

Studies of the Eggs of Odonata^{1, 2}

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Published information on the number of eggs produced by Odonata is scarce. Kormondy (1958) noted that 1060 naiads hatched from a single strand of eggs of *Tetragoneuria cynosura* (Say), but added, "It is impossible, however, to compare the number of eggs they produce with the number produced by dragonflies of other genera, because egg counts for the latter are not available. Neither is there any information in literature on the length of the incubation period of eggs in relation to temperature, except references to the arrestment of development in the eggs of some species over winter. Corbet, Longfield and Moore (1960) listed the incubation period of 23 species of British Odonata and Robert (1958) gave similar data for 24 continental species. There was no reference to temperature in either case. Likewise, the several American authors who have published complete life histories usually quoted the time from oviposition to hatching, but gave no indication of the temperatures to which the eggs were subjected, except that Krull (1929) stated eggs of *Sympetrum obtrusum* (Hagen) were held a 45° F., until hatching was desired.

During the past summer tests were conducted to determine the number of eggs deposited by a female at one time and the effects of several levels of constant temperature upon the incubation period and the percentage of eggs which hatched.

To obtain eggs of known age three methods of collection were used. Females of the Libellulidae and the Gomphidae oviposit while flying over water, usually by striking the tip of the abdomen against the surface. If females of these species are caught while in the act of mating or ovipositing, eggs can almost always be obtained by holding the insects by the wings and "dipping" them so that the tip of the abdomen strikes the surface of water in a jar or other container. Very frequently females flying or resting near the water, and, sometimes, those taken far from water may be induced to deposit eggs by this method.

Females of the Aeshnidae and the Zygoptera oviposit by inserting their eggs into plant tissue. Thus, eggs may sometimes be obtained by observing oviposition and collecting the stem or leaf in which they have been placed. Of course, such plant tissue may also contain eggs, either of the same or of other species, deposited previous to the observation. Sometimes, females, specially of the Aeshnidae, may be induced to oviposit by holding or pinning them so that their feet and abdomen touch a stem or leaf.

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The lots of eggs included in this study were obtained by all three methods—those of the eight species of Libellulidae by the dipping method, one lot of eggs of *Anax junius* (Drury) by holding a female in contact with a plant stem, and one of *Enallagma civile* (Hagen) by collecting a leaf of *Polygonium* in which a female was noted ovipositing.

The clutches of eggs counted included (in cases in which only a portion of a clutch was counted, the number counted followed by “+” is given):

- Pachydiplax longipennis* (Burmeister)—7:86, 157, 244, 350+, 350+, 1027, 1060.
- Libellula pulchella* (Drury)—3:112, 175+, 300+.
- Libellula luctuosa* (Burmeister)—1:125.
- Plathemis lydia* (Drury)—1:1429.
- Perithemis tenera* (Say)—3:107, 278, 590.
- Erythemis simplicicollis* (Say)—2:250, 990.
- Sympetrum obtrusum* (Hagen)—6:2, 6, 48, 80, 106, 126.
- Sympetrum vicinum* (Hagen)—2:23, 379.
- Anax junius* (Drury)—1:30.
- Enallagma civile* (Hagen)—1:223.

Eggs of eight clutches of five species were incubated at constant temperatures and several others at “room” temperatures. In some cases clutches were divided and the several lots of each were incubated at different temperatures, usually 60° to 80°F., at five degree intervals. Results of the experiments of the effects of temperature on the incubation period and the percentages of eggs hatching are summarized in Table 1.

Samples of each clutch or of different clutches incubated at 70°, 75° and 80° showed that hatching correlated with the temperature. The development was more rapid (that is, the eggs hatched in less time) and a higher percentage hatched at higher temperatures. However, different clutches incubated at the same temperature showed considerable variation, both in time and percentage of hatch.

Clutches incubated at “room temperature” usually showed a more extended hatching period than lots of eggs incubated at constant temperatures. This may be due to the separation of the eggs rather than to temperature conditions. Eggs of most species of Libellulidae have a gelatinous covering and tend to mass in large clusters when placed in small jars in the field for transportation to the laboratory. The eggs were probably more completely separated in the lots counted for the temperature tests than were those incubated at “room temperature.”

Several clutches, or samples of eggs were incubated at 60° and 65° but none hatched. Except for one lot of eggs of *Sympetrum obtrusum* of which detailed counts are not available, none other than the two indicated in the table (*P. longipennis*—clutch no. 8) hatched when first exposed to 60° or 65° and later transferred to a higher temperature. All were exposed to the lower temperatures for more than 11 days.

Literature Cited

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