PHOTOGRAPHING EGGS OF INSECTS

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Eggs of insects are excellent subjects for unique and beautiful colored transparencies or photographs. To obtain satisfactory results, one should have access to a camera that will take photographs through a microscope, or possess comparable equipment which will magnify small objects 3 to 25 times or more.

The major problem in photographing a wide variety of eggs is the availability of subject matter. To obtain eggs one may visit the natural habitats of various insects and collect those that may be present, or one may capture living females and confine them in containers where some or many may deposit eggs.

Collecting Eggs.—If one goes to the field to look for eggs much diligent searching is required. When eggs are found, that portion of the plant or object bearing eggs should be cut off and placed in a tin salve box or a similar container where they will not be crushed or dry out before they are photographed, reared or preserved.

In case one does not know the species of the insect that produced the eggs, it is well to take careful notes on their location. Also, one should look for similar eggs that may have hatched. Young larvae or nymphs may be present on or near the hatched eggs. If these are found they should be collected and saved for identification. One should also collect any female insects that may be in the vicinity of the unknown eggs. Under field conditions, one may see female insects, especially butterflies, depositing eggs on foliage and flowers. If one will collect these eggs and the female that deposited them, then one will possess the female for identification. The author has determined eggs of Pieridae and other Lepidoptera in this manner.

A more certain method of identifying unknown eggs is to rear the insects that hatch from them. Be sure to use host tissue similar to that on which the eggs were found. Upon hatching, the first instar larva or nymph can be identified to order and, in many cases, to family. When a larva is nearly full-grown it is possible to determine many individuals to species. One may have to rear many nymphs and some larvae to the adult stage for positive identification.

The identification of immature stages and rearing procedures usually requires experience, time, equipment and frequently an air conditioned environment; consequently, collecting insects for egg deposition may be an easier way to obtain known eggs.

Collecting Insects for Egg Deposition.—A simple and direct way to obtain known eggs is to capture living gravid females found on plants or elsewhere in the field, or at “blacklight” lures at night, or at fermenting baits during the day or at night. Place one or more individuals of a given species in a container prepared for egg deposition. The author has used this method with many species of moths and sucking bugs and a few beetles, flies, mantispid and other insects with considerable success.

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PLATE I

Figure A.—Single, slightly adhesive, near-black eggs of a thread-legged bug. Reduviidae *Emesaya brevipennis* (Say). 20± X.

Figure B.—Single, nonadhesive, near-black eggs of the two-striped walking stick. Phasmatidae, *Anismorpha buprestoides* (Stoll). 5± X.

Figure C.—A cluster of white io moth eggs, each possessing a dark spot and light brown bands. Saturniidae, *Automeris io* (Fab.). 5± X.

Figure D.—Small portion of a mass of near-white, stalked, mantidfly eggs. Mantispidae, *Mantispa interrupta* Say. 20± X.

Figure E.—Single, bright green, nonadhesive eggs of a noctuid showing
After a confined female has deposited many or all of her eggs, she is killed or permitted to die and then preserved for identification. Usually unknown moths are killed after the female has deposited some of her eggs, especially species that do not place all of their eggs in one large cluster. This early killing usually produces satisfactory specimens for identification to species.

Meloid, chrysomelid and other beetles that visit and feed on flowers and plant parts in the field may produce eggs in confinement, especially if female beetles with distended abdomens are selected. Place one or more specimens of a given species in a medium to large sized salve tin possessing paper or plastic, or in a large, glass, cork-stoppered or cloth covered tube, 1" x 5", containing an inner plastic lining and plant parts, including flowers. Most of the eggs will be deposited on the paper, plastic lining or plant parts.

To avoid excessive condensation of moisture within the containers they should be kept in an environment where the daily temperature does not vary more than 5° F. This is also true for insects confined in plastic (polyethylene) bags. Confining beetles in plastic bags is unsatisfactory for many species will chew exit holes in the plastic.

Phytophagous species of Hemiptera, especially Pentatomidae, collected in spring or early summer are more apt to produce eggs in confinement than in the fall of the year. In Florida many terrestrial Hemiptera also produce eggs in the fall.

Females of many phytophagous and predacious terrestrial Hemiptera can be found on the host plants they infest, especially on growing terminals or flowers and fruits that are present. These may be collected by hand, in a large vial or with an aerial net. A sweeping net is also a useful tool for picking up inconspicuous sucking bugs on low-growing vegetation. Insects captured in the field may be sorted to species and placed immediately in oviposition containers. The author prefers to collect many kinds in a sweeping net and then transfer them to a screened, 12" x 12" x 12", transporting container possessing a glass top and a long cloth sleeve attached to a large opening on one side. Upon returning to the laboratory, individuals of a given species are chosen and placed in deposition containers.

A pint or quart glass, mason jar covered with gauze or paper toweling held in place by a metal screw ring, is a satisfactory oviposition container provided it possesses some white paper toweling, a piece of plastic and host plant material inserted in a vial containing water. Many pentatomids will live and produce eggs if the jar contains green or wax bean pods. The

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characteristic vertical and horizontal ridges. Noctuidae. Leucania latiuscula H.-S. 20± X.

Figure F.—A cluster of semi-transparent, flattened, disc-like, adhesive eggs on plastic showing embryos within. Pyralidae, species undetermined. 20± X.

Figure G.—A cluster of rose-colored, adhesive eggs of a pentatomid. Pentatomidae, Mormidae poeciventris Stal. 20± X.

Figure H.—A cluster of reddish-brown, adhesive, assassin bug eggs, possessing near-white fringes about their tops. Reduvidae, Apiomerus cressipes (Fab.). 20± X.
jars should be examined daily for eggs and fresh food replenished if needed.

Another useful cage for egg production by Hemiptera, especially terrestrial species, is a small flexible plastic bag, approximating 2.5" x 4" x 10". Several bugs of a given species, plus one or two small pieces of white paper toweling and plant parts, are placed in an inflated bag and then the end is closed with a rubber band. Some terrestrial Hemiptera deposit more freely if they have access to special depository media. For example, species of Leptocorisa and spittle bugs deposit readily on or in dry grass and grain stems, Zelus cervicallis Stal. deposits on goldenrod flower parts, while milkweed bugs deposit in tight rolls of cellucotton or between compact layers of coarse cotton gauze.

An easy way to collect many night-flying moths and other insects is to use a “blacklight” lure adjacent to a vertical sheet of white canvas where the insects will assemble, or to use fermenting (sugaring) baits painted on tree trunks, fence posts and elsewhere which moths will visit at night and other insects during daylight hours.

Many large saturniid, citheronid and sphingid female moths caught outdoors will deposit some to many eggs if they are confined individually in glass quart jars resting on their sides and partially lined with paper toweling and closed with paper or cotton gauze. Some species deposit more abundantly if the jars contain host plant foliage and a water source. Before large females are introduced, their wings are cut off near their points of attachment. The absence of complete wings reduces decidedly the accumulation of scales on the eggs and the interior of the jar. Apparently lack of wings does not influence egg deposition.

Numerous medium-sized moths with wing lengths between three-fourths of an inch and one and one-half inches that come to lights or baits will produce eggs if they are enclosed individually in inflated small plastic bags approximating 2.5" x 4" x 10" in size. In each bag include a small piece of white paper toweling and the foliage from some plant which will not curl upon drying. Laurel oak, live oak, magnolia and other leaves do not curl when dry. When leaves curl decidedly it is difficult to photograph the eggs deposited upon them. This method has produced eggs from several to many species among the Amatidae, Arctiidae, Geometridae, Lasiocampidae, Noctuidae, Olethreutidae, Pterophoridae, Pyralidae, Tortricidae and other families. Most of the confined females will deposit some or all of their eggs within forty-eight hours on the foliage, plastic bag or paper toweling, named in the usual order of preference. A few species deposit on leaves only, or plastic only.

Very small moths belonging to the above families and others with wing lengths under three-fourths of an inch will deposit eggs when confined individually in small 4- to 6-dram patent-lip vials. Each vial should contain an inner clear plastic lining on the side walls, a small leaf or a portion of a stiff leaf and a cork stopper. Most of the eggs will be deposited on the leaf or plastic lining.

During the course of an evening between 7 to 10 p.m. when the temperature is above 70° F., one may collect 25 or more species of moths at a “blacklight” lure. When a given species is abundant, a maximum of five vials is used with one moth in each vial. Within forty-eight hours one may
find no eggs in any of the five vials, or one vial with eggs, or two vials with eggs and occasionally all of the five vials with eggs. Complete absence of eggs may be due to the fact that a given species will not deposit eggs under the environment offered, or the females have already deposited their eggs, or copulation has not occurred, or the moths may be males. Sexes are not easy to determine, especially when they are placed in the vials under a weak light producing low visibility. Repeated tests with females of some species in vials or plastic bags have not produced eggs to date. An average night of collecting will produce 50 to 75 individual deposition containers. Usually within forty-eight hours one-third or more will show some to many eggs.

Mantispids will come to a white vertical cloth adjacent to a "black-light" lure. The adults are sluggish and easy to capture in vials or plastic bags. Late in September and early in October 1959 at Gainesville, Florida, many adults, including representatives of three species, came to a white sheet adjacent to a "blacklight" which was located on the outskirts of town on the edge of an open field adjacent to a lot containing large deciduous trees. One night forty-five mantispids were captured and each was placed in an individual plastic bag containing a piece of moist paper toweling. Two of the three species captured deposited eggs on the interior of the plastic bag. All told, only five of the forty-five confined mantispids produced eggs. The mass distribution of these eggs closely resembled those found on foliage outdoors.

Egg Preservation.—Occasionally one is unable to photograph eggs immediately or before they hatch; consequently, it is desirable to preserve them for future use. If the eggs have a very firm outer covering which will not collapse or wrinkle after the embryo is dead and dry, then one may use heat to kill the eggs. The author has killed the embryos within eggs of mantids, katydids and walking sticks by placing them for a few minutes under an electric light located in a goose-neck lamp. The temperature range was 125 to 135°F. These eggs were killed without distorting the egg coat. This procedure for eggs of most insects produces collapsed and wrinkled eggs.

Eggs of insects may be killed and preserved in alcohol or formaldehyde solutions. In most solutions the inner tissues pull away from the outer covering and produce an abnormal appearance. The author has had good to fair results with the following mixtures for killing and preserving eggs. He uses most extensively a standard K.A.A. mixture diluted four or five times with ethyl or isopropyl alcohol. A standard K.A.A. mixture consists of commercial kerosene 1 part, acetic acid 2 parts, and ethyl or isopropyl alcohol 10 parts. For many eggs isopropyl alcohol in the K.A.A. solution produces the most satisfactory results. He also uses Kahle's fixing solution made with isopropyl alcohol in place of ethyl alcohol. Kahle's solution as used consists of isopropyl alcohol, 98 per cent—17 parts, formalin, 40 per cent—6 parts, glacial acetic acid—2 parts and distilled water—28 parts.

These solutions are not satisfactory for all eggs. Bright colors, waxy coatings and other surface characteristics of some eggs are apt to change upon standing in liquid preservatives. For most insect eggs it is best to photograph them when they are in a living state; however, some eggs when
killed and preserved in the above solutions will show external and internal features that cannot be seen in living eggs.

Eggs of different insects vary greatly in size, shape, color, adhesiveness and distribution. No attempt will be made to discuss these interesting facts. The illustrations present a few of them among common and unusual species. Eggs may be deposited singly and often in isolated places (Figures A and B)*, while others occur in loose or dense clusters (Figures C, D, G and H). Most eggs have an adhesive coating on their exterior (Figures C, G and H). This seals them to their substrate and together when they are laid adjacent to each other. A few species produce eggs that are dry and usually nonadhesive (Figures B and E).

PHOTOGRAPHY.—The pictures of the eggs shown were taken on 35 mm. Kodachrome daylight or floodlight color film and transferred to black and white film to produce the illustrations. All of the illustrations on Plate I were made through one-half of a Bausch and Lomb stereoscopic microscope using the objective .66, 3.0 and 7.5 only. The camera used was a 35 mm. Kodak attached to a Leitz-Wetzler conical extension tube provided with a shutter, a side arm viewer and a ½ X magnifier which fitted into one ocular sleeve of a stereoscopic microscope. A Contax-D single lens reflex camera with a Kilfitt-Makro-Kilar D 1:2 lens was used when magnifications no greater than natural size were desired.

The requirements for taking photographs of insect eggs for the most part are the same as those required for good photography, especially portrait photography, namely, correct exposure, proper lighting, sharp focusing, position of the eggs and background color.

For correct exposure when using a Contax-D camera the author depended upon a Norwood Director Exposure Meter, Model M 2. To determine the correct exposure when taking pictures through a microscope with a fixed aperture camera a trial run was made on Kodachrome A film. The light source was a number 2 photoflood electric lamp located within a conical aluminum reflector placed ten inches above the object at approximately a 45° angle. The best exposures proved to be ½ to ¾ second through a .66 X objective, 1 to 1½ seconds through a 3.0 X objective and 3 to 5 seconds through a 7.5 objective. Dark-colored eggs usually required 50 percent more light than white or light-colored eggs.

An American Optical microscope spotlight was used for focusing. A few shots were taken with a spotlight alone, time 10 to 20+ seconds. The results were often very good except for color value. Most exposures tended to be somewhat red.

To obtain sharp focus when using the Leitz Wetzler microscope camera requires considerable patience and repeated checking. Before focusing one must be certain that the cross-lines in the side arm viewer are equally black when using a specific eye. Your two eyes may vary in this respect. After this is established then one must proceed to focus on the object. Egg masses are not always perfectly level; also, when using objectives that give 10 X to 25 X magnification all parts of a given egg of most any size are not completely in focus. In other words the depth of focus is very narrow;

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*These photographs were transferred from Kodachrome to black and white films by J. L. Messec.
consequently, one must decide what portion of an egg mass or a given egg is to be portrayed.

Position and background color are often very important for superior photographs. These can be determined by viewing and adjusting the eggs through both lenses of the stereoscopic microscope before attaching the camera. The camera reveals what is seen, so it is up to the operator to make critical adjustments. In general, light-colored eggs should have a dark opaque background—black, deep green, blue or brown; while dark eggs show up best with a light opaque background—white, yellow or some other pale color. If black and white films are to be made from color transparencies it is best to confine background colors to white, greys or black. Background colors can be attained by placing opaque-colored paper on the microscope stage.

Shadows can be eliminated by placing the eggs on glass about one-inch above the background. The author uses the bottom side of a Syracuse watch glass stacked above another watch glass or on an inverted Petri dish. Reflections can usually be avoided by orienting the object or the light source.

In general, many eggs deposited on plastic or similar flexible products yield sharper and better photographs than those deposited on foliage, bark and elsewhere, chiefly because one may choose a suitable background. Reflections may be present when eggs are on plastic, especially if the plastic is old and wrinkled. For this reason it is best to use smooth plastic linings or new bags for oviposition. In case wrinkles occur in the plastic one can reduce or eliminate these by attaching one side of the cut piece of plastic bearing the eggs to the underside of a glass dish by Scotch tape and then sealing the other edges of the plastic piece to the glass dish after the surface is made smooth and taut. When eggs are deposited on plastic one can photograph their manner of attachment to the substrate by reversing the piece of plastic bearing the eggs. Also, when eggs are on plastic the developing embryos within the eggs can be seen, especially if one chooses translucent, flat, disc- or scale-like eggs common among many species of the Olethreutidate, Tortricidae and Pyralidae. By using light reflected from a mirror below the eggs the embryos within stand out as u- or s-shaped bodies.

CONCLUSION.—When eggs of insects are available from field collecting or from captured females one can produce beautiful colored slides with a 35 mm. camera attached to a microscope. If the colored films are distinctly contrasty and have the necessary color combinations, they will produce good black and white negatives provided fine grained film is employed and developed in a suitable solution. These negatives, in turn, will yield excellent black and white pictures.