cows are full of beetles, and every one knows that these offensive substances constitute the nutriment of plants. Animals leave it on the surface, beetles dig holes in the earth beneath each deposit, and convey it to the roots of plants. I have found that a most

efficacious way of collecting dung-beetles is to plunge the droppings in a bucket of water: on stirring up the mixture the beetles will soon be seen floating on the surface, when they can be secured at leisure.

Tufts of grass are always well peopled with beetles; they get down to the very bottom of the stems and even among the roots: if the ground is light and sandy, these tufts may be shaken out over a sheet of paper, or over the infallible umbrella, or on a smooth road or pathway: in either case the beetles will be seen running in all directions in their anxiety to escape, and may be picked up, one by one, with the greatest ease. If near a ditch or a pond, these tufts may be plunged in the water, and the living inhabitants will very soon be seen rising in air-bubbles to the top and swimming towards the land with all their might, and thus in the fancied act of self-preservation rushing, as it were, into the very jaws of the enemy.

Moss is a great resort of beetles in the winter: whenever you have the opportunity go into the thickest woods, and pulling up the moss by handfuls cram it into a canvass bag, which you have taken with you for this especial object. Then on a winter's day, when nothing tempts you abroad, shake out your moss, bit by bit, on a white cloth, and you will soon possess yourself of wonders. It was thus I obtained *Pseudopsis sulcatus*, and *Mniophila muscorum*, and *Boreus hysmalis*, and hosts of *Pselaphidæ*. Moss is a never-failing source of interest to the Coleopterist.

Then comes the question of how to kill? There

are several modes of doing this, all of them very easy : the plan that I adopted for many years was to keep a quantity of chopped-up laurel-leaves in the bottles that I used for collecting. Another very favourite plan is to stupefy the beetles with a drop of chloroform on cotton-wool : another plan is to bring the beetles home in pill-boxes and drop them into boiling water, when death is instantaneous, and they may afterwards be dried on blotting-paper ; but lately Mr. Crotch has propounded a plan which seems likely to supersede all these, inasmuch as it not only kills but preserves in the best possible condition the creatures after they are dead.

“ The following method has now been in use some time, and hence has been fairly tested. Its advantages are very great, so that I make no apology for introducing it to the notice of your readers. The first idea of the process is due, as far as I know, to M. de Vuillefroi, who used it with me in Spain, some years ago, with great success. The specimens may be collected in two ways, according to size and the convenience of the collector. The first and best way, for small species, is by putting them into a bottle containing about half an inch of dry pine-sawdust, in which has been previously placed a small piece of cyanide of potassium about as big as a pea : they will then die instantly. Larger species, and small species which do not fly readily, may be put into spirits in the ordinary way, but the Staphylinidæ and others generally open their wings in this process. The sawdust should be

pine-wood, and sifted free from chips on the one hand and from dust on the other, so as to be of an uniform size. For storing the species thus collected a few tin canisters will be found most convenient; a layer of sawdust is placed at the bottom, and then beetles, and so on alternately to the top. The sawdust used in the tins should be damped (not *wetted*) with a mixture of spirit and one-twentieth part of carbolic acid, which will effectually prevent mould or mites, and will bring the specimens home perfectly fresh and clean. Small species, or specimens from a particular locality, should be wrapped in a piece of rag or tissue-paper, with a little sawdust, and the name of the locality. The specimens collected in spirits should be removed as soon as possible (in a few days at farthest), and transferred to sawdust. When the tins are full, some more spirit and carbolic acid should be poured in and the top soldered down: they will then keep for two years at least. The advantages of this method are manifest, especially in the absence of any danger of breakage or leakage; and it is more than probable that a similar plan might be employed with reptiles, fishes, &c., but for these chloride of zinc suggests itself as the most likely agent to be of service. As the insects do not become rotten by the above process, it is sometimes not so easy to set their legs in the peculiar manner in vogue in this country, but they will have, as a set-off, the advantage of being thoroughly fit for study. When by any chance spirit cannot be obtained, they

will keep perfectly in dry sawdust, if the specimens are dried in the air for a few hours first; all that is necessary afterwards being to relax them in the sawdust instead of removing them from it. Jars or wide-mouthed pickle-bottles may of course be used instead of tins, and are more air-tight, but liable to break."

That eminent and most excellent entomologist, Mr. E. W. Janson, endorses Mr. Crotch's recommendation, and adds a few hints on the subject of collecting beetles abroad, as follows:—

"The sawdust plan, now almost universally adopted by collectors, I can recommend both on account of its simplicity and efficiency. The sawdust should be that of some white or yellow wood without colouring matter—pine is perhaps the best; it should be sifted over fine muslin, and the dust and minute particles rejected. In collecting, wide-mouthed bottles should be used; these should be about one-fourth filled with dry sawdust, adding beneath a piece of cyanide of potassium of the size of a large pea or haricot bean. On reaching home after collecting, the contents of the collecting bottles should be shaken out on to a large sheet of paper, and the insects transferred to the stock-bottle or jar, and the cyanide and sawdust returned to the collecting bottles for future use. Any description of wide-mouthed bottles, such as pickle-jars, may be used as stock-bottles; they should, however, have tightly-fitting corks or bungs. Before putting the insects collected into the stock-bottle, throw into it a quarter of an inch thick of sawdust, *slightly damped*, not

*moistened*, with a mixture made of alcohol (methylated spirit will answer admirably; brandy or strong whisky, if unsweetened, will suffice, but sweetened gin and rum must be avoided), or, still better, benzine or benzoline, and carbolic or phenic acid. These should be mixed in the proportions of nineteen parts of alcohol or benzine and one part of carbolic acid. On the sawdust damped with this mixture place a layer of insects, over them a second stratum of damped sawdust, then a second layer of insects, and so on alternately until the stock-bottle or jar is filled: take care that it is always kept well-closed. When it is filled it may be packed with any other objects in sawdust, hay, moss, or any other elastic substance, and forwarded to its destination."

Lastly, there are two modes of preparing beetles for the cabinet: these are technically called "pinning" and "carding": in either case the wings and wing-cases are allowed to remain in their usual position, quietly closed on their backs; the legs and antennæ, on the contrary, are carefully arranged in the manner supposed to be natural when the insect is crawling. In pinning a beetle its head should be placed on the setting-board away from the operator, and the pin passed through the ~~left~~ elytron very near the shoulder; not that the exact position of the pin in this respect is very important, but that uniformity adds greatly to the beauty, value and neatness of a collection, and if one beetle be pinned through the thorax, another through the right elytron, a fourth through the left

right

elytron, and a fifth through the scutellum, the effect is extremely inelegant and offensive to the lover of order. It seems almost a matter of necessity that the smaller beetles should be carded: a pin, even the finest, completely destroys the symmetry of their shape, always breaks one of the elytra, and often carries away one or more of the legs, as well as forcing out of its place a large portion of the under surface. The plan to be adopted to avoid this difficulty is to prepare a thin solution of gum-trajacanth and the purest colourless gum-arabic in equal proportion, and a small quantity of corrosive sublimate intermixed: this mixture is spread over the surface of the card, and the beetle laid thereon, and its limbs carefully arranged with a camel's-hair pencil, care being taken that the limbs are free from all rigidity and capable of being moved with the slightest touch of the pencil—a state that can be insured, by immersion in boiling water, for years after death.



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