

MYRMECOLOGICAL TECHNIQUE

IV. COLLECTING ANTS BY REARING PUPAE

CLARENCE HAMILTON KENNEDY

Department of Zoology and Entomology,
Ohio State University,
Columbus, Ohio

The nest sought for by the collector, the prize nest of the day's trip, is one which contains all castes in numbers. We have criticized previous ant collectors because up to the present time most collecting has been done by use of a garden trowel. The collector with only a garden trowel (and a scout axe for timber ants) usually collects more ants but more frequently arrives at his laboratory with many missing castes. (We have wished each Christmas for an easily protable steam shovel which could lift a whole nest out of the ground and set it down on a large bed sheet, 108 in. by 90 in., with perhaps two folding camp chairs for the collector and his assistant.) We have actually arrived at the use of a shovel with a four-foot handle and a full sized timber axe besides a scout axe and wood chisel. But we now do much of our collecting with a table spoon!

A table-spoon carried in a vest-pocket or a pocket of the collecting bag gives us the most successful collecting we have found yet. With the spoon go two to four 1-quart glass Mason fruit jars which are usually carried in coat pockets or even better in the leg pockets used in the army uniforms of certain soldiers. More jars are carried in the nearby parked car. (The car carries the lunch which limits its distance from operations so that more jars can be obtained at lunch time and used or filled jars can be stored in the car which is usually parked in a shady place, good for the lunch and good for ants in Mason jars).

The large shovel or large axe is usually used first for the rough exposure of the nest. If cells or chambers of pupae are uncovered these are removed by carefully sliding the spoon under them, usually including a considerable amount of the sand, dirt or trash of the pupal bed. The spoonful of bed and pupae are carefully slid into the open Mason jar. Usually enough of the pupal bed is slid into the Mason jar to fill it to one-fourth or one-third of its possible capacity. Worker ants are included to open the cocoons of silk-covered pupae and to care for any young ants which emerge. In the field a note is placed in the jar giving date, locality and moisture condition of the nest, dry, moist or wet. If ether has been used, a breath or two into the jar before covering with the lid will usually remove extra ether below a level dangerous to the pupae and workers in the jar. The cover is tightly applied.

On return to the laboratory the Mason jars are numbered and recorded after opening each jar and blowing more breath in to remove any ether that has come out of the collected nest during transportation. Usually blowing out of ether is repeated the following day or two, if the nest has had a heavier dose of ether in the field than is usually given. Some very active species take a surprising amount of ether during the process of opening and collecting the nest.

In the laboratory these jars of ants and cocoons each representing one nest are fed and checked each day or two. As emerging ants appear on tipping the jar on its side, light etherization is used to quiet the nest, the lid is removed and the whole contents of the jar are dumped on to a newspaper or a flat surface in bright sunlight where all ants can be inspected. Mature winged ants are removed by fingers or tweezers and placed in vials of 70° alcohol. If unopened pupae remain, all workers and unopened pupae are returned to the jar to be resorted for later emergence. The vial (1 drahm) is labelled to match the general field label already

in the jar and is deposited in the jar on top of its nest contents to be removed to the collection when the nest is finally cleaned up. Teneral, too immature in color or hardness of the exoskeleton are returned to the jar to mature. We have left such in the jar for a week or two.

The workers in the rearing jar have to be watered and given air. Watering is done by pipette using perfectly fresh water. A few drops a day suffice. The nest material should be kept relatively dry, usually slightly dryer than found in the field, to keep fungus down. One season while the process was in development we lost all cultures by fungus which would develop almost over night. On cleaning up the culture jars at the end of the summer session (Univ. of Mich. Biol. Sta., Douglas Lake, Mich.) we found that our assistant of that year had hidden a table glass of water with pipette among the Mason jars and rather than walking the length of the laboratory room (Houghton Hall) to obtain fresh water each day, had merely squirted stale water into each culture without even observing the wetness or dryness of the jar contents. The glass of water was soupy with bacteria, protozoa and fungus. Such cultures were lost to masses of filamentous fungi, a loss of several hundred dollars in gasoline, collecting time, board and other expenses. This particular loss was more than usually serious as that summer was followed by an "open winter" with scanty snow. More than half of all nests in that area were destroyed by freezing. Whole areas of some species disappeared. The ants that remained had special local protection, such as nests in deep ravines, nests four feet deep or under drifted logs.

Cultures have to be fed. As the majority of northern (Canadian-border) ants are honey-dew feeders, cane sugar on a small (2 x 4 in.) rag suffices. Sugar and a few drops of water to keep the sugar drinkable are added every few days. This suffices for a jar worker-population of 10-100 *Formicas*, large (*rufa*) or small (*Microgyna*). On the possibility that our culture may need fresh meat small parts of large live insects are tossed into the jar. In our studies in northern Michigan and southern Ontario we have not determined whether insect flesh is actually necessary.

In the summer of 1950 we have had complete success with this culturing process. In other years while the process was being tried out we have had trouble in bringing some species of *Camponotus* through. We did not succeed in determining whether the lab was too dark and cool or the season was not long enough. These ants appear in winged form in the nest in late summer and fly in the following spring. The species studied (undescribed), worked all night in the jars and was quiet in the daytime. We have taken all of its winged forms from nests in the field the latter part of August.

Ants have to have fresh air while being reared in Mason jars. We find that usually sufficient air can be supplied merely by removing the lid and blowing into the jar a full breath of air from the caretaker's mouth perhaps helped by giving the jar a rotation on its side so that stale air is blown out of the nest contents, dirt, sand, wood particles or what not at the end of the process of aeration. Quickly the cover is replaced as airing the nest contents in the lower half of the jars stirs up the ants in the nest material whereupon many may rush to the top of the jar and may escape. In quieter species the rotation or shaking up of the nest may be omitted. A puff of breath in the mouth of the jar which may not disturb the ants can be followed by leaving the cover off 10-15 minutes for aeration. This uncovering is risky if several jars are under observation as the caretaker's attention may stray away and some ants may escape.

A further method was tried. I instructed my assistant, Mr. John Moser, senior student in entomology at O.S.U., to procure fine brass or copper screen which could be soldered across the top of the ring of the Mason jar cover. The flat inner disc cover that holds the rubber ring in canning was to be removed. This gave the can a screen top through which air could pass with some freedom. In

making this screen covers for the Mason jars Mr. Moser found several bits of information about Mason jars and bronze or brass screen. He found three types of Mason jars. The one common in grocery and hardware stores has a short neck, so short that the brass screen has to be soldered across the exterior top of the ring of the screw-top. This is the Kerr Mason jar. The glass jar has four flat sides which saves space on the rearing table. We usually use this in the field as the jars fit together in a box or basket in the car. A second kind available in the U.S.A., has a longer screw-top or neck and a taller lid ring. This is the Ball Mason jar. It is less easy to obtain and appears to be going off the market. There is enough space under the taller lid to solder the screen on the inner or underside of the ring lid makes a smoother, more finished screen top. In Canada we found a second brand, Canadian "Jewel," of long necked Mason jar in which there is enough space under the taller lid to solder the screen on the inside of the ring top. This is not available in the States.

There are various sizes of mesh. No. 80 mesh was found to work. 60 mesh worked also. The latter is that usually available as it is used widely for milk strainers.

Two kinds of solder are available (1) wire solder in which the flux or acid runs through it as a fine core. It is used with a hot soldering iron, electrical or gasoline heated. (2) The other comes in paste tubes, is cold, soft and squeezed out and used cold. It hardens rapidly. This paste type comes in two kinds, "general," which is the one for ant jars, and "radiator," which is used on auto radiators. The other tool necessary is a small heavy scissors or "tin snips" to cut the round discs of brass screen.

John Moser finally came to collecting the nests in the field in tight, regular, Kerr Mason jars, and later in the lab to rearing the nests in the screened jars.

For the first time in about twenty summers of collecting ants from the Great Smokies in eastern Tennessee north to western Ontario, the writer feels that this type of summer entertainment has come under a technique of control. We admit we have had a slow, cold, late season (1950) so that we have found early (May, June) emerging species in numbers in June and July. We point out also that for number of species the season of 1950 has been one of the poorest because it was preceded (1949-1950) by an "open winter" with light irregular snow fall which gave the overwintering nests little snow protection from freezing.

The Chicago University Zoology Department's Rearing Method.—The use of open glass battery jars. This method was brought to the U.S.B. Lab. from the University of Chicago by Miss Mary Talbot and has been referred to as the Chicago method. The writer has not run across it in the literature and cannot give credit to its originator. At the time Miss Talbot brought it from Chicago Allee, Emerson and Schneirla were active on the behavior of social insects. The Chicago method, if painstakingly used with reference to air, water and food, has always been successful.

It can be awkward in the usual restrictions of laboratory space: Mason jars save space in field as well as lab. The Chicago method as usually used involves glass battery jars. In nearly every set-up of jars these are too large to be carried to the field. Means to collect the nest in the field, then to transport it to the lab have to be provided. Sometimes a small cloth sack that can be tied tight at its top is used, sometimes a large-mouthed bottle can be used for transportation. Soft pupae in a sack can be injured which may start the eating of injured pupae by workers, if the food supplied the nurse workers is not satisfactory or adequate.

The most convenient size of battery jar, especially for the rearing of winged forms for identification only, is 6 x 8 inches. These take the least space on a rearing table. Around the inner surface of the edge of the jar is smeared a $\frac{3}{4}$ -inch wide band of stiff engine cup-grease. The majority of our common ants will not walk

across such a band. Engine cup-grease in hot weather is stiff enough to hold its form and not run.

Troubles can happen in handling live animals. Their wits are pitted against the caretaker's wits. Covers for battery jars have to be at hand as do covers for Mason jars. The cup-grease may not be fully effective. Some individual ants may defy it. Types of cup-grease are not fully uniform. Some stop ants less often than do other batches. Apparently if held over a year or two some element of the grease dries out leaving a residue less offensive to ants. A plane of glass for cover can stop ants that are not stopped by grease.

Associated with the collection and rearing of pupae is the knowledge of when ants in the field will be found in the pupal stage. This means that good ant collecting will be done by the field students who cover one collecting area season after season until they have a fairly full knowledge of when the ant species of that area will be bringing off brood. Collecting pupae cannot be successful before or after pupae appear in the field.

In earlier days the present collector covered as much ground as possible. If pupae were not present the queen was dug for until the nest was destroyed. Later visits were useless. We do less and less of such destruction with more experience. One good nest carefully collected for rearable pupae is more valuable than a day's work rushing from nest to nest sampling.

The collector should get into the field early which means on the Canadian border by late May or early June, locate good areas and watch thrifty nests until pupae appear. Some very early species (*Prenolepis*) and some late species (*Camponotus*) may be missed. This produces a summer collection with males and females in many nests of many species. This method gives identifiable material. If well described it avoids the rehash and re-rehash of ant taxonomy. Probably Emily Post would approve of this consideration of subsequent students.
