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GENERAL DIRECTIONS

FOR

Collecting and Preserving

Exotic Insects and Crustacea.

By GEORGE SAMOUELLE, A.L.S.

With illustrative Plates.

[Price 5s. extra boards.]

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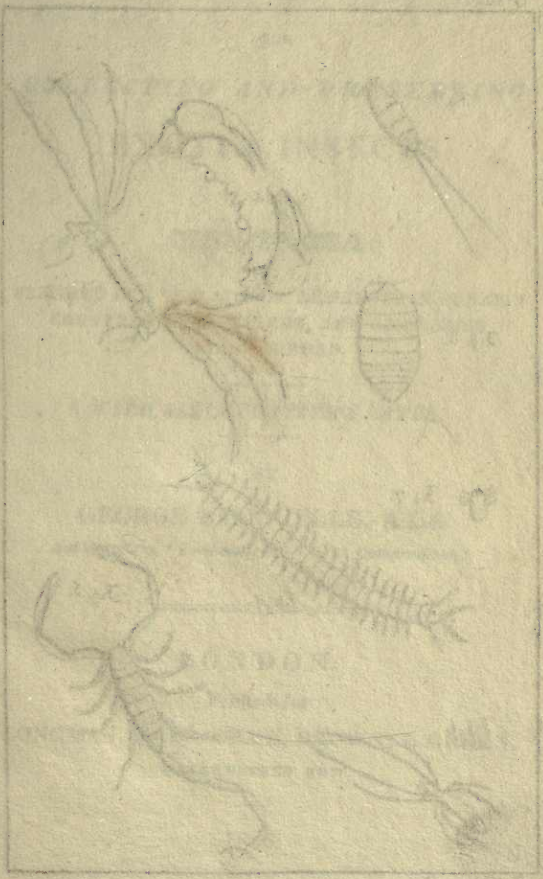
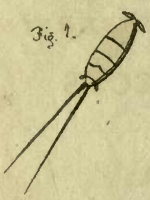


Plate 1.



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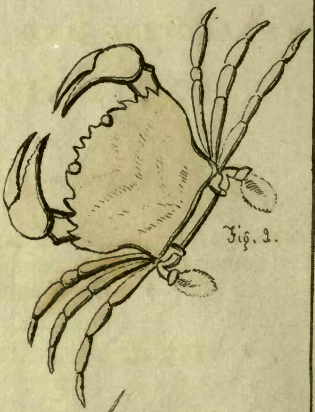

Fig. 2.

Fig. 3.

Fig. 7.

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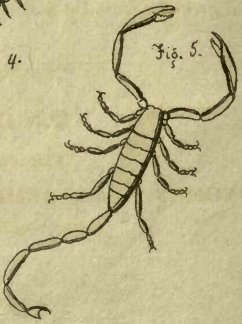

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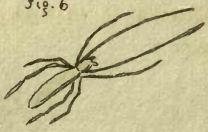

Fig. 6

J. H. Newton. Fecit.

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General Directions

FOR

COLLECTING AND PRESERVING

EXOTIC INSECTS

AND

CRUSTACEA:

DESIGNED FOR THE USE OF RESIDENTS IN FOREIGN COUNTRIES, TRAVELLERS, AND GENTLEMEN GOING ABROAD.

WITH ILLUSTRATIVE PLATES.

BY

GEORGE SAMOUELLE, A.L.S.

Author of the 'Entomologist's Useful Compendium.'

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TO

CHARLES KONIG, Esq.

KEEPER OF THE NATURAL HISTORY DEPARTMENT IN THE BRITISH MUSEUM, F.R.S. F.L.S., MEMBER OF THE ROYAL ACADEMIES OF MUNICH, ST. PETERSBURGH, &c.

This Work

IS MOST RESPECTFULLY AND GRATEFULLY

INSCRIBED,

BY HIS OBEDIENT SERVANT,

THE AUTHOR.

London, 19th July, 1826.

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ADVERTISEMENT.

The lively interest taken by the British Public in the promotion of every branch of science, and the numerous Collections of Objects of Natural History *that are forming in every part of England, afford a convincing proof of the progress of this delightful study, and of the very general feeling manifested in its favour. If it should be asked whence this has arisen, we cannot but think that the intercourse with the Continent has, in a great measure, tended to awaken these feelings, and has naturally excited this laudable curiosity,—and stimulated an inquiry into those works of the* CREATOR *which the most unenlightened cannot behold without admiration and delight.*

As no branch of Natural History can be pursued with so much facility as Entomology, *it is hoped that the following directions for collecting insects (though brief) will be found useful, and sufficiently explicit: the Author has been induced to publish them*—first, *from the number of applications that have been made to*

him by gentlemen and persons going abroad, to whom he has been under the necessity of giving them briefly in manuscript; and, secondly, *that as Great Britain possesses such vast territories in Asia,—colonies in Africa and the West Indies,—and is now cultivating extensive connections with both North and South America; (not to mention the entire possession of that extensive and interesting country* New Holland), *a fine opportunity is afforded for forming Collections of rare and beautiful Insects, as well as enriching those already made; and especially as these objects of Natural History are admitted into this country* free of all duty. *Many persons, therefore, who have been hitherto deterred from consigning to their friends valuable Collections of Insects, may now gratify them at a trifling cost; and we would anxiously impress upon our readers who may visit or reside in foreign countries, the great importance of attending to this subject, as we are persuaded that some of the choicest Collections in England have received their most rare and novel specimens from such well-timed and pleasing donations.*

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GENERAL REMARKS.

THE animals which come under our observation, in the present essay, belong to the type of *Annulosa*, and are characterized as having no skeleton; their muscles are attached to the skin, which is hard, or to processes issuing from it; and the nervous system consists of a series of knots or ganglia, brought into communication by two longitudinal nervous cords. The classes to which these animals belong may be distinguished by the following characters:—

* *Gills for respiration.* Classes.

Legs sixteen: antennæ, two or four..... 1. CRUSTACEA.

** *Sacs for respiration.*

Legs twelve: antennæ, none...3. ARACHNOÏDA.

*** *Tracheæ for respiration.*

a. *No antennæ.*

Legs six or eight.....4. ACARI.

b. *Two antennæ.*

Six thoracic legs: abdomen also, bearing legs..... 2. MIRIAPODA.

Six thoracic, and no abdominal legs..... 5. INSECTA.

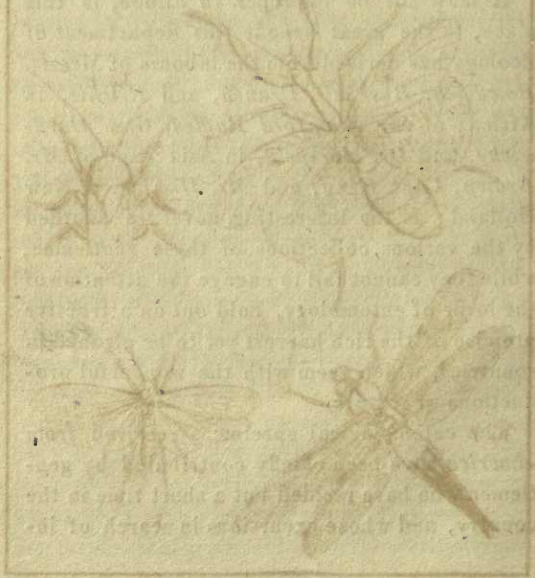
Annulose animals are universally spread through the various regions of the habitable globe; and, like the animals of the higher orders of creation, are geographically distributed, but are confined to certain limits; and, from the immense number of species, the annulosa appear to be still more local. Indeed, the shortness of their life, the nature of their food, and its abundance, generally precluding the necessity of migration, we have, comparatively, but a very slight knowledge of these animals, by far the most numerous of all Nature's productions; England alone furnishing our cabinets with upwards of *ten thousand* species, and every year's research adding to the number. And, if so extensive a list can be formed of an island so far north, and so small as England, what have we not to look for from our friends on the continent of Europe,—the traveller in the untrodden wilds of Africa,—the extensive woods of America,—and the vast territories and islands of Asia and New Holland? It is to be hoped, therefore, that visitors, travellers, and residents in those parts, will use their best endeavours to form collections, which can readily be done with but little trouble, and at a most trifling expense; more especially by *residents*, as they will possess

advantages and opportunities that cannot fall to the lot of others. To promote this object, the following instructions have been rendered as explicit as the nature of the subject would permit; and more particularly, that gentlemen may be enabled to instruct their servants, and especially the *natives* of the country where they reside, to collect the Insects and Crustacea which we are about to enumerate.

It may not be improper to allude, in this place, to the great benefit this department of Zoology has derived from the labours of Messrs. *Bowditch*, *Burchell*, *Cranch*, and *Ritchie*, in Africa; of *Sir Stamford Raffles*, *Gen. Hardwicke*, and *Dr. Horsfield*, in Asia; and of *Mr. Brown*, *Capt. King*, and *Mr. Hunter*, in New Holland; as the interesting novelties afforded by the various collections of these gentlemen, while they cannot fail to engage the attention of the lover of entomology, hold out an attractive promise of the rich harvest yet to be gleaned in countries, which teem with the wonderful productions of Nature.

The entomological specimens received from *America* have been chiefly contributed by gentlemen who have resided but a short time in the country, and whose excursions in search of in-

sects were, probably, but few and limited; we cannot, therefore, expect yet to possess any thing like a knowledge of American Entomology; yet we have enough to give a stimulus to further researches, and to afford us abundant evidence of the treasures to be found in those countries of the New World not yet visited by the Entomologist.



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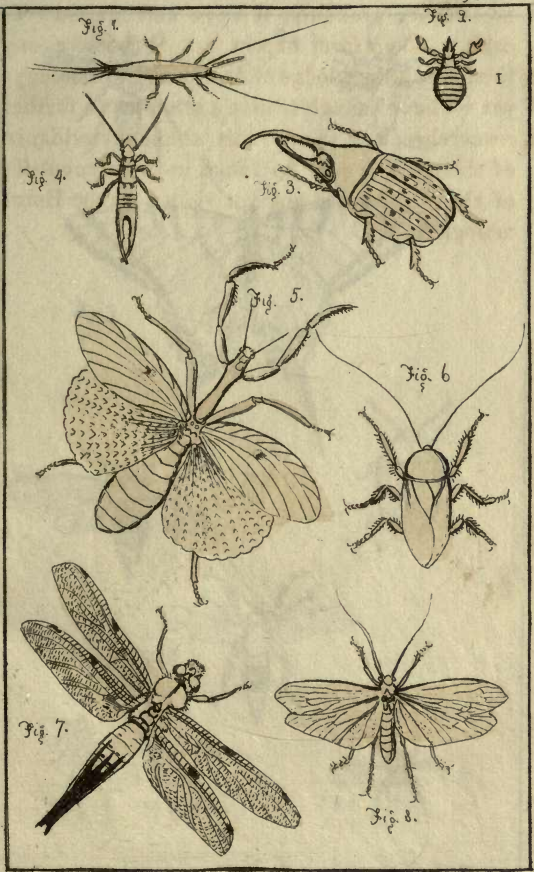

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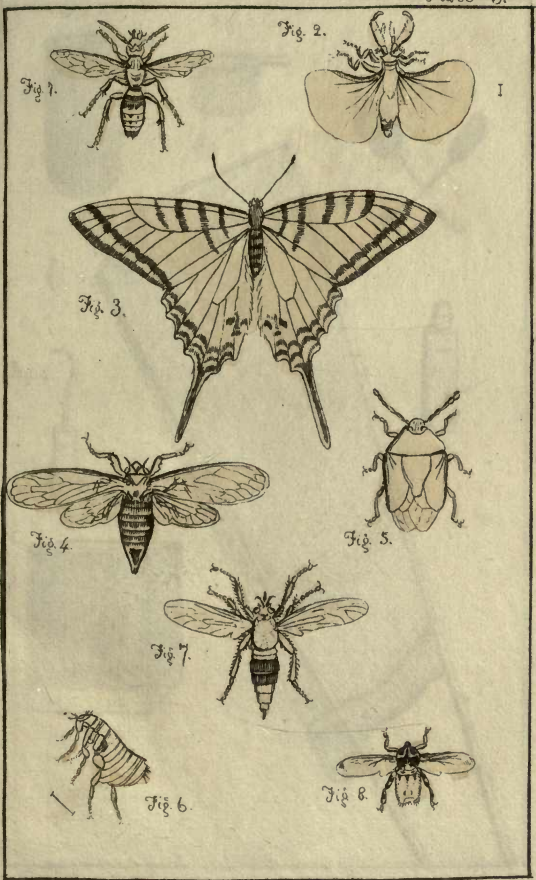
Plate 3.



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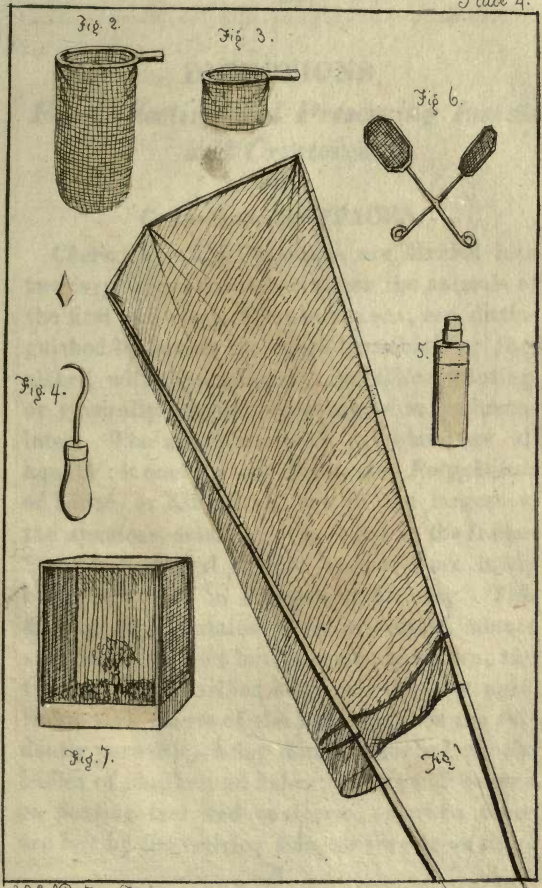

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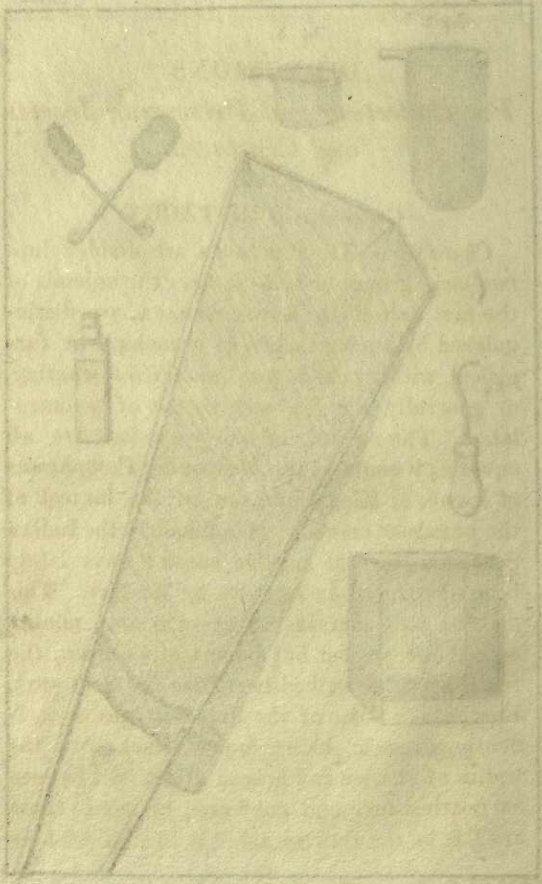

DIRECTIONS
For Collecting and Preserving Insects and Crustacea.

Class 1.—CRUSTACEA.

Character.—The Crustacea are divided into two large groups or sub-classes: the animals of the first sub-class, Entomostraca, are distinguished by having their *legs* branchial, or furnished with appendages; *mandibles* wanting, or generally simple; *eyes* sessile or pedunculated. The animals of this sub-class are all aquatic; it contains the *Monoculus Polyphemus* of Linné, or King Crab, one of the largest of the annulose animals; it is found in the Indian Seas, and several smaller species have lately been discovered in America by Mr. Say. This division also contains many extremely minute animals at present but imperfectly known, the few that are described being, for the most part, European. Some of the Entomostraca are evidently parasitic, being found attached to the bodies of sharks and fishes; others will be seen on floating fuci and confervæ, or when these are left by the retiring tide, or thrown on shore

by gales of wind or storms. Several species may be taken in pools, ditches, stagnant waters, and the clearest streams; and many of the minute species have the appearance of bivalve shells. The smaller species of this sub-class are best secured in spirits, but the larger as hereafter directed. [Pl. I, fig. 1.]

Sub-class 2.—MALACOSTRACA. *Legs* simple, without appendages; *mandibles* palpigerous; *eyes* pedunculated or sessile. To this section belong all those animals known by the familiar names of crabs, lobsters, cray-fish, pandals, prawns, and shrimps, the whole of which have the power of re-producing their claws when lost.

The animals of this division, in tropical climes, are as remarkable for the richness of their colours as the elegance of their forms; some of them are extremely beautiful, whilst not a few are as terrifying from their gigantic size, and powerful legs and claws furnished with spines, which render them rather difficult to be taken. Some will be found resembling shells overgrown with weeds, others like fragments of rugged rocks; whilst some, from the singular formation of their feet and claws, might be taken for eggs or bivalve shells. These animals mostly inhabit the seas, and even the

deepest waters; numbers will be found on rocky and sandy shores, towards evening, in search of food, or left in pools by the retiring tide; many also may be discovered under stones, fragments of rocks, and in holes, or buried in the sand. Every opportunity should be taken to visit the sea-shore after storms and heavy gales of wind, and the sea-weed and other rejectamenta should be carefully examined, as well as the nets of fishermen. The empty shells found on the sea-shore, are frequently the habitation of the animals of which we are in search. The fresh water species are numerous, and will be found in rivers and running streams: some few are parasitic, being found attached to fishes; many perforate buildings of wood, piles, &c. The few terrestrial species yet known may be found in rotten wood, under moss and stones; and these, though they may be considered *common* by the indifferent observer, may yet be unknown to the naturalist. Under these circumstances, it is to be hoped, that persons who may have the opportunity, will avail themselves of our hints; for although many of the animals of this and of the next class may be found in great numbers, yet it frequently occurs that they are completely *local*, and may never be met with

again; it is better therefore to secure, at once, a sufficient number of specimens, for the sake of illustrating the variations which many species are liable to. [Pl. I, fig. 2.]

Directions for preserving Crustacea.

Those Crustacea that inhabit the sea may be killed by being put into cold fresh water (General Hardwicke informs me that he usually tied them in pieces of linen or small bags, as they would otherwise injure each other), and in which they should be allowed to remain for some hours, to extract the salt, which would soon destroy the specimens by attracting moisture; they must then be well dried, taking care to place the legs, antennæ, &c. in as compact a form as possible, to prevent injury. Such as will admit of being wrapped in soft paper may afterwards be packed in boxes, on layers of cotton, which for large specimens is a safer plan than that of transfixing them by pins proportioned to their size; but, as they are extremely brittle, it is better to put them into spirits.

Class 2.—MYRIAPODA.

All the Myriapoda have the head distinct from the body, and are furnished with two *antennæ; mandibles*, two; *maxillæ* four, confluent and forming a lower lip. All or most of the segments of the body are furnished with two or four legs. This Class is divided into two Orders.

Order 1.—Chilognatha. *Antennæ* seven jointed; *legs* short; *body* generally crustaceous. [Pl. 1, fig. 3.]

This order contains the genera *Glomeris, Iulus, &c.*; they inhabit beneath stones, moss, the bark of trees, and sandy situations: from their very fragile nature they are best preserved in spirits.

Order 2.—Syngnatha. *Antennæ* composed of fourteen or more joints; *legs* elongated; *body* depressed, coriaceous or membranaceous. [Pl. 1, fig. 4.]

To this order belongs the *Scolopendra*, or centipede; they inhabit moist places, beneath stones, moss, the bark of decayed trees, outhouses, decayed vegetable substances, and ripe fruits. In tropical countries they are extremely numerous; some are large, being a foot in length; many are carnivorous, and should there-

fore be put into spirits as soon as taken: this, indeed, is the best method of preserving them.

Class 3.—ARACHNOÏDA.

The Arachnoïda are divided into two Orders.

Order 1. Polymerosomata.—*Body* composed of a series of segments; *abdomen* not pedunculated; *mouth* furnished with didactyle mandibles and maxillæ; *eyes* two, four, six or eight. [Pl. I, fig. 5.]

The scorpion, of which there are many species, is the principal type of this order; some of the species of tropical climes are, in all probability, venomous, and will have a more deleterious effect upon some constitutions than others: the poison is emitted through the hook which terminates the tail; some little care is, therefore, requisite in capturing them, and they should be immediately put into spirits, which will soon kill them. In a state of nature they lurk beneath stones, moss, and the detached bark of trees: we are yet but little acquainted with their natural history. After being killed in spirits they may be pierced with a pin, and placed in cork boxes as described for insects; taking care, at the same time, that they are sufficiently attached to the pin: it is, however,

better to fix them securely by placing two or three pins across the extremity of their body: they are thus completely secured from injuring others that may be placed near them.

Order 2.—Dimerosotoma. *Body* composed of two segments, the abdomen pedunculated; *mouth* furnished with mandibles and with maxillæ; *eyes* six or eight. [Pl. I, fig. 6.]

Spiders are the animals that compose this order; they live principally on insects, but in South America, and within the tropics, where they grow to an immense size, they have been known to seize humming and other small birds while sitting on their nest; and there is no doubt but that the poison which is conveyed through their strong and powerful mandibles acts as effectually, and as rapidly, on those small birds, as that of the European species does on the common fly; it is, however, doubtful whether it be injurious to man: it is so, probably, in a very slight degree; but this can only apply to the larger species, which, from their formidable appearance, are not likely to be handled more than necessity requires. Unfortunately, from the general disgust with which spiders are regarded, naturalists have been presented with but few specimens for their observation; con-

sequently but little is known of them; some extremely interesting and singular species have, however, occasionally found their way to Europe, evidently collected without design, as they are promiscuously and but seldom seen in collections of insects. Spiders abound in hot climates, and will be found in houses, windows, gardens, out-houses, woods, heaths, forests, the blossoms of flowers, the crevices of rocks, and on walls, pales, trunks of trees, &c. Many inhabit waters, walking on the surface, and diving on the approach of danger: these perambulate also, with facility, the aquatic plants beneath; and those that inhabit still waters walk on their webs, previously attached to various substances. Many species, for the want of nipples, are incapable of making silk; these, therefore, are under the necessity of taking their prey by surprise, either by jumping or darting suddenly upon such insects that may alight near them, or secreting themselves in such situations as will insure them food. Many of the species are extremely brilliant, and are as remarkable for the singularity of their forms; they are, however, very difficult to preserve, for no method has yet been discovered effectually to secure their colours; it is, therefore, best to put them all in

spirits, which will, at least, preserve a certain portion of their characters.

Class 4.—ACARI.

The bodies of the Acari are formed but of one segment; the *mouth* is rostriform, and in some is furnished with maxillæ and mandibles; the *legs* six or eight: *tracheæ* for respiration. [Pl. I, fig. 7.]

Most of the *Acari* are parasitic, and numbers will be found on aquatic animals, especially amphibious quadrupeds; they also attach themselves to fishes: most quadrupeds are attacked by them, and man does not escape; insects are also much annoyed by them, being sometimes completely covered with these animals: the dog-tick and cheese-mite belong to this class. Many of the species are confined to the water, their legs being formed for swimming; they are extremely brilliant in colours, and most beautifully marked: they are chiefly found in clear fresh waters. Like spiders, they must be preserved in spirits.

Class 5.—INSECTA.

The class *Insecta*, or Insects, is by far the most numerous of all the classes of the annulose animals, there being, at least, 100,000 species

known in collections, of which number the smaller species of Europe forms a large proportion: the minute exotic species have never been collected; as, in the eye of any but an experienced Entomologist, they are of little importance,—being completely eclipsed by the beauty and splendour of the larger kinds. That the smaller species exist, and in myriads, there is no doubt; for we have lately been informed by *Mrs. Bowditch* (the widow of the late unfortunate African traveller), that during her residence in that country, when the cloth was laid before or after a shower of rain, they were obliged to clear the table and shake the cloth, which was literally covered with various insects, before they could take their meal; and that the numbers were so great, at times, as completely to extinguish the lights, and to become, in various other ways, extremely obnoxious.

Sub-class 1.—Ametabolia.

Insects undergoing no Metamorphosis.

Order 1.—Thysanura. Spring tail. *Tail* armed with setæ or filaments; *mouth* with mandibles, palpi, labrum, and labium. [Pl. II, fig. 1.]

The body of the animals that compose this order is generally covered with scales or hair,

Their motions are extremely rapid, and are performed by leaping. They abound in Europe, under stones, in woods, on the ground, in damp hedges, and on the shores of the sea and rivers: they are generally small, and should be collected in quills, and killed by exposure to heat: when dead, they may be put on gummed paper.

Order 2. ANOPLURA.—*Tail* without setæ or filaments; *mouth* in some furnished with two teeth or (mandibles?) and an opening beneath; in others, with a very short tubulous haustellum. [Pl. II, fig. 2.]

This order contains those disgusting insects known by the name of *lice*, the species of which are far more numerous than is generally supposed. Most quadrupeds, birds, fish, and even *insects*, are annoyed by them; and, in several instances, many kinds have been found peculiar to the species of bird from which it was taken: to the Ornithologist, therefore, a knowledge of this fact is frequently of importance, as the parasite will often enable him to distinguish varieties from species. Some birds are more subject to these pests than others: they do not attach themselves immediately to the skin, but are generally secreted in the feathers, and

leave the bird, or other animal, soon after it is dead.

Order 3.—Coleoptera, or *Beetles* [Pl. II, fig. 3] are easily distinguished, by having, for the most part, two wings covered by two *elytra* or wing-cases, meeting by a straight suture down the back: are furnished with two antennæ, two mandibles, two maxillæ, and either four or six palpi: by the modification of these parts the characters of the genera are determined. Beetles are extremely numerous, and are found in almost every situation, as in sandy places, on the sea shore, and the muddy banks of ponds and rivers, running about in the sun; others will be seen in the above places, but secreted under stones, fragments of rocks, chalk, &c. seeking their food early in the morning or late in the evening. The aquatic species may be taken in ponds, ditches, rivers, and running streams; and some few will be found buried in the sand or secreted amongst the pebbles of shallow brooks. The method of taking the water beetles is by the aquatic net, which should be attached to a strong stick, and plunged among weeds, rushes, &c., and, when withdrawn, it should be carefully examined; as most of these animals are ex-

tremely active, and soon secrete themselves amongst the weeds taken up in the net, and thus easily escape notice. Besides the above haunts, in fine, clear, and calm weather, numbers will be seen sporting on the surface of the water, others floating or swimming beneath it; considerable dexterity, therefore, is requisite in capturing them. Aquatic insects are frequently as *local* as the land animals; no opportunity should, therefore, be lost in taking them whenever they are observed. Again, it is not uncommon for these insects to leave the waters in the evening, and fly to a considerable distance: there are also stated times for the appearance of all insects in their perfect state; their lives are brief, and they, after the lapse of a short time, will be supplanted by other species; thus, a small district of only a few miles in circumference, will afford ample employment to an active collector for some years. Most of the insects of which we have been speaking are *carnivorous*, and feed on others, either in the perfect or larva state; it will, therefore, be advisable to put them, when collected, at once into spirits, by which they will be effectually prevented from destroying their companions. Dead animals, dried bones, decayed vegetable substances, and

the dung of animals, more especially that of cattle, afford food to some hundreds of species, which will be found feeding on the surface or buried beneath it. They also form subterraneous excavations, sometimes to a considerable depth, in order to deposit eggs in a place of security. With respect to the *carrion-feeders*, they appear of rare occurrence in tropical countries; species, it is true, have been brought from the East Indies; but their labours are, in a great measure, superseded by the multiplicity of ants, of a gigantic size, which abound in all hot climates. Traps, or wide-mouthed bottles baited with flesh, and placed out of the reach of ants, should be suspended by prepared cords, or insulated by water; and the scent of the meat will soon attract such insects as feed upon it: the bottles should be frequently examined, and there is no doubt that the collector will be soon repaid for his trouble.

Some of the largest known coleopterous insects reside in decomposed vegetable substances; as tan-beds, the decayed roots of trees, and the refuse of gardens. Boleti, fungi, dry rotten trees, and detached bark, must never be passed over by the collector; insects may frequently be detected, at several inches from the surface, in

rotten trees, and may be procured by means of the *digger:* this is also the method of obtaining the caterpillars of the wood-feeding insects. Trunks of trees in woods and forests must be examined with care, especially in the evening and early in the morning, as it is common for the night-flying species to crawl up those places for the purpose of drying their wings or seeking their mates: they will also occasionally be found, apparently asleep, during the day, whilst numbers will be seen sporting in the noontide sun, alighting at intervals to feed on certain juices that may exude from the trunks of trees. The moss also at the foot of trees affords shelter, during the winter or rainy season, to many insects; which may be obtained by collecting the moss, and shaking it over a cloth or a sheet of white paper; others secrete themselves, at this period, a few inches beneath the surface of the earth near the trunks of trees. Beetles that inhabit the foliage of trees or shrubs may be obtained by holding the folding net, or placing a sheet beneath the branches, beating them with a long stick; by which means the insects are disturbed, fall into the net or cloth, and are easily captured: this mode of collecting is most successfully pursued early in the morning,

or before a shower of rain, as, during the heat of the day the insects are, for the most part, on the wing, occasionally alighting on the blossoms of trees and shrubs, and particularly on flowers of the umbellate kind. There are many species of this order that may be taken crawling in pathways, road-sides, and hedge-rows, also on the stalks of grass and plants of a low growth: others will be seen flying in the evening, in clouds, around the summits of the highest trees; while many may be detected by the light which they emit. The roots of grass on banks with a southern aspect generally abound with small beetles and other insects. It will be well to remark in this place, that sudden *inundations* and the overflowing of rivers will furnish the collector with some thousands of insects, and that he will have but little trouble in collecting them.

The method of obtaining insects from floods is, to watch the retiring of the waters, and wherever a narrow channel is produced, to gather all the small pieces of wood, floating grass, or other substances, which will be found to be literally covered with insects. At this time, also, the rejectamenta left on the banks of rivers may be examined, and a portion should be collected:

these abound with the smaller insects, and should be put into a bag on the spot, and the mouth of it tied close to prevent the escape of the insects. As soon as an opportunity occurs the bag should be plunged into boiling water, which will, at once, destroy the lives of the insects thus secured: it should then be emptied, the contents spread on a cloth, or by other means exposed to the sun, or otherwise *thoroughly dried*, and then packed either in boxes or bottles with camphor, until we have leisure to select and secure the specimens thus obtained. If the rejectamenta and insects be well dried they may thus, with safety, be conveyed to Europe: we may also observe, that in packing the insects collected and preserved in this way (a method that might be employed for all the insects of this order), layers of cotton, moss, or tobacco, previously well dried, should be introduced, to prevent, in the first instance, injury from moisture; and a portion of camphor should be used, to keep off the minute mites, &c. that would otherwise destroy them; they should also be *packed close*, so that any sudden shake may not injure them, by breaking off their legs, antennæ, &c. Chip boxes will answer well for this purpose.

Before we conclude our hints on this order of insects, it should be observed, that naturalists are much in the dark with respect to the larvæ and economy, not only of this order, but of exotic insects in general. Of the importance of a knowledge of the larvæ of coleopterous insects, suffice it to say, that the natural distribution of the perfect insect, according to the views of the first entomolgist of the present day, depends on the form of the larva ; and there appears sufficient ground for this arrangement, and there is no doubt that the larvæ of the other orders will tend, in no small degree, to illustrate and accelerate these views of a natural affinity. We are induced to extend our remarks thus far, in the hope that those who may have the leisure and opportunity of making notes and observations on the natural history of insects, will become as great benefactors to this delightful branch of science, as they who may add hundreds to the yet undescribed species existing in the museums of Europe. We are fully aware of the difficulty of thoroughly investigating the natural history of any one individual species ; it should be remembered, however, that many curious and useful observations may be made that will be highly interesting, and of great value to

the entomologist, who seeks for something more than the mere acquisition of new species.

Beetles may be killed by immersion in hot water or spirits of wine; they may be then pierced with a pin, and when thoroughly dried may be placed in corked boxes: they require no further preparation.

Order 4.—Dermaptera. *Elytra* somewhat crustaceous and abbreviated, of a square form; the suture straight; *wings* membranaceous, externally coriaceous, large, folded transversely and longitudinally; *body* linear, depressed, terminated with forceps, which are horny and moveable; *antennæ* inserted before the eyes, composed of from twelve to thirty joints, the first articulation longest, the second very small, the others short, obconic, or nearly globose; *mandibles* with their points bidentate; *palpi* filiform, terminated with a very obscure tuberculiform little body or spine; *tarsi* three jointed, villose beneath; *eyes* triangular-orbicular, and but little prominent. [Pl. II, fig. 4.]

The insects composing this order are well known by the name of *Earwigs:* as the insect is so very common in Europe, many persons who reside in foreign countries neglect to capture them; the exotic earwigs, however, are

rarely of the same species; all, therefore, that present themselves to the collector should be taken: it is not often the case, that *European* insects are ever found in America, Asia, or Africa; they may, it is true, have a similar appearance, but when compared with European species, they will be found to be sufficiently distinct. The insects of this order inhabit trees, hedges, and gardens, feeding on fruits, or secreting themselves in the crevices of wood work and under the bark of trees; some few will be found in the neighbourhood of dunghills, and others under stones on the sea shore: as the bodies are liable to shrink in drying, they should be preserved in spirits.

Order 5.—ORTHOPTERA. *Elytra* coriaceous, the internal margin of one overlapping the same margin of the other; *wings* membranaceous, the anterior margin coriaceous, longitudinally folded; *palpi* short; *body* elongate, narrow; *tarsi* with three or four, very rarely with five joints. [Pl. II, fig. 5.]

This order contains the Grasshopper, Locust, Mantis, Walking-leaf, and the Cricket. They inhabit trees, shrubs, rushes, and grassy places, and are extremely abundant in tropical climates, where they are found of a large size.

In certain years their numbers increase to such an astonishing degree, that the vegetable growth of a district is not sufficient to afford food to their myriads; and from the scarcity they have created, are under the necessity of migrating: these occasional visits are frequently of the worst consequence to the inhabitants, by destroying the growing crops and every vegetable production, producing not only famine, but frequently pestilence from the effluvia which arise from the bodies of the insects that have been destroyed. The insects of this order should, upon being captured, be put at once into spirits, that they may be immediately killed, and effectually prevented from eating one another, which they would otherwise do if put loosely into a box; if they are *pierced*, they must be completely transfixed by pins being placed across their bodies, to prevent their injuring themselves or other insects. It is necessary with most of the species of this order to make an incision along the under part of the body, and carefully remove the contents: cotton must be substituted, to give the insect its natural shape and plumpness; if this be not attended to, the bodies are liable to shrink and lose their colours: the process is very simple, and a little practice will be sufficient to enable the collector

to perform the operation. When time or circumstances will not admit of this process, we would recommend their being put into spirits. It is also necessary to observe, that in many of the species the antennæ are very long and as fine as a hair; great care is therefore requisite in packing them, that they may not be injured by other insects getting loose in the box.

Order 6.—Dictyoptera. *Elytra* coriaceous, nervose, decussating each other; *wings* membranaceous, with a few longitudinal folds; *maxillary palpi* elongate; body depressed, oval, or somewhat orbicular; *tarsi* with five joints. [Pl. II, fig. 6.]

The insects of this order are the too well-known *Cock-roaches*, or the Black Beetles of cooks and housemaids: the species generally found in the kitchens of the houses in this metropolis is not, strictly, a native of this country, but was introduced originally from America. In a state of nature, *cock-roaches* inhabit trees, secreting themselves during the day in crevices and beneath the detached bark of trees; in tropical countries they are large and numerous. The females are generally apterous, or have their wings abbreviated. The different species are, as yet, but little known. A genus

of Hymenopterous insects (*Evania* of Fabricius) are so far parasitical as to breed in the eggs of cock-roaches: this fly is small but singular in its formation, and where the cock-roaches are numerous, the former are no doubt plentiful; for we lately observed a number of specimens in the collection of insects formed in *Sumatra*, by the late Sir Stamford Raffles; it contained also many species of the insects of this order.

They may be killed in spirits of wine or hot water, and afterwards dried and put into corked boxes.

Order 7.—Neuroptera. *Wings* four, membranaceous, generally of equal size, with numerous decussating pterigostia resembling a net-work; *mouth* with mandibles, maxillæ, and lip. [Pl. II, fig. 7.]

The *Libellulæ* or Dragon-flies, *Myrmeleon* or Lion-ants (so called from the singular manners of the larvæ), the Scorpion-fly, Day-fly, Golden-eye Camel-fly, and White Ants, all belong to this interesting order of insects.

Dragon-flies are found in the neighbourhood of waters, are powerful on the wing, and the larger species, during the day, are fond of sporting and hunting in the more open parts of woods in search of insects. The females inva-

riably deposit their eggs on aquatic plants, as the larvæ inhabit the water. It is necessary to observe, that the larger species of dragon-flies require the same preparation as described for some of the grasshoppers; for without this care and attention the body, more especially of the larger species, will become of a dirty brown, and lose all those beautiful markings and colours with which it is usually adorned; those with slender bodies seldom require this preparation.

The *Myrmeleons*, or Lion-ants, resemble somewhat, in the appearance of their wings, the dragon-flies, but are easily distinguished from them by the antennæ, which in some are very long, and generally increased or clubbed at the extremities. The myrmeleons, and the other insects of this order, inhabit trees and shrubs in the more open parts and on the skirts of woods, and may be observed flying about: many, however, may be obtained by beating the trees, and the insects will fall into the net, and thus be easily captured. The white ants and their habits are too well known in the countries they inhabit to need further observation. The whole of the insects of this order must be pierced when taken, and placed in the collecting box;

and, if the insects be pierced through the side, it will, in a great measure, prevent their fluttering and injuring themselves.

Order 8.—TRICHOPTERA. *Wings* four, membranaceous; the Pterigostia or wing-bones, hairy; *mouth* with maxillæ and lip; *antennæ* inserted between the eyes, often very long, composed of an infinity of joints; *feet* elongate, spinulose; *tarsi* elongate, five-jointed; the last joint with two small nails. [Pl. II, fig. 8.]

The *Phryganea* of Linné constitutes the insects of this order; in the larva state they are known by the name of cad-bait, or caddis-worms. The larva is elongate, agile, somewhat cylindric, composed of twelve joints, the three first harder than the rest, and each bearing a pair of feet; the last segment with two hooked processes: inhabits tubes constructed of sand and bits of wood, shells, stones, or grass, glued together by a cement impenetrable to water. The pupa, which somewhat resembles the perfect insect, remains shut up in the tube it inhabited whilst a larva, but has the power of motion; prior to emerging from the water (in which it resides) it comes to the surface for the purpose of changing into the fly state. The perfect insects inhabit trees and shrubs; and many will be found

among rushes, long grass, and trees on the banks of rivers; towards evening, many of the species assemble in vast numbers and sport in the air. As they are liable to injure themselves if put loose into separate boxes, it is best at once to secure them by passing a pin through the thorax; and they will soon die if a little camphor be kept in the collecting box. We know of but few exotic species; they must, however, be numerous, as they are the principal food of fishes; yet they seem to have been neglected on account of their plain appearance, and to have been completely eclipsed by the more splendid insects; they are, notwithstanding, extremely interesting to the Entomologist, and will, it is hoped, be diligently sought after by the Collector.

Order 9.—Hymenoptera. *Wings* four, membranaceous, the hinder ones always smallest; the pterigostia do not decussate each other, or resemble net-work: *mouth* with mandibles, maxillæ, and lip. [Pl. III, fig. 1.]

The *Tenthredo* or Saw-fly, *Ichneumon*—Ruby-tail, Bees, Wasps, Ants, and Gall-flies, are the principal insects of this order. The Tenthredines and Ichneumons inhabit trees and shrubs; the former have a sluggish flight, the latter are

very active, and may be found during the day; the females more especially, in the pursuit of larvæ, in which they deposit their eggs. The *Chrysis*, or ruby-tail, is found in sandy places, or engaged in perforating pales, posts, and other wood-work, frequently in company with bees, who also nidificate in these places. Bees will likewise be found seeking their food from flowers in every situation. Wasps, like bees, live in society, forming their nests in the interior of decayed trees, but many attach them externally to the branches; these vary in size and shape according to the species, and the number of its inhabitants. Ants are extremely numerous in all tropical countries, and appear to be the chief agents of Nature in removing and destroying decayed animal substances, which would otherwise putrefy and infect the air; the species are, no doubt, numerous, and deserve particular attention: we know that very minute species exist in Africa; they are, however, but seldom collected. The gall-flies are not often to be met with in Collections, although the galls are an object of commerce: the flies are minute, which in some measure accounts for this deficiency; and here we would wish to impress upon the minds of those who collect in foreign

countries, the necessity of attending to *minute* species of insects.

The insects of this order are extremely numerous, and the economy of the respective families peculiar; we have, therefore, to observe, that, for the most part, they are to be taken only during the day, and when the sun is powerful; and from our own practical knowledge we should recommend the beating of the trees early in the morning, and searching diligently in the places we have mentioned.

Hymenopterous insects may very frequently be taken by the forceps, and a slight pinch will so far cripple them as to enable the Collector to secure them. They may be put into separate pill boxes, or pierced with a pin when taken: there are but few that require any further preparation.

Order 10.—Strepsiptera. *Wings* two, longitudinally folded; *mouth* with mandibles.—[Pl. III, fig. 2.]

The singular insects which form this order are very minute, but extremely interesting; the few species yet discovered are parasitic, and in the larva and perfect state inhabit the bodies of bees and wasps. As a further illustration of the economy of these insects, we cannot do

better than quote the observations of Mr. Kirby, who first discovered it in England, and says, "I had previously more than once observed upon other species (of Bees) something that I took to be an *acarus*, which appeared to be immovably fixed, just at the inosculations of the dorsal segments of the abdomen; at length, finding three or four upon a specimen of *Melitta nigro-ænea*, I determined not to lose that opportunity of taking one off to examine and describe; but what was my astonishment when, upon my attempting to disengage it with a pin, I drew forth from the body of the *Melitta* a white fleshy larva, a quarter of an inch in length, the head of which I had mistaken for an *acarus!* After I had examined one specimen, I attempted to extract a second; and the reader may imagine how greatly my astonishment was increased, when, after I had drawn it out but a little way, I saw its skin burst, and a head as black as ink, with large staring eyes, and antennæ consisting of two branches, break forth, and move itself briskly from side to side. It looked like a little imp of darkness just emerging from the infernal regions. My eagerness to set free from its confinement this extraordinary

animal may be easily conjectured. Indeed I was impatient to become better acquainted with so singular a creature. When it was completely disengaged, and I had secured it from making its escape, I set myself to examine it as accurately as possible; and I found, after a careful inquiry, that I had not only got a non-descript, but also an insect of a new genus, whose very class seemed dubious." These insects, though rarely, have been taken flying near the nests of bees.

Order 11.—LEPIDOPTERA. *Wings* four, membranaceous, covered with meal-like scales; *mouth* with a spiral tongue. [Pl. III, fig. 3.]

This order contains those very beautiful and splendid insects, the Butterflies, Hawk-moths, and Moths, whose extreme brilliancy has induced many persons to take up the study of Entomology, who would otherwise have remained ignorant of this delightful science. Butterflies appear during the day, and abound in hot climates; many of the species are extremely local, and from the shortness of their lives require greater assiduity in the Collector, and a wider range of search, than is generally supposed. As an illustration of this fact, we must observe, that the number of the Papi-

lionidæ found in England is about seventy-two: of this number not more than fifty are to be met within twenty-five miles of London; of these again, several are confined to the vicinity of a chalk cliff, or are peculiar to a meadow or a certain wood; and, even in these situations, their appearance in the perfect state is limited but to a few days, and at a certain season of the year. Of the remaining number, not found within this distance from London, some are confined to fens near a hundred miles from the metropolis, and others to the mountains of Scotland; but equally limited in the times of appearance and shortness of their lives. There is also another circumstance in the history of these insects that must not be passed over in silence; that there are several species of insects which, from some hitherto unknown cause, appear in the season, but only in certain years, when they will be found in abundance, and probably extended over a vast tract of the country, but again disappear for some time, and not a single specimen is to be found for a period of many years, when they will again be seen as plentiful as before. This is a circumstance that is not confined to England, where it might be attributed to our "ever varying clime:" it

occurs also in tropical countries; for DR. HORSFIELD informs me, that the first year he began to collect the insects of Java he met with a certain species of Papilio in abundance, and spread all over the island; at this time he fortunately secured a quantity, but, wishing to replace some injured specimens, he afterwards sought in the most likely places, and at the same season of the year, for several successive years, but never met with them afterwards. Butterflies fly only during the day, and are found on the skirts of woods, and in the open parts or plains; some are peculiar to extensive marshes, and many are confined to chalky districts and meadows. The best method of catching them is with the FOLDING NET: the insect, when secured, must be pinched in the thorax, at the insertion of the wings, rather smartly, and a pin passed through the thorax or side: for the larger species, the latter method will frequently be found the best, as it will prevent them from fluttering and injuring their wings when put into the collecting box.

The *Hawk-moths* fly during the night, not commencing their flight until very late in the evening, except those species denominated *clear-winged sphinges*, most of which feed, during

the larva state, in the wood of trees, from which they emerge early in the morning, and will at this time be found sticking against the trunks of the trees, until their wings become sufficiently expanded and dried, when they take wing and fly with the greatest rapidity. But they may occasionally be found feeding on the nectar of flowers, into the blossom of which they dart their long tongues, whilst they remain, like humming-birds, suspended on the wing in the air. *Moths* are far more extensive in the number of species than either of the before-mentioned tribes, but appear more difficult to be obtained, if we may judge from the state of various collections; indeed, this difficulty is increased, as but few of these insects fly during the day, and then dart along with a rapidity that often puts the Collector at defiance: a few, however, may occasionally be disturbed from their retreats by beating about heath and long grass; and these will fly only for a short distance and settle again, but often so secrete themselves as to completely elude the most vigilant research: the Collector must, therefore, be active, and, with his net always ready, pursue and capture them before they again settle, or they will be lost for ever. The same will also

occur in woods and their neighbourhood. The far greater proportion of moths may, however, be taken in the abovementioned places, towards the close of the day, or about two hours before sunset; the minute species are generally found at this time: the hedges also should be beaten occasionally and lightly, which will induce many to take to the wing; the smaller species seldom fly for more than an hour, when they are succeeded by the *Phalæna* and *Geometra*, which are larger, but light on the wing. These will be found sporting about on fine evenings for a considerable time, indeed till twilight, when they cease to fly: the *Noctuæ*, *Bombyces*, and *Hawk-moths* will then appear; and on moonlight and fine nights will continue on the wing until midnight. The most successful places for mothing are the skirts of woods under the wind, where there is abundance of plants in blossom, as it is the nectar of flowers on which they feed. Great numbers will also be observed in marshy and swampy places, and on the aquatic plants that grow in ditches and on the banks of rivers.

The best method, however, of obtaining the finest specimens of the Lepidoptera is to collect the *larvæ*, or caterpillars, and feed them in cages on the plants on which they are found:

the larvæ are obtained by beating the hedges and the trees early in the morning, as most of them feed in the night, and retire soon after sunrise; they are, therefore, but seldom to be met with during the day. Caterpillars are found in Europe from the spring until the autumn of the year; and some few live through the winter, even in this state: they, however, decrease in bulk, but are still attached to the stems of trees; on the rising of the sap and the budding of the trees they resume their usual vigour, feeding on the more tender shoots, and retiring to the pupa state before the trees are in leaf; we make this observation, because in tropical countries, where trees are ever green, many larvæ, no doubt, remain in this state during the rainy season. Most larvæ are obtained in England, about the middle of the spring and the end of summer, or in May and September.

Many of the larvæ of moths feed on the bodies of decayed trees, and others on the roots of grass; these, when obtained, should be put into cages, and constantly supplied with fresh grass, that the roots may furnish them with food; decayed wood must also be put into the cages, as many species form their coccoons of it. Those

persons who may have the leisure to make accurate drawings of the larvæ, will render a most essential service to natural history by so doing; and any little observation connected with their economy should be noted. This order of insects require no further preparation than merely passing a pin through the thorax; but as some would live for a considerable time empaled in this way, and this mode of killing them must be repugnant to every feeling mind, we shall merely state, that we have succeeded in destroying the life of the largest moth, by immersing the body in *boiling water:* it is further necessary to observe, that the whole of the body must remain under water for the space of half a minute: the water must be quite clean, and free from every kind of grease; the wings should be pressed together, and held firm by the finger and thumb, so that the upper surfaces be not rubbed, which would spoil the specimen; the insect should be then put on blotting paper, to extract the moisture, and may afterwards be placed on a corked board to dry. These insects are said to be readily killed by dipping the pin into aquafortis previously to passing it through the insect: should this be found suffi-

cient, it is a most convenient mode for travellers, who may not have the opportunity of immersing them in boiling water. With respect to the smaller species, they are, in general, soon killed, as passing the pin through them will frequently deprive them of life in a few minutes; but the usual method is, to collect the very minute moths in separate pill boxes, and kill them by the fumes of sulphur. The following is the best method of effecting this: elevate the lid of the box sufficiently to admit the fumes of the sulphur, without letting the insect escape; then place the box under a bason and light a match, or put a little sulphur on the end of some paper, and place it under the bason: in the space of a few minutes the insects will be all killed, and may then be pierced and put away into boxes.

Order 12.—Omoptera. *Rostrum* attached to the inferior part of the head; *elytra* coriaceous or membranaceous throughout, suture straight; *thorax* composed of two segments, the second as long or longer than the first; *ocelli* three. [Pl. III, fig. 4.]

The celebrated Fire-fly, Lanthorn-fly, Cicada or Frog-hopper, the Plant-lice, and Cochineal insect, are the principal insects belonging to this order. As yet, but few species are known of

the Fire-flies; there is little doubt, however, that many more are to be discovered in the interior of India. The Cicadæ appear to abound in tropical climes, and the species are numerous: many of those brought from *Sumatra* by Sir Stamford Raffles were very large, and, from the number of specimens, appear to have been extremely common. The males make a loud chirrupping noise, and in New Holland are known by the name of *Razor Grinders*, from their singular note. The *plant-lice* are minute, and peculiar to each species of plant; it, therefore, requires a knowledge of Botany to become acquainted with them; they are also very difficult to preserve: under these disadvantages it will be necessary to procure specimens of the plants on which they are found, and such memoranda should be made at the time as will enable the botanist to identify the species. It would also be advisable to preserve the different species in separate pill boxes, with a number that may correspond with the observation, and likewise agreeing with the number of the plant. The *Coccus*, or cochineal insect, has much the appearance of the buds of plants, as it attaches itself so close to the smaller branches; these scale-like animals may be detached from the

trees by means of a pen-knife: they are, for the most part, minute, especially the *males*, which are furnished with wings, and from their diminutive size are not easily detected, except narrowly watched; and should be sought for in those situations where the females are found in abundance: like the Aphides, they are only seen on certain plants, and from the observations of Naturalists, it appears that each species of plant has its peculiar Aphis and Coccus. We should advise that the same method be adopted in preserving the Cocci as mentioned for the Aphidæ.

The Fulgora and Cicada may be pierced with a pin, or put into spirits, unless the bodies are very cottony, which is the case with many; and when this occurs, we should advise that they be pierced on the spot, and placed in the collecting box.

Order 13.—Hemiptera. *Rostrum* attached to the anterior extremity of the head; *elytra* somewhat crustaceous or coriaceous, with the apex membranaceous, placed in a horizontal direction, one decussating the other; *thorax* with the first segment (which bears the feet) larger than the following one; *haustellum* with three

setæ; *ocelli* or little eyes, two, one being obsolete. [Pl. III, fig. 5.]

The *Cimex* or Bug, the Water-scorpion, and the Boat-fly belong to this order: the species are numerous, and many are extremely beautiful in their colours; others are as remarkable for their size and singular forms. *Cimices* inhabit trees, shrubs, and ferns, feeding on the juices of plants and animals, but principally on the larvæ of lepidopterous insects; many will be found crawling in grassy places and at the roots of grass, as well as on rushes in marshy situations: some few inhabit beneath the detached bark of decayed trees. The Water-scorpion and Boat-flies are found in the waters, and may be taken by means of the aquatic net. The insects, when captured, should be immediately pierced and placed in the corked collecting box, or put into separate pill boxes, and killed either by sulphur or hot water: as they are very brittle when dry, they should be pierced while in a recent state.

Order 14.—Aptera. No wings or elytra; *mouth* with a tubular, jointed, sucking rostrum; *body* ovate compressed, covered with a coriaceous skin, and composed of several segments;

trunk short, consisting of three legs bearing joints; *head* small, compressed, rounded above, and truncate before; *eyes* minute, orbicular, lateral; *antennæ* lamelliform, small, ciliated with spirules, one-jointed at their base, inserted in two excavations behind the eyes; *palpi* filiform (composed of four rounded joints) scarcely longer than the head, porrect, generally resting on the rostrum; *legs* strong, and formed for jumping, especially the hinder ones; *coxæ* and thighs large, compressed; *tarsi* elongate, cylindric, composed of five simple joints, the last articulation furnished with two long, acute, and slender nails. [Pl. III, fig. 6.]

The common *Bed-flea* is the best example of this order. It is not generally known that many birds and quadrupeds are much annoyed by fleas, more especially the latter, and from an examination of those taken from the mole, squirrel, and bat, there is no doubt of their being distinct species from the bed-flea: under these circumstances, the fleas of birds and quadrupeds should be carefully collected, and the name of the animal whence it is taken should be attached. These small animals should be collected in quills, and killed in hot water:

they should afterwards be put on gummed paper.

Order 15.—Diptera. *Wings* two, naked, unprotected; *halteres* (poisers or balancers) placed behind, and generally beneath the wings; *head* distinct from the thorax by an evident interval; *proboscis* (rarely wanting) univalve; *tarsi*, with two simple nails. [Pl. III, fig. 7.]

The Diptera are easily distinguished from the other orders of insects by having only two wings. They are extremely numerous, and many of the exotic species are very large. This order contains the *Tipuliadæ* or Crane-flies, Gnats, House-flies, the Bots of Cattle, &c.—The Diptera of foreign climes are certainly less known than any other order of insects; those persons, therefore, who may have the opportunity, will render a most essential service to Entomology by collecting them: they feed, for the most part, on animal and vegetable juices, and are generally quick on the wing; they are found in the blossoms of flowers in woods, meadows, banks of rivers, and morasses; during the day they are on the wing, and may often be taken while settling on flowers and the trunks of trees, especially before rain; when they may

be easily captured, either with the forceps or net. The *Æstridæ* or Bots, when in the larva state, cause the large pustules frequently to be seen on the backs of cattle; but many of the perfect insects deposit their eggs on the hair of the animal, and pass into the stomach in consequence of its licking itself: the pupæ of the latter will be found in the dung of horses at certain seasons of the year; others in the larva state inhabit the frontal sinuses of sheep and deer, and the perfect insects will be found on stones and places contiguous to the resort of these animals. The insects of this order should be pierced as soon as taken: no further preparation is requisite.

Order 16.—Omaloptera. *Mouth* with mandibles and maxillæ; *lip* simple; *wings* two or none. [Pl. III, fig. 8.]

The Forest Fly, Sheep and Swallow-tick, are of this order; there are many other species inhabiting both quadrupeds and birds: very few exotic species are known; those found on the camel and tiger, however, have been described.

Having now concluded our directions for collecting insects, it may not be amiss to add some observations by Mr. W. Macleay, relating to the insects of Java collected by Dr. Horsfield;

and as information of this nature is seldom to be met with, it cannot fail of being acceptable to our readers. The collection formed in Java by Dr. Horsfield, is, without doubt, the most perfect that has ever reached England from the Indian Archipelago ; the number of the specimens exceeding 20,000, and the whole being in the highest state of preservation. From these valuable materials, it is likely that the students of Entomology will reap the most important benefits; Mr. W. Macleay, whose liberal and enlarged views of his favourite science place him at the head of our British Entomologists, having commenced a descriptive Catalogue of the Insects of Java, accompanied with some excellent remarks on their natural distribution. From the first part of this work we extract the following useful observations on the locality of certain Javanese Insects: —

"In the year 1812, or soon after the conquest of Java by the British arms, Dr. Horsfield's original plans were considerably enlarged, in consequence of the liberal patronage which was bestowed on his researches by the Honourable East India Company, through the friendly medium of Sir Stamford Raffles, the Lieutenant-Governor of the Island. At this time, Dr. Hors-

field was established in an extensive plain, elevated nearly 200 feet above the level of the ocean, and situated near the middle of the island, in regard both to its length and breadth. This plain is highly fertile, and, with very little exception, is in a complete state of culture. The soil is a deep vegetable mould, which, near the banks of several large rivers that flow through it, is mixed with sand. Here the collection of insects was carried on with zeal and perseverance, not only by Dr. Horsfield himself, but by various native assistants, who had been properly trained to this pursuit. His attention, as may be conceived, soon extended itself to all annulose animals, without exception; and his assistants were, accordingly, instructed to look for them in every situation, and, as far as possible, to leave no place unexamined. During these researches therefore, the party, being provided with all the usual implements of entomological collectors, neglected none of the ordinary resorts of insects, such as flowers, decayed wood, carcases of dead animals, ponds, &c., and consequently, the collection now in the possession of the *East India Company* may very fairly be considered as affording a general view of the Entomology of the abovementioned plain.

When any remarkable deficiency is observed in particular natural groups, we may at least conclude that such insects are, on this plain, comparatively very rare. According to Dr. Horsfield's general observation, indeed, those insects which live on plants, shrubs, and trees, are extremely abundant in Java; while such as are, in more temperate climates, commonly found in various situations near the surface of the earth, are limited to a few families. At the same time, however, it will be well to bear in mind, on regarding the immense proportion of herbivorous insects in the collection, that, from the nature of Dr. Horsfield's more immediate pursuits, he was particularly led to collect on plants.

"From the plain just mentioned, in which, on account of the extension of agriculture and a numerous population, the variety of vegetable and animal productions is necessarily limited, Dr. Horsfield often made journies, in different directions, through the more wild and uninhabited parts of the island. Some of these were undertaken almost exclusively for entomological research, and were particularly directed, at the proper seasons, to a long range of hills, extending parallel to the southern coast of the

island, and rising to an elevation of 2000 feet above the level of the ocean.

"The base of this range is of a mixed nature; partly calcareous, partly trappean, and the hills are covered with trees and shrubs, although in many places the vegetation is less abundant and luxuriant than in the volcanic district, which constitutes a long series in the centre of the island. And here may be stated a curious circumstance in entomological geography, observed by Dr. Horsfield; namely, that the temperature which exists from an elevation of 1000 to that of 2000 feet above the level of the ocean, is most productive of coleopterous insects; and consequently, that this order occurred more abundantly in the southern and lower central ranges. The *lepidoptera*, on the other hand, appeared to be most abundant at an elevation of between 3000 and 4000 feet; that is, on the declivities of the high volcanic peaks. On such lofty situations, the luxuriance of vegetation greatly exceeds that of the southern ranges; and here, at the height of nearly 4000 feet above the level of the sea, multitudes of the most brilliant and rare *lepidoptera* were taken; and from the quantity of larvæ observed by Dr. Horsfield, he conceives

that many more species remain still to be collected.

"If the Collection can be considered defective, Dr. Horsfield imagines that it is only scanty in such species as may be peculiar to the districts which extend from the immediate confines of the ocean to an elevation of 200 feet. On the south coast the hills rise so abruptly from the sea to an elevation of several hundred feet, that probably few species were lost by those shores not having been examined; but along the northern coast of the island, which in many cases is low, and bounded by extensive plains of sands, there possibly remains much to be discovered."—*Macleay's Annulosa Javanica, No.* I.

APPARATUS.

The apparatus used for taking insects is few and simple: the following instruments are indispensable, and will be found to answer every necessary purpose.

1. A Net, similar in its construction to a bat-fowling net: this is generally made of fine gauze or coarse muslin, and may be either green or white; the advantage of the latter is, that minute insects are sooner discovered than if the net be green, but the green-coloured is generally preferred, being less conspicuous, and better adapted for mothing. The *net-rod* should be made of ash, beech, hazel, or other tough wood; and from three to five feet in length, round, smooth, and gradually tapering from the base, which should be about an inch in diameter. At the top of each rod an angular ferrule is fixed, so as to form a right angle with the rest of the rod; the cross pieces should be of cane, and fitted into the ferrules: for the convenience of carriage, each rod is divided into three pieces, which are fitted together by means of ferrules, and rendered similar to a fishing

rod. The net must be bound with a broad welt of ribbon or cloth, for the sticks to pass through; at the top or centre, where the cross-pieces meet, a bit of wash-leather should be sewed in the band, and stitched through the middle, to form a hinge, and to prevent the cross-pieces from slipping over each other; at the bottom of the net about four inches of the gauze should be turned up, to form a bag; this will frequently impede the escape of many insects, and prevent others from falling out of the net. This net is intended to take insects on the wing, and it is well adapted for that purpose, as it may be instantly opened or folded together, and thus the insects are easily secured: even the smallest insects cannot escape, if the net is not damaged, and the gauze is fine. It also answers well for collecting caterpillars, and many of the coleopterous insects that inhabit trees and shrubs: in using it for this purpose, the Collector must hold it in his left hand, under the tree or shrub intended to be beaten, and strike the branches with a stick, when the insects will fall into the net, and are easily captured. [Pl. IV, fig. 1.]

2. Hoop Net.—As many of the butterflies settle only on the summits of trees, and always

fly high, this net is extremely useful; it is made of a hoop of cane, with a long bag-net attached to the end of a stick or pole: the net should be of such a length, that, upon a slight twist, it may fall against one side of the hoop, and prevent the escape of the insect. [Pl. IV, fig. 2.]

3. Landing Net.—This is made of strong cloth, with an open canvas bottom, and attached to an iron ring, such as is used by anglers: the net should not be above four or five inches in depth. [Pl. IV, fig. 3.]

4. The Digger.—This is a piece of iron or steel, of about six inches long, fitted into a wooden handle, and is used for collecting the pupæ of *lepidoptera* at the roots of trees, and also for stripping off the bark of decayed trees. [Pl. IV, fig. 4.]

5. A Tin Bottle, useful in collecting coleopterous insects.—In this bottle a tube is introduced, which extends a little way down the bottle, to prevent the insects from escaping when the cork is taken out for the purpose of putting in other insects. [Pl. IV, fig. 5.]

6. A Pair of Forceps.—These are about ten inches in length, and are made of iron. The fans are either circular or of an octagon form, and are covered with fine gauze; they are held and moved as a pair of scissors, and are ex-

tremely useful in taking the hymenopterous and dipterous insects. If an insect be found on a leaf, both leaf and insect may be inclosed in the forceps; or if lodged against the trunk of a tree, paling, or any flat surface, they may very conveniently be entrapped: the forceps is also the best instrument for taking bees, wasps, and such insects as inhabit walls and sandy banks. When the insect is secured in the forceps, it should be pressed with the thumb and finger pretty smartly on the thorax, but not so hard as to crush it; it may then be shaken into the hand, and a pin passed through the thorax (this method is also used with moths when taken in the net), or a pin may be passed through the thorax while the insect is between the gauze, and then carefully taken out by the pin. [Pl. IV, fig. 6.]

8. Collecting Box.—This, for hot climates where the lepidopterous insects are large, must be in proportion, otherwise the Collector will frequently be obliged to reject insects for want of room. The box should be about four inches deep, and corked at top and bottom; a large chip box, being light, answers extremely well, if the top and bottom be previously well secured with glue. Camphor in a piece of muslin should always be kept in the box, which will tend, in a

great measure, to hasten the death of those insects that it is necessary to pierce. We would also recommend that small pieces of sponge or cotton be secured in different parts of the box, and saturated with spirits of turpentine, the effluvia of which tends to destroy life.

9. Pins.—The pins used either for Crustacea or insects must be adapted to the size of the animal: the Entomologist should, therefore, have at least four different sizes; the largest, used for crustacea, should be about four inches long, and thick in proportion; the other three sizes should be gradually finer, and about an inch and a half in length. *Needles* should *never be used*, as they soon rust, and the insects are liable to serious injury.

10. Pill Boxes.—The lightest, for the convenience of carriage, are those made of paper, and should be of four different sizes, so that they will nest or pack one within the other: as the tops and bottoms are seldom sufficiently secured, and in the event of either getting loose it is frequently a source of vexation to the Collector in the loss probably of a valuable insect, it is best to strengthen them by glueing paper at the top and bottom. If a particularly rare insect should be captured, and secured in a pill

box, it will be advisable to wrap it in a little paper, to distinguish it from the other boxes.

11. Quills will also be found useful: these should be large and thick; they must have one end carefully stopped up with cork or cement, and the other with a cork stopper. It is also of advantage to tie a piece of waxed sewing silk round each end, to prevent the quills from splitting. The Entomologist may in these secure with safety the most minute insect.

12. Larvæ Box.—This is essential to the Collector for the safe conveyance of caterpillars: it should be a large chip box, with a piece cut out of the top and bottom, and covered with gauze, for the free admission of air: a few leaves or sprays of the plants on which the caterpillars feed should be put into the box with them. A tin box of a convenient size, and perforated with small holes, is preferred by some Entomologists, as, in this case, the plants retain their moisture better.

13. Breeding Cages are used for rearing insects from caterpillars, and should be made of wainscot, in the form represented in Plate IV, fig. 9, with the sides and front covered with gauze; in the centre of the box should be a tube for the reception of a bottle of water, in which

the stems of the plants should be put to keep them alive. It is necessary to observe, that the constant supply of fresh plants is essential to the obtaining fine specimens of the perfect insect; it is also requisite to keep the cages clean by clearing away the dung, which is injurious to the health of the caterpillars. When caterpillars are large, which is the case with many of the exotic species, it is scarcely necessary to say that the cages must be in proportion. When drawings can be made of the larvæ, they should be kept by themselves, in order to ascertain the species. As most of the caterpillars in a state of nature feed during the night, and secrete themselves in shady and cool places in the day time, the cages should be kept either in an out-house or cellar; at the bottom of the cages there should always be a quantity of earth, of the depth of four or five inches, for such larvæ as pass the pupæ state underground; and this should be kept moist. As many of those insects that undergo their metamorphosis below the surface of the earth form an artificial cell, in which the pupæ can freely turn, it is hardly necessary to say that such must never be disturbed: many will remain in this state for several months, and some from one to two years.

14. Store Boxes.—To completely secure the success of the Collector, particular attention to the nature of store boxes, and the packing of insects, is of the utmost importance, as carelessness in the proper fixing of the insects, or defective boxes, will, in a short time, ruin the labours of many years' research. We have, with much regret, seen many valuable insects completely destroyed by not attending to these minutiæ. The boxes should be about two feet long, fourteen inches wide, and five inches high, divided down the middle, so as to open like a backgammon-board, with a cell at each end, for the reception of camphor; a ledge of half an inch should rise on the inside of the lower half, to exclude dust and minute insects. The boxes should be made of yellow deal, and previously to putting the insects in should be well saturated with spirits of turpentine, as the effluvia arising from it will tend to keep off any living insects that might injure those which are preserved. The boxes must be lined with a sheet of cork at the top and bottom; or, what is more economical, slips of cork, about half an inch wide and and a quarter thick, may be placed at the distance of an inch from one another, and glued down to the box. A still simpler plan may be

pursued: take the corks of common wine bottles, and divide them into pieces of about three-eighths to half an inch in thickness, and glue them to the bottom and top of the box at a distance of about an inch and a half from each other. Care must be taken always to pass the pin sufficiently deep into the cork, so that no sudden jerk will remove or displace the insects thus transfixed. It may be necessary to suggest, that in the event of making an extensive collection of the insects of any country, it is advisable to have the boxes made uniform, and of one size, for the convenience of packing in chests, which should be rendered, by paint and pitch, perfectly secure against wet and damp; the boxes ought also to be previously examined, and well saturated with spirits of turpentine, and a sufficient quantity of camphor should be secured to prevent the insects from being injured by dermestes, &c. The edges of the boxes should be covered with paper pasted on them, to exclude the air and dust.

*** *Sets of Apparatus may be had on application to the Author, through the medium of the Publishers.*

EXPLANATION OF THE PLATES.

Plate I.

Fig.

1. Example of Class I. CRUSTACEA; Subclass 1, ENTOMOSTRACA, Pandarus bicolor.
2. — 2. MALACOSTRACA, Carcinus Mænas.
3. — II. MYRIAPODA; Order 1. CHILOGNATHA, Glomeris marginata *(Margined millepede)*.
4. — 2. SYNGNATHA, Cryptops hortensis.
5. — III. ARACHNOIDA; 1. POLYMEROSOMATA, Scorpio Europæus *(European scorpion)*.
6. — 2. DIMEROSOTOMATA, Tetragnatha extensa.
7. — IV. ACARI; Hydrachna geographica.

Plate II.

1. — Class V. INSECTA; Order 1, THYSANURA, Petrobius maritimus.
2. — 2. ANOPLURA; Hæmatopinus Equi. *(Louse of the Horse)*.
3. — 3. COLEOPTERA, Dynastes Hercules *(Hercules beetle)*.
4. — 4. DERMAPTERA, Labidura gigantea.
5. — 5. ORTHOPTERA, Mantis precaria.
6. — 6. DICTYOPTERA, Blatta orientalis *(Cockroach)*.
7. — 7. NEUROPTERA; Libellula 4 maculata *(Dragon fly)*.
8. — 8. TRICHOPTERA, Limnephilus nervosus.

Plate III.

1. — 9. HYMENOPTERA; Vespa crabro *(Hornet)*.
2. — 10. STREPSIPTERA; Stylops melitta.
3. — 11. LEPIDOPTERA; Papilio Protesilaus.
4. — 12. OMOPTERA; Cicada hæmatodes.
5. — 13. HEMIPTERA; Pentatoma prasinns.
6. — 14. APTERA; Pulex talpæ *(Mole's flea)*.
7. — 15. DIPTERA; Asilus crabroniformis.
8. — 16. OMALOPTERA; Hippobosca equina *(Forest fly)*.

Plate IV *(Apparatus)*.

1. Net.—2. Hoop-net.—3. Aquatic net.—4. Digger.—5. Tin bottle.—6. Forceps.—7. Breeding cage.

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