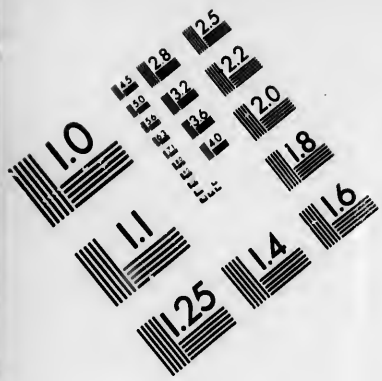

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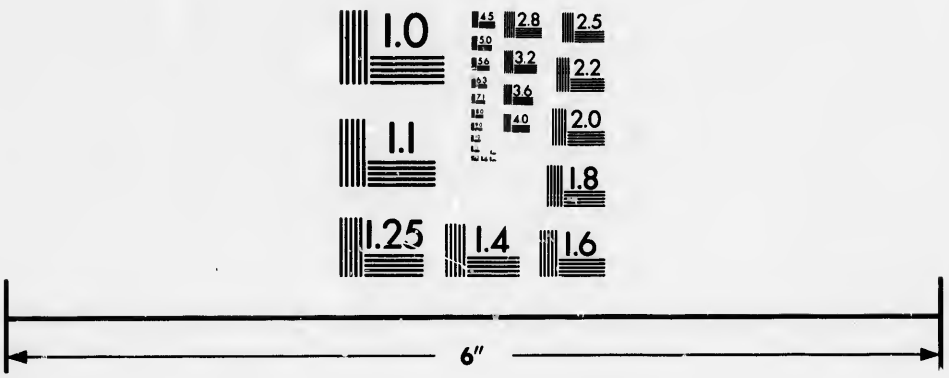

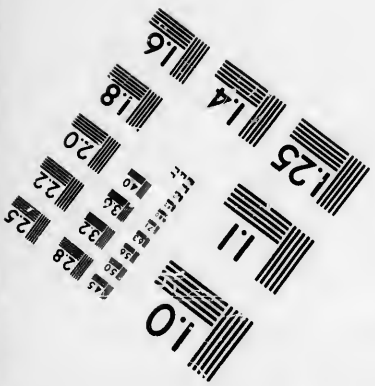

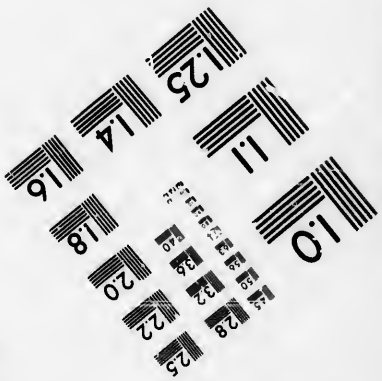

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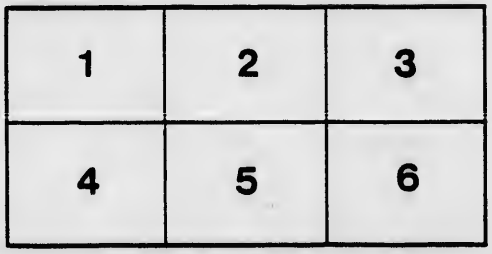

With Author's compliments

THE

ORDERS, SUB-ORDERS,

AND

GENERA OF INSECTS.

By WILLIAM COUPER,
Cor. Mem. Ent. Soc., Philad.; Nat. Hist. Soc., Montreal; Assistant Sec. Lit. and Hist. Society, Quebec.

[Read before the Society, 20th April, 1864.]

THE animal kingdom consists of four great divisions, which are called *Departments*.—It contains about 250,000 species.

I. VERTEBRATA—Mammals, Birds and Fishes.
II. ARTICULATA—Insects, Lobsters, Crabs, &c.
III. MOLLUSCA—Cuttle-fishes, Snails, Clams, &c.
IV. RADIATA—Sea Urchins, Jelly-fishes, Polyps and Star-fishes

The ARTICULATA are animals whose body is composed of rings or joints. It embraces three classes:—

1. Insects.*
2. Crustaceans.
3. All forms similar to the earthworm.

The Insects include three *orders*:—

a. Manducata. Those which have jaws for dividing their food, consisting of wasps, bees, ants and ichneumon-flies; beetles, grasshoppers, crickets and dragon-flies.

b. Suctoria. Those with a trunk for sucking fluids. The various bugs, cicadae, &c.; butterflies and moths and the two-winged flies are examples.

c. Aptera. Those destitute of wings, of which the flea is a good example. Apterous genera occur also in *Manducata* and *Suctoria*. We find the first wingless parasites among the two-winged flies. In *Hemiptera* or bugs, some of the lower groups are wingless parasites, and the wingless lower genera

* Fully one hundred and fifty thousand have already been described.

of *Neuroptera* present more analogies than other insects to the *Myriapods*.

The above three classes are also sub-divided into seven divisions, occupying an intermediate rank between orders and families, and called *sub-orders*.

The classification of old authors is as follows:—

1. *Coleoptera*—Beetles.
2. *Orthoptera*—Grasshoppers, Locusts, &c.
3. *Hemiptera*—Bugs.
4. *Neuroptera*—Dragon-flies, &c.
5. *Hymenoptera*—Bees, Wasps, &c.
6. *Lepidoptera*—Butterflies and Moths.
7. *Diptera*—Two-winged flies.

1. Beetles are known by their hard bodies, free and well-developed mouth parts, and by their first pair of wings being hardened into sheaths, which are termed *elytra*. They pass a complete metamorphosis to the *imago* or perfect state. Many of the species are aquatic. Beetles have been studied much more than other insects; in this country there have been described some 8,000 species,* but from the difficulty of finding their larvæ and carrying them through their successive stages of growth, the immature forms of but few native species are known. The family forms are easy to distinguish and characterize; the genera are based upon marked changes in the different parts of the body, which vary greatly, and some of the best characters lie in the relative size of the head-pieces and those pieces that make up the flanks of the three thoracic rings, and the basal joints of the legs. The relative size and the sculpture of the body and of the elytra; and lastly, the coloration, which varies

* The definition of "species" is one of the most difficult tasks assigned the Naturalist. It corresponds very nearly with the common term "sort," or "kind." It is that race or chain of beings, descended from common parents, and which always produces the same kind, or very nearly so. For instance, the white oak is a species, the black oak is another; and the acorn or fruit of one will not produce a tree of the other kind. Insects being small animals, great care is necessary to avoid confounding the species with another, or making two species out of one where the sexes differ. On the fact of the permanency of species hangs the entire system of classification. For if what is now a white oak may in a century produce a black oak, or a chestnut, and what is now a frog may in five hundred years produce a bird, a description given by Aristotle or Linnæus, would be of no service to us of this day. In fact, Natural History would cease to be a science.

much among the individuals, afford good specific characters.

The most productive places for the occurrence of beetles are alluvial loams, covered with woods or with rank vegetation, where, at the roots of plants, or upon their flowers, under leaves, logs and stones, under the bark of decaying trees, and in ditches and by the banks of streams, the species occur in greatest numbers. Grass lands, mosses and fungi, the surfaces of trees and dead animals, bones, chips, pieces of board, and everything lying upon the earth that serves to attract insects should be searched diligently. Many are thrown ashore in sea-wrack, or occur under the debris of freshets on river banks. Many carabidæ run on sandy shore. Very early in spring stones should be upturned, ants nests searched, and the waters be sifted for species not met with at other times of the year.

The tiger-beetles abound in sandy roads and banks of rivers, where the rays of the sun have full play. They run swiftly and are also very excellent flyers. They are captured by throwing the bag-net quickly over them.

There are other ground beetles, called carabs, provided with powerful jaws, which are shorter and not so much curved as in the tiger-beetles. They are runners, the under wings being often absent. They run in grass, or lurk under stones and sticks, bark of trees, and in the debris of freshets, in the greatest number in spring. The following species are taken in the latitude of Quebec :—

Cymindis laticollis Say. Rare.

The beautiful little *Lebiini* are found in autumn on trees and tops of composite plants.

Lebia axillaris Dej. occurs in June, near the Hermitage.

Platynus retractus Lec. June—uncommon.

" *stigmosus* Lec. is found everywhere near Quebec.

" *atratus* Lec.

" *obsoletus* Say, common.

The genus *Amara* feeds on pith and stems of grasses. Others feed on wheat. *Amara avida* Lec. is very common in June. *A. littoralis* Zimm. is occasionally taken near Quebec. *Stenolophus conjunctus* Lec. is generally found under bark of trees—it is rather rare. *Patrobus angicollis* Randall is found during the month of

June under stones on the margin of the Montmorenci river. *Elaphrus*, which is flat, and covered with coarse metallic punctures, runs on the mud flats of rivers. The larvæ of *Calosoma* ascends trees to feed on caterpillars. *C. calidum*, our common golden-spotted species, digs holes in fields, where it lies in wait for its prey. Another uncommon species, *C. frigidum*, occurs here, but its habits are not definitely known.

The *Dytiscidæ* or diving-beetles are, by their carnivorous habits, closely allied to the carabs. They are aquatic, flattened, elliptical beetles, with their hind legs ciliated, forming a broad surface for swimming. In night time they leave the water and fly about. The larvæ of *Dytiscidæ* are called water-tigers. The following species are taken in the vicinity of Quebec:—

Dytiscus hybridus Aubé.

Cnemidotus muticus Lec. This species has lately been described by Dr. LeConte, in the Smithsonian Misc. Coll., part I. His specimens came from the Middle and Western States; those in my collection are from ponds near this city. *Hydroporus rotundatus* Lec.—This insect is also described as new in the above work, by Dr. LeConte. The description is from a specimen taken by me at Toronto, ten years ago. It is common in ponds north of Quebec.

Hydroporus undulatus Say, taken with the above.

" *catascopium* Say.

" *modestus* Aubé.

" *puberulus* Lec.

" *tenebrosus* Lec. (var?)

" *similis* Kirby.

" *inæqualis* Lec.

Laccophilus proximus Say—not common.

Agabus fimbriatus Lec.—In ponds, Beauport.

Of *Colymbetes* but two species have been taken at Quebec. They belong to the third section *Cymatopterus* Esch. *C. sculptilis* Harris, and *C. binotatus* Harris.

The *Gyrinidæ* or whirl-gigs, are easily distinguished by their form and habits, being always seen in groups, gyrating and circling about the surface of pools, and when caught, giving out a disagree-

able milky fluid. They are provided with two pair of eyes, two for looking into the water, and the others for ærial purposes.

Hydrophilidæ, also aquatic. They are small, convex, oval or hemispherical beetles, with short antennæ and long slender palpi. The larvæ are carnivorous, but when beetles, vegetable feeders, and living on refuse and decaying matter. This family unite the habits of the previous mentioned families with those of the scavenger beetles.

Tropisternus glaber Herbst.—In ponds, Beauport. *Hydrobius regularis* Lec., in ponds—common.

Silphidæ; carrion, or sexton beetles, are useful in burying decaying bodies, in which they lay their eggs. Smaller species live in fungi, &c.—other genera live in caves. The genus *Catops* lives in ants nests. Another genus, *Brathinus*, has been found from Lake Superior to Nova Scotia, about grass roots, in wet places. Dr. LeConte, of Philadelphia, says they are small shiny insects, of graceful form.

The *Staphylinidæ* or rove-beetles, which are of a linear form, with remarkably short elytra, are largely represented in Canada. Though sometimes an inch in length they are more commonly minute. They inhabit wet places, under stones, manure-heaps, fungi, moss, bark of dead trees and decayed leaves. Some burrow in sand. *Tachinus picipes* Er. occurs in fungi in July and August. *Staphylinus badipes* Lec. Lately described by Dr. LeConte as new. It appears to be common here; the latitude of Quebec may be considered its most northern range.

Histeridæ.—These beetles are square or oblong, hard, solid, shiny insects, black, with the prothorax hollowed out to receive the head, which has prominent jaws. They are found in similar situations with the last-mentioned family. *Hister merdarius* Paykull is common in August.

Dermestidæ.—Every entomologist dreads the ravages of *Dermestes* and *Anthrenus* in his cabinet. The ugly insidious larvæ which so skilfully hide in the body whose interior it consumes, leaving only the shell, ready to fall to pieces at any jar, can be kept out only with great precautions. *Dermestes lardarius* is oblong oval,

legs short, black, with the base of the elytra gray buff, covered by two broad lines. It is timid and slow in its movements, when disturbed seeking a shelter, or mimicking death. *Anthrenus musæorum*, is round, oval, with transverse waved lines. Its larvæ is thick, with long bristles, which are largest on the ends of the body. They eat, also, the integuments of stuffed specimens, doing great injury. Boxes and drawers should be tight enough to keep them out, or it may be done with camphor or benzine in a sponge or in cotton.

Ips sanguinolentus Say is common in mucus on birch, in May.

Peltis ferruginea Kug. Very rare.

Peltis quadrilineata Mels. In trees, June and July.

Thymalus fulgidus Er. May, in fungi—rare.

Cucujus clavipes Fabr. Rare.

Laemophloeus biguttatus Lec. Rare.

Mycetophagus flexuosus Say. Common in bones.

Attagenus pellio Steph. Common.

Thanasimus undulatus Say.

Byrrhus also occurs in Canada. We generally find them in fields, under stones, &c. When disturbed they counterfeit death. *Byrrhus americanus* Lec. is very common in May and June on the Beauport road.

Scarabeidæ or Lamellicorns are of great interest to agriculturalists, from the injury they do as leaf-eaters. They are distinguished by their lamellated antennæ, short, broad, thick convex form; their legs are flattened, and toothed for the purpose of digging. The males are often armed with horns on the clypeus. Among them occur the largest of insects. *Lucanus* has immense jaws, especially in the males. The larva forms a cocoon of the chips it has made in boring into decayed trees. In Canada, this genus is, as far as yet ascertained, confined to the West. *Aphodius terminalis* Say. is found in the Quebec district.

Melalontha and allies are leaf-eaters, which have long clawed legs to cling on to leaves, where they are found early in summer. Their larvæ eat the roots of grass, and before transforming form oval earthen cocoons. *Macrodactylus*, the Rose-beetle, is found on roses and rhubarb blossoms, in gardens; but, fortunately, it does

not occur in the Lower Province; but *Lachnosterna*, an allied genus, which does much injury to apple and cherry trees, is abundant about the woods near this city. *Trichius affinis* Gory is common on flowers during June and July. *Dichelonycha linearis* Schönh is found on trees in June.

Buprestidæ.—Beetles with elongate, flattened, very solid bodies, often angulated; the antennæ slender and serrated, legs short—the head is received into the excavated prothorax. Colors brilliant, often metallic. On being disturbed they draw up their legs and feign death. They creep slowly, flying in the hot sun, and feed on wood, flowers and sap; being found especially on fir trees. A great many species are found in Western and Eastern Canada; they are considered very destructive to various trees.

Elateridæ or snapping-beetles, are known to many by their power of righting themselves when turned on their backs, by jerking themselves up in the air, since their legs are too short to catch hold of the surface they are upon. They frequent the flowers of viburnum, of rhubarb, in gardens, and are found under bark. Their larvæ are called *wire-worms*, from their long, cylindrical form. They feed on the roots of grass, grain, turnips, salad, cabbages and pinks, living in the interior of these stems. Moles devour great quantities of them. Other species inhabit rotten stumps. They live several years in the larva state. The following species were determined since my former list was published:—

Elater apicatus Say.—Quebec. May.
Cryptohypnus? planatus Lec. June.
Corymbetes spinosus Lec. June.
" *nitidulus* Lec. May.
" *medianus* Germ. June.
" *falcificus* Lec.
Sericosomus incongruus Lec. June.
Dolopius fuscosus Lec. June.
Photinus (Ellychina) *lacustris* Lec. Quebec. June.
Silis percomis Say.
Podabrus modestus Say.
Telephorus excavatus Lec.

Meloidæ.—This and the following family are most interesting, from their parasite habits, and demand careful study and observation. *Meloe angusticollis* is an inch long, thorax very small, square; the elytra are small and oval. It feeds on grass in the spring, in the summer it is found in the neighborhood of Quebec, feeding on *Clintonia borealis.* The larva is very different from the beetle, and as found parasitic on wild bees, resemble larva of some Staphylinidæ, being oblong, flattened; the three thoracic rings above of nearly equal size, transversely oblong; the head nearly of the same size, with short antennæ; the legs have very long claws, with an intermediate long pad; they are found living on bees, between the joints of the head and thorax, their heads immersed in the dense scales of the bee. In Europe, this genus has been found parasitic on a beetle of the genus Cetonia. Our beetles, related to the latter, should be searched for them. The eggs are laid on the ground, and the active larvæ attach themselves, soon after hatching, to bees and to various two-winged flies.

Cantharis, and our *Epicauta* secrete cantharidine, of use in pharmacy. *E. atrata* is found in abundance on Golden rod, and it is perfectly black, with long elytra. *Epicauta atrata* has been very destructive in the Quebec gardens during the months of June and July of this year. They were never known to be so abundant before.

Cephaloon lepturides Newm.—Quebec. Rare. *Ripiphorus* is parasitic on the wasp; *Ripidia* on *Blatta Americana,* the cockroach. *Myoditini* is represented in this district by two species not yet determined.

Calopus angustus Lec. June—rare. Dr. LeConte says that Quebec is an extrordinary locality to find this insect. The only one in his cabinet came from New Mexico. It is possible that *Stenotrachelus arctatus* Lec., a genus of somewhat similar shape, may be found at Quebec.

Curculionidæ.—This group is at once recognized, by having the head lengthened into a long snout, near the middle of which are situated the elbowed antennæ. Their bodies are hard and round, and often very minute in size. The beetles are very timid, and

quickly feign death. The larvæ are white, thick, fleshy, legless grubs, with tubercles instead of wings, and armed with thick, arched strong jaws. They feed on nuts, seeds, the pith of plants, leaves or flowers; while some are leaf-miners, and others make galls. Before they transform they spin a silky cocoon. *Bruchus pisi* lays its eggs in the pea, when in flower, and lives in the pea till the following spring. *Brenthus* inhabits the solid trunks of oaks. *Apion* inhabits the seeds of clover. *Hylobius pales* is found under the bark of the pine, and lately I have discovered and described another large species inhabiting pine, which I have named *pinicola*. The pine is also infested by a weevil *Pissodes strobi*, where it occurs in all its stages. *Rhynchænus nenuphar* infests the plum. *Calandra granaria*, the grain weevil, is an eighth of an inch long, and consumes the interior of wheat. *Balaninus* forms galls on the willow. *Scolytus, Xyloteres* and *Tomicus* are cylindrical bark-borers, and the pines of our forests are being largely destroyed by them—"they form gallaries in the bark or sap-wood, often causing the disease called fire-blight."

Cerambycidæ.—The longicorns are insects with long bodies, tapering behind; the elytra broader than the prothorax; the antennæ and legs are long, and are large, handsome beetles, often gaily ornamented. They fly in hot days about woods and timber. All the insects of this family are wood-borers, and found in trunks of trees. The following are additions to the Quebec list:—

Callidium ligneum Fab. Rare.

" *janthinum* Lec. June—rare.

Heliomanes bimaculatus Say. Rare—Quebec, June 20th.

Liopus maculatus Hald. Gomin woods, July.

Leptura (Grammoptera) *sphæricollis* Say.

" *lineola* Say. June—common.

Donacia, which approaches the *Cerambycidæ* in its elongated body and long antennæ, lives, as a larva, in the stems of aquatic plants. There are several species inhabiting the Quebec district, but *D. emarginata* Kirby is the only one as yet determined. They frequent swampy places.

Chrysomelidæ.—The insects of this family have hemispherical

or oval convex bodies, with small heads sunken in the thorax, and live, in all their stages, on the leaves of plants.

Orsodacna vittata Say. (Var.) June.

" *Childreni?* Kirby. June.

Anoplitis rosea Weber. June—Gomin woods. The Northern specimens are smaller than those taken in the West; the form is so reduced that an inexperienced eye would take it for a new species.

Hispa (Microrhopala) *Pluto* Newm. At the Hermitage, June—rare.

H. (Microrhopala) *Xerene?* Newm. Taken with the former.

Lema trilineata, which closely resembles the squash beetle devours the leaves of the potato.

Phyllotreta striolata Illig. is sometimes abundant at Quebec.

Cassida is also a vine-leaf eater. *Hispa* is a leaf miner, its mute larva making galleries in the leaves of the apple tree and wild cherry. *Galeruca vittata*, the squash beetle, is yellow, with black stripes. *Haltica*, or flee-beetles, are little, black-colored, most hurtful insects, which destroy young tomatoes, turnips, &c. Several species of *Calligrapha* are found on alders; they are oval, and richly ornamented with dots and curved lines.

Chrysomela viridis Mels. On the margin of ponds in May—common.

Chrysomela (Helodes) *trivittata* Say? var? The Quebec insect comes near several European species.

Pachnephorus 10-*notata* Say. Uncommon.

Chelymorpha cribraria Fabr. June—rare.

Galeruca rufosanguinea Say was very common here on plum and choke-cherry trees, during the summer of 1864.

Luperus meraca Say. Common at the Hermitage, June.

Cryptocephalus mutabilis Mels. A beautiful variety of the insect was taken at the Hermitage, in June.

Coccinellidæ (Lady-bugs).—They are hemispherical, generally red or yellow, with round or lunate black spots. *Chilocorus* is black, with yellow dots. The eggs are laid often in a group of plant lice (Aphides); as soon as hatched the larvæ devour them. When about to turn to pupæ they attach themselves by their ter-

minal rings, to the leaf they are upon. The beetle is as voracious as the larva. In Europe, gardeners take pains to collect and put them on trees infested by lice, which they will soon remove. We have about fourteen species in Canada.

Coccinella tricuspis Kirby. I obtained two or three specimens of this beautiful little beetle at the Hermitage—June.

Coccinella trifasciata Linn. Gomin woods—July.

Pystloboro 20-*maculata* Say. June—common.

Phymaphora pulchella Newm. Found under the bark of trees on the 24th May.

Emmesa labiata Say. June—rare.

Mordella scutellaris Fabr. Gomin woods—June and July.

Every collector should keep a daily diary of his captures and observations, noting down every fact and hint that falls under his notice. In this book, commenced as soon as the season opens in the spring, can be placed on record the earliest appearance, the time of greatest abundance, and the disappearance of every insect in any of its stages. Also, a description of larvæ, and observations upon their habits, with sketches of them; though drawings had better be kept upon separate pieces of paper, for easier reference. The insects, when captured and unnamed, should be numbered and refer to corresponding numbers in the note book. At the close of the season one will be surprised to see how much material of the kind has accumulated. He can make a *calendar of appearances* of perfect insects and larvæ, so as to have the work of the next season portioned out to him; he will thus know when and where to look for any particular insect or caterpillar.

A sweep-net must be employed to collect the minute species. Strong brass wire makes the best ring for this net; then a bag is made of linen or Berlin-wool canvass to suit the size of the ring, which is attached to the stick by means of a screw. The ring is hinged in the centre for the purpose of being more portable, and the ends are bent round and flattened, so that one end sits on the other on the top of the stick. I use but one ring for the sweep-net and butterfly-net; they can be carried in the pocket and used as required. The water-net is generally smaller, and shallow. It is

made of various material, such as grass-cloth, coarse millinet, fine brass, concave, and full of small holes. Aquatic beetles can be fished up in mud, which will strain through the net, leaving them to be picked up. For beetles, a collecting bottle is necessary—one with a wide mouth is best; it should have a good cork, and it is better to encase it in tin to prevent its being broken. The bottle should be half-filled with fine pine sawdust, previously baked in an oven, to destroy any vegetable moisture; the sawdust is then moistened with spirits of wine or good alcohol, and it is then ready for use. After an excursion, the contents of the bottle are emptied out on a piece of white paper, and the new captives selected therefrom, mounted on pins suitable to the size of the insects.

2. Grasshoppers and crickets have the mouth parts free, and the organs of nutrition very highly developed. The first pair of wings are still partly hardened, to protect the broad net-veined hind pair, which fold up like a fan underneath them. Their transformations are not complete, the *larva* and *pupæ* resembling closely the *imago*, both being active. All the species are terrestrial.

"The transformation of grasshoppers need careful study. For this purpose their eggs should be sought for, and the development of the embryo in the egg be noted; the date of deposition of the egg; the manner of laying them; how long before the embryo is hatched; the date of hatching; how many days the pupæ lives; also, so of the pupæ and of the imago; while the intervening changes should be carefully observed. Birds feed on them in all their stages. Ichneumon parasites prey on them, and also the lower worms. Orthoptera can be easily preserved in strong alcohol, and can afterwards be taken out and pinned and set at leisure. They can be killed with ether or benzine without losing their colors. Many of the species can be collected in the same way as Coleoptera; they are both numerous and destructive in Lower Canada, but, up to this instant, nothing has been done to collect them and study their habits.

The different sounds produced by crickets and locusts should be carefully studied; every species can be distinguished by its peculiar note; and as in different families the musical apparatus varies

so each family has a characteristic chirrup, or shrilling, or harsh, grating, rasping noise.

3. Bugs have the mouth part formed into a sucking tube. The first pair of wings are often thickened at the base, net-veined at the apex, and laid flat or inclined upon the body. Transformations incomplete. The species are largely aquatic Some of the lower groups are true wingless parasites.

Aquatic species should be taken out by the water-net, by thrusting under swimming species, or pushing it among submerged grass or weeds, where small species are lurking. Several species of small size are found lurking under logs, &c. in the water. By sweeping grass or herbage, as for Coleoptera, in the last part of the summer, large numbers occur, which can only be obtained in this way. Hybernating species are found under leaves, in hardwood forests The large carniverous kinds are found on bushes frequently, with Lepidopterous larva transfixed in their jaws. All *Hemiptera* should be pinned through the distinct triangular scutellum, in the middle, at the base of the wings.

4. Dragon-flies have the mouth parts free; the wings large and net-veined, the hind pair being often larger than the primaries. Their bodies are more elongate than those of other insects. The metamorphosis is incomplete; the larva and pupæ closely resemble the perfect insect, and both are active, and, with few exceptions, they are all aquatic. The different species present strong analogies to all the other sub-orders. They occur in swampy, low grounds, the banks of pools and rivers, and sometimes in thick, dense forests. The large dragon-flies, when taken with the net, must be killed, by brushing the body with alcohol or benzine, carried in a vial, and then the wings can be folded together, and the insects be placed in bags, or pieces of paper. The smaller, more slender and delicate species should be pinned directly in the collecting box.

Distribution of the Northern Species.

	Species.
Greenland	6
Arctic America	29
Russian Colonies	7

Canada	100
Labrador	6
Nova Scotia	33
Massachusetts	27
New York	104
Pennsylvania	65

North America contains 716 species.
South America " 507 "

Deducting 53 species found in both North and South America, the whole Continent contains 1,170 species.

5. Bees and wasps are known by their hard, compact bodies, distinct head and thorax, the small narrow wings, irregularly veined, and by the possession of a hard ovipositor, often forming a poisonous sting. Their transformations are the most complete of all insects. The pupa has the limbs free, contained in a thin silken cocoon. The species are all terrestrial. Dana, in the "Am. Jour. of Science and Arts", vol. xxxvii., states that "the structures among bees, wasps, &c. are compact, comparatively uniform in proportions, and with rather narrow limits as to size, much narrower than in the butterflies, beetles, and grasshoppers. In bees, the integuments are firm, the parts neatly adjusted, and all well proportioned. Among them there is no imitation of the forms of other tribes, while they are extensively copied after—a characteristic peculiar to a type of the very highest grade. The mouth has a suctorial lip for feeding; but besides this, well-developed mandibles; and these serve, in many species, for the high purposes of making nests, taking prey, and transporting young and food. The jaws are therefore *per-functionate* in these species, to a degree comparable with that of the jaws of a carnivore among mammals. The higher kinds also supply the young with food, either by storing it or by direct feeding—a quality approximating to that of the Altrices (nursers), or highest sub-division of birds. The food is either vegetable or articulate-animal, not vertebrate-animal; the animal food being thus the same in kind with the material to be made of it, just as among *mammals*, the highest of carnivorous species live on the flesh of mammals, and only the lower on fish and insects. Individuals of many of the

higher species live in communities, for mutual work, and with sometimes a special division of the work between them. The wings are fitted eminently for the legitimate purpose of flying, and are typical in size, texture and power." The Hymenoptera are the most numerous in species of all the sub-orders, except Coleoptera. They have been less studied in this country than almost any other sub-order, though so deserving, from their interesting habits. Especial attention should be paid to collecting the smaller species. They should be pinned through the hard thorax, high up on the pin. Their habits should be studied long and patiently, and attention be given to rear in the same way as given for butterflies and moths. Great attention should be paid to the collecting of galls on various trees.

6. Butterflies and moths have the mandibles obsolete, the maxillæ greatly prolonged and rolled up between the labial palpi; and soft bodies, covered with dust-like scales. Their transformations are complete. The caterpillars (larvæ) spin silken cocoons before changing to pupæ (chrysalides), with the exception of the butterflies. Some of the families are somewhat aquatic, feeding on water-plants.

A few of our butterflies have been introduced into this country by commerce, from Europe. The *Vanessa antiopa* is double-brooded, common, and a hybernating species in Canada, while it is rare in England, where it is called the Camberwell beauty. The caterpillar feeds on our willows and elms. Another species, supposed to be the *Pieris rapæ* of Europe, is one of the most common butterflies in our neighborhood. Four years ago, I captured the first specimen of this butterfly in Quebec, and then looked on it as a great rarity; but, unfortunately, I cannot do so now. In England it is called the turnip butterfly, where it appears at the end of April or middle of May, and beginning of July or middle of August, therefore the species is double-brooded in England; and, as far as I have studied the introduced butterfly, it is the same with us Here, it appears to have discarded its British food-plant and taken to our cabbages; and the chrysalides can be found now on any garden fence where cabbage was cultivated last summer. It would

be very interesting to ascertain how far this butterfly has penetrated the country. Westwardly, it has not reached Montreal, and it has not been traced south of Point Levi; eastward, it has not been taken at St. Anne's, where a Lepidopterous collector resided during the time of its occurrence here; north-west it appears to have made the greatest inroad, for it has been noticed at a distance of thirty miles in that direction. I am safe in stating that five years have not elapsed since this butterfly was introduced into Lower Canada, and it is now brought before the public as an unprofitable addition to our insect fauna.

Butterflies are easily distinguished from the other groups by their knobbed antennæ; in the *sphinges* and their allies the feelers are thickened in the middle; in the *moths* they are filiform, and often pectinated, like feathers. Lepidoptera have also been divided into three large groups, called Diurnal, Crepuscular and Nocturnal, since butterflies fly in the sunshine alone, most sphinges in the twilight (many of them fly in the hottest sunshine), and the moths are generally night-flyers—thus showing that the distinctions are somewhat artificial. In collecting them to pin dry, we must remember that the least touch will remove some of the scales from the wings and bodies, thus injuring them for study and spoiling their looks. The collector should have the gauze net, a box lined with cork, to pin his captures into. A piece of sponge, saturated with benzine, and pinned at the bottom of the box, will produce a strong odor, and prevent the specimens from fluttering. When the insect is taken in a bag-net, by a dexterous twist of the handle, which throws the bottom over the mouth, it should be confined with the other hand, with great care, and then pinned through the thorax when in the net. The pin can be drawn through the meshes upon opening the net. The collector can afterwards set his specimens to his own fancy. The catalogue published by the Smithsonian Institution enumerates over 2,000 species.

7. The two-winged flies, the house-fly for example, have the mouth parts formed into a kind of probosis; the second pair of wings are undeveloped, being reduced to a pair of pedicelled knobs, serving as *balancers* or *poisers*. Their transformations are complete.

Many of the species are aquatic. Here we first find the wingless parasites.

To this sub-order belongs the cecidomya or midge, so destructive to wheat. The entomologists of the United States have estimated by careful calculation, the loss of cereals in the Western States, by the devastations of insects, at one hundred millions of dollars per annum. The insect armies that invade our fields are more to be dreaded than an army of foreign mercenaries The utility of a study that will lead to the investigation of the character and habits of insect life, in order to facilitate their destruction, either by destroying their larvæ or in increasing their natural enemies, is apparent. These insects are very insignificant individually, yet, when they invade our fields, the hopes of the farmer are dissipated, and his labor destroyed. Surely, if there is an antidote to such mischief, it would be useful to know and apply it.

Mr. Dana places the *Diptera* immediately after the bees and wasps, because the anterior locomotive organs have their normal superiority. Flies can be pinned alive, without killing them by pressure, which destroys their form; and numbers may be killed at once by moistening the bottom of the collecting box with creosote, benzine, or ether.

The entomologist should not neglect to collect insect architecture. Many important discoveries are made by tracing the insect to the plant. Galls on oaks, currants, rose, raspberry and other plants should be secured, and a note made of the time. The specimens must be placed in separate boxes, that the insects producing them may be determined. Leaves of trees, mined or otherwise deformed by the larvæ of insects, such as moths and two-winged flies, should be carried home and treated in the same way; this is the most correct mode of ascertaining the natural history of insects. Bees, wasps, and ichneumon-flies are good architects, and many very pretty specimens of their work are to be found in Canada. Caterpillars of moths construct neat habitations, in which their chrysalides rest during winter. Indeed, all insects, while in their second stage of metamorphosis, produce some kind of protective building for its future form. Spiders are ingenious architects and good

mathematicians. I have collected many pretty specimens of their work in this country.

"The double effect of the study of entomology is to impart a certainty to the mind and religion to the heart. The creation is a visible ladder by which man ascends to the invisible creator. Philosophy, politics, history, and morality itself, are subject to the intellectual revolutions of wavering humanity; but the facts of the creation are as invariable as God, and the analysis of a plant or an insect marks its demonstration with the seal of eternal truth." Children are liable to be cruel and tyrannical when no direction is given to their minds. Give a boy a gun, and he will slaughter every living animal that is not the subject of property, without discrimination, without compunction or remorse. He kills for the sake of killing; and the dying agonies of a wounded sparrow excite no sympathy, no regret. Think you that if a companionship had been established between him and living things; that he had learned their value in the scheme of creation; their uses in the economy of nature; their beauty, their innocence, their helplessness, that he would thus destroy them for mere wantonness? We know, from observation and experience, that there can be a softening, humanizing influence brought to bear upon youthful minds through a correspondence and communion with nature's works. Those who are interested in birds and flowers must be refined by the association. An intimate connection with the varied works of creation leads the mind from vicious associations, and preserves it from contact and contamination. The man or woman educated to observe and reflect upon the condition of natural objects, can never be alone—will never want companionship. Under circumstances where others would be miserable and lonely, the naturalist may indulge in sweet, though silent, communion with nature, and look "through nature up to nature's God."

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