RETARDED DEVELOPMENT IN INSECTS.*

By C. V. Riley, Washington, D. C.

In this paper the author records several interesting cases of retarded development in insects, whether as summer coma or dormancy of a certain portion of a given brood of caterpillars, the belated issues of certain imagines from the pupa, or the deferred hatching of eggs. One of the most remarkable cases of this last to which he calls attention, is the hatching this year of the eggs of the Rocky Mountain Locust, or Western Grasshopper (*Caloptemus spretus*), that were laid in 1876, around the Agricultural College at Manhattan, Kansas. These eggs were buried some ten inches below the surface, in the Fall of 1876, in grading the ground around the chemical laboratory. The superincumbent material was clay, old mortar and bits of stone, and a plank sidewalk was laid above all. In removing and regrading the soil last spring Mr. J. D. Graham noticed that the eggs looked sound and fresh, and they readily hatched upon exposure to normal influences, the species being determined by Prof. Riley from specimens submitted by Mr. Graham. Remarkable as the facts are there can be no question as to their accuracy, so that the eggs actually remained unhatched during nearly four years and a half, or four years longer than is their wont, and this suggests the significant question: How much longer could the eggs of this species, under favoring conditions of dryness and reduced temperature, retain their vitality and power of hatching?

Putting all the facts together Mr. Riley concludes that we are as yet absolutely incapable of offering any satisfactory explanation, based on experiment, of the causes which induce exceptional retardation in development among insects. It is a very general rule that a rising temperature stimulates and accelerates growth, while a falling temperature retards and torpifies, and experiments recorded by the author* show that such is the case with regard to the eggs of *Caloptenus spretus*. But there are many exceptions to the rule. The eggs of Crustaceans, as *Apus* and *Cypres*, are known to have the power of resisting drought for six, ten or more years without losing vitality, while in some cases they seem actually to require a certain amount of desiccation before they will hatch. Yet the fact remains that different act differently in this respect. In short, nothing is more patent to the observing naturalist than that species, and, even individuals of the same species, or the progeny of one and the same individual, act very differently under like external conditions of existence; or in other words, that temperature, moisture, food, etc., influence them differently. Hence—as has been shown by Semper to be the case with other animals, so it is with insects—changes in the external conditions of existence will not affect the fauna as a whole equally, but will act on individuals. We can understand how this great latitude in susceptibility to like conditions may and does, in the case of exceptional seasons, prove beneficial to the species by preserving the exceptional individuals that display the power to resist the unusual change; but we shall find ourselves baffled when we come to seek a demonstrable explanation of the cause or causes of such retardation, while the principles of evolution afford us the only hypothetical one at all satisfactory. In the innate property of organism to vary, and in the complex phenomena of heredity, we get a glimpse at the cause—a partial explanation—of the facts of retarded development; for the exceptional tendency in the present may be looked upon as a manifestation through atavism of traits which in the past had been more commonly possessed and more essential to the species.

*—Abstract of a paper read before the Entomological Section of the A. A. A. S., at Cincinnati.

*—9th Rep. Ins. Mo., also 1st Rep., U. S. Entomological Commission.

ON THE "LIFE DURATION OF THE HETEROCERA (MOTHS*)."

(Abstract.)

By J. A. Lintner, State Entomologist of New York.

The subject of life duration of our insects, not having been given special study, so little is known upon it, that the present contribution would not be warranted, were it not that the confession of our ignorance upon the point, may serve as an incentive to its examination.

It is a difficult field of study, for the observations should be made upon the insects in the natural conditions—not in confinement. Even of the latter state, our knowledge is quite limited. Entire broods of species have seldom been reared, except in the Bombycidæ and Sphingidæ, where the eggs are easily to be obtained. But in the large family of Noctuidæ, I do not know that an entire oviposition, or even a considerable part of one, has ever been carried through to the perfect stage, nor have I any personal knowledge of the time, place, manner or duration of copulation among them.

In the Attacinæ of the Bombycidæ, the lives of most are brief; that of the female seldom reaches fifteen days, while in the male it is still shorter. It is longer in the Sphingidæ.

We may best obtain an approximation to the life period of the moths, from reference to the dates when they are observed abroad. The lists published of collections "at sugar," furnish us with the best data. From a list prepared by myself, it appears that a large number of species of Noctuidæ were abroad for about one month. Deducting one-third of this time for their probable unequal emergence from the pupæ, there would remain a term of three weeks for their approximate life duration.

Mr. W. L. Devereaux, of Clyde, N. Y., from his observations, also infers, "that most of the species remain for about a month."

As would be expected from so heterogeneous a family as the Noctuidæ, the different groups present different life periods. The genera Xylina, Homoptera and Catocala, are found to have a considerably longer continuance than that above given. Three species of Xylina were observed by me for forty-one, forty-seven and fifty-one days; ten species of Catocala, for an average of forty-five days; and nine species of the same genus, as reported by Mr. Devereaux, for fifty-seven days.

In view of the benefits which would result to Entomology, it is suggested, that in future lists published of our insects, the different dates at which they are observed throughout the year, be included. It would aid us in determining life duration—would indicate the time when to guard against the commencement of insect attack—when to commit our crops to the ground—when to search for specimens for our cabinets—in short, it would furnish an essential part of the life histories of our species.

Mr. G. Fasoldt says, in a letter to the *American Journal of Microscopy*:—

I have ruled plates up to 1,000,000 lines to the inch, one of which was purchased by the United States Government at Washington.

These plates show lines truly and fairly ruled, as far as lenses are able to resolve, and above this point the *spectral* appearance of the bands in regular succeeding colors (when examined as an opaque object) shows, beyond doubt, that each band contains fairly ruled lines up to the 1,000,000 band.

I do not believe that I will ever attempt to rule higher than 1,000,000 lines per inch, as from my practical experience and judgment, I have concluded that that is the limit of ruling.

* Read before the A. A. A. S., Cincinnati, 1881.