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Effect of Temperature on the Emergence of Mayfly Imagoes from the Subimago Stage¹

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While rearing a series of adult specimens of certain mayfly species from mature nymphs to the adult stage under circumstances closely simulating natural conditions, the normal length of the subimago stage was determined as approximately 24 hours for both sexes of each of the species considered. However, as the rearing was carried on out of doors, it was further observed that this 24-hour interval was materially lengthened by a period of cool weather. Clemens (1915) recorded that the length of the subimago period for laboratory-reared specimens of *Stenonema tripunctatum* (Banks) is generally one day, but in the early part of the season, it may last 3-4 days. He also stated "no doubt this time would have been shortened had the subimagoes been out of doors." He did not give his reason for believing this, but in an earlier paper (1913) he mentioned that temperature and humidity seemed to be factors in determining the duration of the subimago stage. While humidity seems to be a significant factor that may determine in general the success or failure of the subimaginal molting process, it may be pointed out that concrete experimental evidence is lacking as to its exact role in the transformation of subimago to imago. The purpose of this writing is to direct attention toward the effect of temperature on the length of the subimago period; it is not an attempt to settle the question of the effect of humidity

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differences on the life of the subimago. Preliminary experimental evidence is given below to support the contention that temperature is definitely a controlling factor which determines the length of the subimago stage and that humidity is probably a minor factor.

To study the influence of temperature upon the length of the subimago period, several subimagoes of both sexes of *S. femoratum* (Say) were placed in a glass jar with an inner screen-wire lining and perforated top. This jar was then placed in a refrigerator regulated at an average temperature of 7.2° C. Soon after being placed in the cold, the subimagoes became inactive and ceased practically all movement during the entire time at this temperature, although they retained their normal vertical position on the wire screen. None of the specimens had emerged after 130 hours, at which time they were removed from the cold. All individuals were apparently in good condition, for they emerged successfully within 12 hours under the prevailing air-temperature conditions of mid-summer (25.0° C.-30.0° C.).

A number of other specimens were collected as they emerged from their nymphal skins during the evening and were immediately placed in the glass jar described above. The jar was then submerged, except for the perforated cover, into an aquarium provided with a steady flow of cold water. The air temperature within the jar remained at 16.7° C. throughout the duration of the experiment. The length of the subimago period under these conditions lasted for about 48 hours while other specimens collected as subimagoes at the same time and maintained as controls during the same period under the higher prevailing air temperatures and under similar conditions of humidity emerged in about 24 hours.

Individuals of *S. interpunctatum* (Say), *Ephemerella bicolor* Clemens, and *E. temporalis* McDunnough which normally also have a subimaginal period of 24 hours were subjected to experimental conditions as described above with similar results.

While temperatures were varied and humidity remained more or less constant during the experiments, it seems evident that temperature is an important factor determining the length of

the subimago period. Since the life-span of the adult mayfly is relatively short and swarming for most species can best be carried out during periods of warm, fair weather, it is a distinct advantage to the mayfly to have its aerial existence prolonged so as to tide it over times of cold, inclement weather. It has been noted that unusually large swarms of *Hexagenia* follow an interval of cool, windy, and rainy weather.

LITERATURE CITED

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