THE COLLECTION AND PREPARATION OF COLEOPTERA*

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The purpose of the present essay is not to attempt to add to the already ample literature on the methods of collecting and preparing specimens of Coleoptera for study, but rather to assemble a few suggestions that may guide the beginner in the adequate preparation of his material. Two preliminary remarks are in order. (1). Everything else is subsidiary to the production of adequately prepared specimens accompanied by adequate data. (2). The methods for bringing about this result are legion; there is no *best* method—there are satisfactory methods, but no best method.

Some of the more general accounts of collecting methods in English are: Banks, U. S. Nat. Mus. Bull. 67, 1909, 135 pp.—Sanderson and Jackson, Elementary Entomology, 1912, p. 330-358.—Lane and Banks, U. S. Dept. Agr. Farmer's Bull. 606, 1917, 22 pp.—Lutz, Field Book of Insects, 1918, p. 9-26.—Torre-Bueno, Can. Ent. LVII, 1925, p. 6-10, 27-32, 53-57. —Tillyard, Insects of Australia and New Zealand, 1926, p. 484-500.

KILLING—Potassium cyanide is to be preferred, but sodium cyanide is nearly as good. Shell vials up to an inch in diameter will serve for all but the largest species. A quarter of an inch or so of pulverized or powdered cyanide is placed in the bottom of the bottle, covered with some saw-dust or dry plaster of Paris, and several tightly fitting discs of blotting paper are tamped down to hold it in place. The cyanide in such bottles is very easily renewed when it becomes exhausted.

In larger bottles, the cyanide must be held in place by plaster of Paris. A layer of dry plaster of Paris is used first, and this is covered by a mixture of plaster of Paris and water, which is allowed to set. As little water as possible must be used, but even with the greatest care, the cyanide may become dissolved after a few days. Several discs of blotting paper are placed on top of the plaster of Paris.

Cyanide is a virulent poison, and care must be taken not to inhale the fumes or get any into the circulatory system through scratches in the skin. It should always be handled under a hood or in a good draught. Its high solubility makes it possible to remove easily all traces after preparing bottles. As a toxic agent, it acts directly on the nervous system. Recovery from a non lethal dose is complete, so that specimens must be left in the bottle until dead.

It is desirable to place numerous strips or crushed pieces of absorbent paper in the bottle to protect the specimens from each other and to absorb excess moisture. After each trip the insides of the bottles should be wiped dry and dry paper placed within. Cyanide is highly deliquescent.

In the absence of cyanide, or in case a less dangerous killing medium is desired, the bottle can be supplied with a pad of cotton at the bottom covered by blotting paper to prevent the appendages of the specimens

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from becoming entangled in the cotton. Carbon tetrachloride (Hall, Ent. News XXXIII, 1922, p. 112-113), "carbona" (whose active agent is carbon tetrachloride), ether, chloroform, or gasoline, in descending order of merit, may be used as the killing agent; but the tendency of most of these is to cause an exaggerated relaxation and an unnatural expansion of the speciment and to precipitate a layer of grease on or near the outer surface of the integument.

Specimens, except larvae, should never be collected in alcohol or other preservative, as this tends to expand the parts and makes unnatural appearing specimens. Some students do not object to this, however,—in fact even think it desirable as it expands and makes more visible some of the difficultly observed parts in minute species. Furthermore, alcohol is likely to cause the elytra to spread. The elytra are held together and in place by a complicated locking device, which is rather easily disturbed in minute species. Unless purely duplicate material for morphological rather than taxonomic study, specimens should not be preserved in alcohol. A partial exception seems to be water beetles, which do not seem to be injured by long preservation in alcohol.

THE NETS:— Several types of nets are desirable, though not all are necessary, especially for the beginner.

(1). A light butterfly net of gauze or netting with a handle at least three feet long for securing *Cicindela, Bembidion,* and other actively flying species.

(2). A canvas net twelve or fifteen inches deep and ten or twelve inches in diameter, on a heavy iron hoop, provided with a short stout handle about eighteen inches long. The net is for beating and sweeping grasses and bushes, and must be very strong. My own net is similar to that described by Torre-Bueno (Can. Ent. LVII, 1925, p. 9.).

(3). A dip net for aquatic collecting. This must likewise be stout, with as long a handle as the collector is willing to transport. The hoop of my dip net is semicircular in outline, with the handle attached to the middle of the curved side. The bag has a depth of six or eight inches, its upper portions are of canvas, its center of a fine scrim or silk bolting cloth.

(4). For a sifting net I use a cylindrical canvas net about eight inches in diameter attached to stout hoops at both ends. The bottom of the net consists of a copper screen of about ⅛ inch mesh.

(5). For an "umbrella" or beating cloth I use a piece of cloth about a yard square with the adjacent sides sewed up at the corners for about two inches to form pockets. This is suspended from two sticks of proper length which are cut in the field. The opposite ends of each stick are placed in the pockets at opposite corners of the cloth so that the sticks cross in the middle where they are held by the hand. The umbrella, sticks uppermost, is held under the branch with the left hand (if one is right handed), while the right hand shakes the branch or beats it with a club.

METHODS OF COLLECTING:—It is not the purpose of the present essay to detail the methods of capturing beetles. They are as numerous as there are habitats and collectors. The best general account is that by Schwarz, in Bank's U. S. Nat. Mus. Bull. 67, 1909, p. 76-86. Recently

a series of articles on special methods of collecting have been appearing in the *Koleopterologische Rundschau*: Scheerpeltz, XII, 1926, p. 139-144 (alpine Leptusae), p. 245-257 (beetles of mud, sand, and gravel-banks); Netolitzky, XII, 1926, p. 207-209 (beetles of clay banks); Breuning, XIII, 1927, p. 28-31 (*Carabus*); Zimmermann, XIII, 1927, p. 81-86 (water-beetles); Fleischer, XIII, 1927, p. 127-128 (*Colon* and *Liodidae*).

In this connction the more extensive collection of larvae is urged. These should be collected and preserved in alcohol. At the present time larvae are determinable only to a very limited extent, usually only to tribe or genus. It is to be hoped that this condition will gradually be remedied, and that the larval stages will gradually become as well known as the adults. The larval stage is always of vital ecological significance, it is the stage in which all the growth of the beetle is accomplished, and is often the stage in which the beetle spends the greater portion of its life cycle.

MOUNTING:—Beetles are fragile objects and must be handled accordingly. They are best mounted within a day or so after being killed, but, if it is necessary to defer this or to put up duplicates without mounting, they may be packed between layers of cellucotton. *Beetles should never be packed in papers without first being placed between layers of cellucotton.* If the specimens are packed in tin boxes, a few drops of 5% carbolic acid solution should be added to prevent mold. Specimens are relaxed for mounting by placing them in a jar or box in which the atmosphere is kept saturated with moisture. A few drops of carbolic acid must be added to the relaxing chamber to prevent mold.

Medium and large sized beetles should be pinned with No. 1 or No. 2 insect pins, through the right elytron, never through the prothorax, left elytron, or through any of the sutures separating different portions of the body. Every effort should be made to prevent the elytra from spreading, to prevent the pin from emerging at such a point or in such a manner as to break off one of the legs, and in general to produce a perfect specimen. The specimens should be mounted at a uniform distance from the head of the pin, usually about 10 millimeters or 3-8 of an inch.

Small or minute specimens should be mounted on triangular points. They should never be mounted on elbow pins or *minuten nadelen*, because of the danger of spreading the elytra, or on slides as balsam mounts, because of the undesirable clearing effects and the impossibility of studying the specimens from all points of view. The points should be cut out of good card-board or bristol board, two or three millimeters wide at the base, from five to ten millimeters long, and with the apex more or less truncate according to the size of the specimen. Either La Page's glue or red or white shellac dissolved in from 95% to 100% alcohol, either ethyl or methyl, is used as an adhesive.

The proper mounting of minute specimens on points is one of the most important arts for the collector of beetles to acquire. All specimens should be so mounted that at least half the ventral surface and all the upper surface is exposed for examination. They must be mounted so that the anterior end of the specimen is directed forward when the point extends to the left of the pin. Hemispherical specimens (such as Coccinellidae, Phalacridae, some Hydrophilidae) may be mounted without bending the tip of the point. Specimens with a convex ventral surface are

best mounted by bending down the apex of the point and applying it usually to the region of the right side of the mesosternum. In very minute specimens (Lathridiidae, Ptiliidae, etc.) it will not be necessary to bend the point at all, simply put a minute amount of glue or shellac on the apex of the point and apply it directly to the right side of the animal. I find it most convenient to adjust the points on the pin first, and then, laying the beetles on their backs, touch them with the sticky points. A slight adjustment of the specimen is usually necessary after it has adhered to the points. "Practice makes perfect."

The judgment of the collector must determine which specimens to pin and which to mount on points. The more experienced he becomes, the more he will favor points, because no injury is done to the specimen. In general specimens under about seven millimeters should certainly be "pointed." Due to their extremely narrow habitus, all but the very largest Staphylinidae should be mounted on points.

I find it convenient to mount series of minute specimens on little cards about 10x20 mm. in size, using glue or shellac (glue causes the cards to warp while shellac does not). The cards can be stacked six or eight to a pin, and from two to a dozen specimens can be mounted on a card.

LABELING:—Each specimen should bear a locality label which should give the state and county, the date (it is convenient to allow a Roman numeral to stand for the month), the collector, and a number which will refer to further data in the notebook. In the case of large counties presenting great differences of topography, a further locality or altitude may be desirable. Printed labels can be obtained in thousand lots from C. V. Blackman, 7 Emerson St., Stoneham 80, Mass. and from Ward's Natural Science Establishment, Rochester, N. Y. Many persons are now using photographic labels, but the chief objection to such is that no one really knows how permanent such methods of reproduction are. The labels are typed onto a sheet of paper, this is photographed, at the same time being reduced to the desired extent. Entries should be made in the note book as to the exact locality (an exact record of the section is often possible in country that has been surveyed) and the habitat.

CARE OF THE COLLECTION:—Every collector must be warned against the invasion of his collection by the larvae of *Anthrenus* and other genera of Dermestidae. These larvae feed on the dried internal parts of the specimens, and in a few weeks may cause irreparable injury. Constant vigilance, only, is the price of protection. No box, even a supposedly insect-proof one, should ever go unexamined for more than a few months or a year at a time. Even a more frequent examination is necessary for non-insect-proof boxes. Infested or suspected boxes can be rendered immediately and completely sterile by treatment with about a teaspoonful of the crystals of paradichlor-benzene, or, if the box is too full to allow such treatment, by the use of an equal amount of carbon disulphide or carbon tetrachloride. These last are both liquids and evaporate rapidly. Carbon disulphide is the more active agent, but is explosive and must be handled with the precaution one would use in handling gasoline. The paradichlorbenzine will evaporate within a few weeks, leaving a fine inert residue. The use of naphthalene is not recommended, since it will not kill larvae

already present. Its effect is to tend to discourage the invasion of new larvae, and its rate of evaporation is somewhat slower than that of paradichlorbenzene.

In preparing mounted specimens for shipment, the pin should be stuck so securely into the bottom of the box that a light pull on the pin will not loosen it. Extra pins should be used to prop up the sides of the larger specimens to keep them from swinging. The boxes should be packed in larger containers and surrounded by not less than a two inch layer of firmly packed excelsior. The purpose of the excelsior is not to protect against stresses and strains, as in packing crockery, but to absorb shocks, so that it must not be packed too tightly. Entire insect collections can be packed similarly in barrels or packing boxes, and I have used a small upright piano box for about 140 insect boxes on two occasions. Properly packed and barring wreck, an insect collection will travel safely by parcel post, express, or freight.

It is not the purpose of the present essay to describe the further work of the student of beetles. The person who would give himself to the study of taxonomic coleopterology must dedicate himself to the formation of a collection and a library as extensive as his circumstances will permit. He must regard the first ten years of his study entirely as a propedeutic. But such a student will consult the original references mentioned in the introductory paragraph and will have little use for the elementary directions of the present essay.

DEALERS:—As regards entomological supplies, the American student will find most of his needs met by Ward's Natural Science Establishment, 84-102 College Ave., Rochester, N. Y. and by the Kny-Scheerer Corporation of America, Department of Natural Science, 10-14 W. 25th St. New York, N. Y. The leading dealers in specimens are Staudinger and Bang-Haas, Dresden-Blasewitz, Germany, but the following also have large stocks of specimens: E. Le Moult, 4 rue Dumeril, Paris 13e, France; Albert Winkler, Dittesgasse Nr. 11, Wien XVIII, Austria; Emmerich Reitter, Aspernstrasse 5, Troppau Schles., Czechoslovakia. Among the more prominent dealers in entomological literature may be cited John D. Sherman, Jr., 132 Primrose Ave., Mount Vernon, N. Y.; W. Junk, Sächsiche Strasse 68, Berlin W. 15, Germany; Max Weg, Königstrasse 3, Leipzig, Germany; Dultz and Co., Landwehrstrasse 6, München, Germany; Dulau and Co., 32 Old Bond Street, London W. 1, England; Jaques Lechevalier, 12 rue de Tournon, Paris 6e, France.