5 to 10 days. At the end of that time it was noticed that in every case the plants containing the liver extract in solution were distinctly greener than the controls without the liver extract. Some factor in the liver extract has apparently checked the destruction of the chlorophyll; this destruction of chlorophyll goes on constantly, but in the daylight the pigment is constructed as fast as it is destroyed. Whether this is the same effect as observed in the use of liver extract in cases of hemoglobin deficiency, such preliminary experiments can not decide. Purified extract or amino acid crystals from liver extract should be used instead of the crude extract. Also it should be of interest to see if the liver extract will aid in the formation of chlorophyll in seedlings completely etiolated. Miss Mary E. Reid (unpublished experiments) found that albino seedlings when fed liver extract in a similar fashion showed a greening in excess of controls.

Since laymen still like to get evidence upon the fundamental relationship of plants and animals, such experiments might be brought forward in support of the doctrine of the common origin of plants and animals, but such was not the original purpose of these rather elementary researches. On the other hand, these experiments as here reported were simply meant to be suggestive of the aid which the study of plant physiology may be able to render to the study of animal physiology on the assumption that vegetable and animal substances of a similar chemical nature and of common origin may be supposed to have a physiology at least similar if not strictly identical.

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THE LIFE CYCLES OF TRICHOGRAMMA MINUTUM IN RELATION TO TEMPERATURE

THE egg parasite *Trichogramma minutum* is an ideal organism to use in experimental work. Practically the only limiting factor in its production is the amount of food available. Under proper conditions, however, its food can be easily provided. In the laboratory, with an abundance of food at hand, it is one of the most easily reared of any highly developed organism. It can be reared at the rate of 52 generations a year. Reared under mass production methods, the average number of progeny per female is 12 and the sex ratio is about 0.5.

The adults are sexually mature when they emerge from their host, and they mate promptly so that the sequence of generations is uninterrupted. Because of the large number used in experimental work, individual variations are easily discounted. *Trichogramma* can be reared in the eggs of the common grain moth (*Sitotroga cerealella* Olivier) for endless series of generations in tightly corked glass vials in complete darkness. The amount of food consumed by each individual is practically constant, since as a rule only one individual develops in each host egg. Host eggs can be produced in sufficient quantities so that the average size of the eggs is constant.

Temperature appears to be the predominant, if not the only, ecological factor influencing the rate of development. The frequency of life cycles, however, is also dependent on the available host material. Under field conditions the frequency of cycles would range from one week in summer to several months in winter. Differences in length of cycles and in frequency possibly would register effects not recorded by artificial methods. Rates of development of other organisms can be compared for various sets of temperature conditions directly in terms of life cycles without resorting to developmental units or the summing of temperatures, particularly since such methods have not been perfected.

To insure uniformity of data, investigators should be supplied with a race of *Trichogramma* which has the widest range in developmental temperatures, in standardized units consisting of freshly parasitized eggs in sealed glass vials under refrigeration. Each unit should contain enough individuals so that variation can be eliminated when making observations to determine the end of the life cycle.

The period of continuous development ranges from as short as 6 days to as long as 80 days. When the temperature drops below 50° F., or rises above 90° F., its development is more or less discontinuous. Each insect is so small (a half dozen can be reared in a space of 1 cu. mm) that its response to changes in temperature is immediate.

Certain races of *Trichogramma* that are indigenous to cold climates, as in northern New England, show a wide range in degree of pigmentation correlated with developmental temperatures. When the adults of one such race show dark markings on the body, they have passed through part of their life cycle at temperatures below 70° F.

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