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George E. Klee
Michigan State University

James W. Butcher
Michigan State University

LABORATORY REARING OF *PHALANGIUM OPILIO* (ARACHNIDA: OPILIONES)[1]

George E. Klee and James W. Butcher

Department of Entomology, Michigan State University
East Lansing, Michigan 48823

While a good deal of work has been reported on the natural history and ecology of the opiliones in Europe and England (Bristowe, 1949; Sankey, 1949; Todd, 1949; Phillipson, 1959; Savory, 1964; Juberthie, 1965), this important group has received little attention in North America. Bishop (1949) published a concise synopsis of reactions and general habits of the opiliones of New York and, in a Ph. D. dissertation, Edgar (1960) described the biology of the order in Michigan.

Current studies at Michigan State University on the effects of insecticides on non-target organisms have revealed an acute lack of biological information on the group, and before the effects of insecticides could be determined, life histories of the opiliones had to be clarified. Consequently, in 1966 a study of the ecology and rearing requirements of selected Michigan species was initiated. The present paper describes a new incubation technique for opilione eggs that shows promise of facilitating laboratory rearing of this group.

METHODS

Many Michigan species of Opiliones appear to be litter forms, but a few range into the underbrush and low trees. After sampling in several localities, we decided to investigate ***Phalangium opilio*** Linn. for the following reasons: it is a litter form, closely associated with the soil and therefore more directly affected by insecticide residues; it is plentiful in the area, and easily collected; and it is one of the few species of Opiliones that can be identified easily in the laboratory and field without dissection or magnification.

Adults placed in large styrene containers survived well in the laboratory growth chambers at a temperature of 65 degrees F. and a constant relative humidity of 75-90 per cent. A dried bacon and cornmeal diet was used, and water was provided in moist blotters hung inside the containers. In addition to providing a water supply, the latter prevented drowning and helped to keep the relative humidity high. Changing the blotters frequently minimized mold, which was a constant problem at the high humidity.

Collecting eggs in the field was difficult enough, but incubating them successfully was almost impossible. The first eggs were obtained from a female that had oviposited in one of the open-water containers used in preliminary maintenance experiments. The eggs were removed and put on a moist sand substrate in a dark growth chamber at 60 degrees F., but mold soon covered and destroyed them.

Eventually, some pairs were found mating in the field, and a female was observed ovipositing in crevices of a rock and in the soil along its edge. When other

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rocks in the vicinity were turned over, several egg masses were found about 3/4" from the edge of the rock in moist soil. The rocks were brought into the laboratory and put into the growth chambers in darkened containers. Relative humidity was kept as close as possible to 100 per cent, and temperature at 60 degrees F. Air circulation was minimized by putting cellophane over the containers.

After 27 days a large number of juveniles appeared on the rocks, many more than the number of eggs that had been observed. Evidently the rock had been covered with eggs, as there were well over one hundred young on it. Some had already escaped into the growth chamber and had died from desiccation. The others were transferred to smaller containers with a bacon-corn meal food supply and moist blotters (Fig. 1). They fed on the corn meal and also on each other. In future work they whould be separated quickly to prevent cannibalism. Two different hatches were obtained from two successive collections. The eggs were all *Phalangium opilio.*

Bringing entire rocks into the laboratory proved rather cumbersome and attempts were made, therefore, to obtain egg masses from mated females in the laboratory on a variety of artificial substrates.

Holes of various diameters and depths were punched in one-inch blocks of styrofoam and cork. The blocks were placed in containers with mated pairs and maintained at 60 degrees and 100 per cent. The blocks were kept as moist as possible.

No eggs were laid on the cork blocks but within four days there were five different groups of eggs on two different blocks of styrofoam. Deposition was quite uniform; all groups were in the side about 1/4" from the bottom of the block, in 1/8" or smaller diameter holes, and at a 3/4" depth (Fig. 2). The styrofoam could easily be cut open to count the eggs. There were about 50 in each of the two sites that were opened. The yellow color of the eggs contrasted well with the white styrofoam, so counting was very easy.

The blocks were kept moist, and some eggs hatched in approximately four weeks. Some were probably never fertilized and did not hatch. Some dried out and mold also took its toll. However, in this relatively sterile condition, mold was not as much of a problem as it had been in open containers.

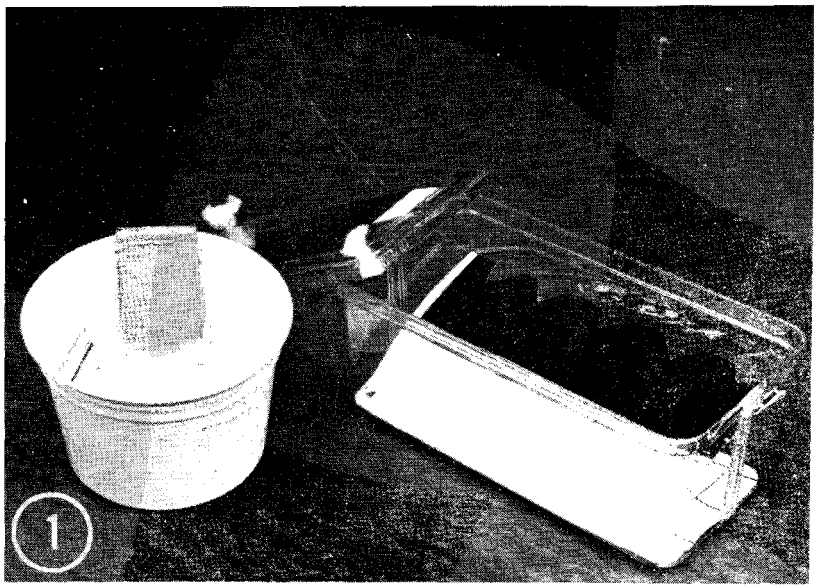
DISCUSSION

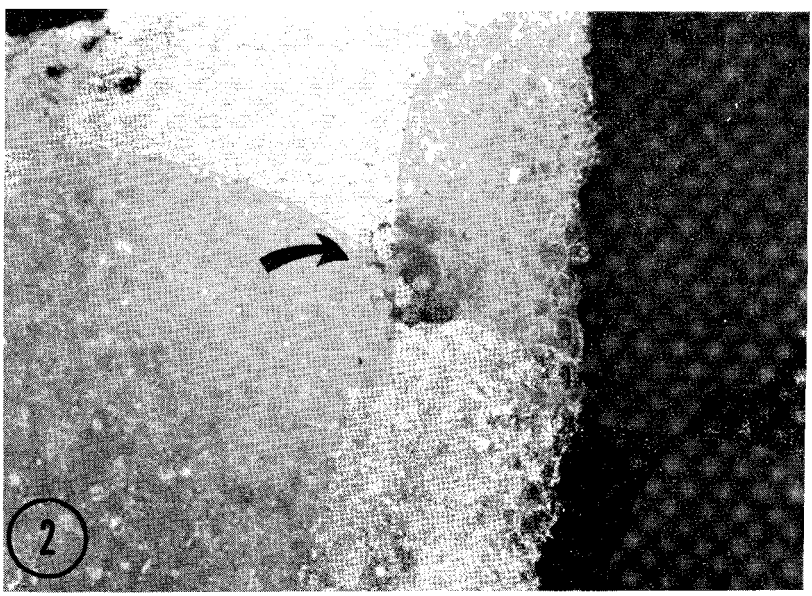
Mold and desiccation were the worst problems when using this artificial substrate, and several improvements in the technique are under consideration. There is a water-absorbing type of styrofoam used by florists that might be used to maintain a moister situation around the egg masses. A soil inoculum could be added to the water used, in hopes of getting some soil antibiotic effect against the mold. The eggs in the soil surrounding the rocks never molded at all; perhaps there is something in the soil which inhibits mold growth.

In spite of these problems, however, this is the first time that a purely artificial substrate has been used successfully for opilione oviposition. All other studies depended on locating eggs in the field, or dissecting fertilized females with eggs. Probably because of its cosmopolitan distribution and tolerance of a wide variety of habitats, *P. opilio* lays its eggs in a wider variety of sites than most other species. More intensive field studies and obser-

vations are currently being conducted. The more subtle requirements of some other species should be found, and suitable oviposition substrates may be developed.

A procedure whereby several species could be reared would give useful biolog-





Figures 1 & 2. 1, the two types of containers used for rearing juveniles; 2, egg masses *in situ* in styrofoam block (approximately 3X).

ical information for insecticide work. It could also be helpful in straightening out the current North American taxonomic problems in the group. Treating the group as a whole, Goodnight (1953) discussed the extreme variation among members of a single species. He has expressed the opinion that there are probably several mid-western species complexes that could be lumped together (pers. comm.). Breeding experiments would be an excellent test of this.

ACKNOWLEDGMENTS

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COVER PHOTO

The cover photo depicts oviposition of *Dendrosoter protruberans* Nees. This braconid parasitizes the elm bark beetle, *Scolytus multistriatus*, the major vector of Dutch elm disease.

D. protruberans was collected in Southern France by the U.S. Department of Agriculture. Laboratory cultures of *Dendrosoter* were established in Michigan in 1965, and field releases have been made since that time. A large scale research project is underway in the Michigan State University Entomology Department encompassing parasite establishment, overwintering survival, and control efficiency. It is part of an interdepartmental effort involving insecticides, application methods, pesticide side effects and tree resistance.

Photo from an Ektachrome transparency by James G. Truchan (M.S.U. Photo Lab. Negative No. 68588).