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The Development of Myrmecaelurus trigrammus Pall. (Myrmeleonidae)

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The attention of naturalists has been attracted by the highly intriguing mode of life and behaviour of Myrmeleonid larvae for over 200 years. However, most of the information on the development of Myrmeleonidae refers to the two Middle European species *Myrmeleon formicarius* L. and *Euroleon nostras* FOURCR., without even touching on all developmental stages. Scanty and insufficient data exist only on certain Mediterranean and some Non-European species. The largest Neuropterous family with none less than 2000 species appears as a field least studied from the point of view of bionomy. Therefore the results of a rearing of larvae of *Myrmecaelurus trigrammus* are of some interest. Studies of the larvae and the development of this species have been carried out by REDTENBACHER (1884), DOFLEIN (1921) and BRTEK (1961).

The larvae of *Myrmecaelurus trigrammus* were found on May 22nd 1968 at an altitude of 250 m on the steep left slope off the Struma River, in the Kresna gorge, Southwest Bulgaria. The slope is chiefly covered with single *Juniperus excelsa* trees, a few deciduous shrubs (predominately *Paliurus aculeatus* and dry herbaceous vegetation. Pits of antlions were found in the course of six hours of searching along the slope only under one of the oldest *Juniperus* with thick and rather low boughs which protect the pits from showers without blocking the sun's rays to reach the soil until late in the afternoon. According to REDTENBACHER and BRTEK the larvae live in higher open sunlit places and their pits are not protected from the wind and rain. The larvae had carefully built their pits in hard cinnamon forest soil. Eight larvae were collected, three of them in second instar (width of the head 1,3 to 1,4 mm) and five in third instar (width of the head 1,9 to 2,2 mm). Two of the third instar larvae were preserved in alcohol, while the rest were reared in captivity in plastic cups separately, over different lengths of time.

In its behaviour the larva of *Myrmecaelurus trigrammus* occupies a particular place among the other Myrmeleonidae. Usually it moves forward under the surface of the sand and leaves traces like those of other antlions. Occasionally it actively pursues its prey on the sand. Taken out of its typical habitat it also starts moving forward rapidly. It moves backwards only when it hides itself in the sand or when it comes across an obstacle. It buries itself in the sand, similarly to other antlions, by means of tremulous movements of the rear part of the abdomen. The building of a pit is not obligatory. The younger larvae, as well as those which are very hungry make pits, but most often those of third instar do not live in pits for months, they bury themselves under the surface of the sand. Only the wide open jaws and sometimes the whole head remains above the sand. Thus the larva of *Myrmecaelurus trigrammus* occupies an intermediate position between the larvae, which make pits and move only backward, for instance *Myrmeleon* and *Euroleon* and the larvae, which do not make pits and move both forward and backward, for instance *Acanthaclisis*.

The larvae were fed on flies (Muscidae and Calliphoridae), caterpillars of *Plodia interpunctella* HÜBN., and larvae of *Tenebrio molitor* L., as well as on smaller numbers of various ant species. Observations on the behaviour at the moment of the catching of its prey indicate, that the larva of this species is considerably more active, more aggressive and greedier than *Myrmeleon* larvae. Whenever it fails to catch its prey in its first attempt, the larva swiftly snaps its jaws several times in different directions, taking its head out of the sand. If a small brush

is placed close to an antlion of this species, it immediately bites it, then pulls back and once again sets out in attack. The poison of the larva is stronger than that of other Myrmeleonidae. A one cm long caterpillar died after a bite within six seconds, a large fly within ten seconds, while the maximum time (for a large caterpillar – Macrolepidoptera) is up to two minutes. The akinesia of the larva is generally shorter than with larvae which regularly make pits. At a temperature of about 20° C its maximum is one minute.

The partial rearing of the larvae and the presence of two instars in the sample made it possible to establish the length of the complete life cycle as well as of certain separate stages. The second instar larvae moulted on July 7th and 15th 1968. Evidently the first moult occured during the previous autumn. About two weeks prior to the moulting the larvae remained buried deeper without moving or feeding. After a period of feeding and activity during the summer the mature larvae began to come to the surface and move about, and once again ceased feeding. As it was obvious that they were searching for a place to hibernate they were placed at a lower temperature in an unheated room at the end of October; there they did not take any food for six months. One of the larvae escaped during the winter, which confirmed DOFLEIN's observation, that the larvae of this species successfully climb up almost vertical walls. One of the larvae was reared up to imago. After an active period of about three weeks it spun a cocoon on May 26th 1969 and the imago emerged on July 14th 1969.

The larvae collected in 1968 in third instar and reared to imago, developed along different lines. One of the larvae formed a cocoon on June 20th 1968, the other one two months later, on August 22nd 1968. An imago emerged from the first cocoon on the 29th of July the same year, while the pupa within the second cocoon remained to overwinter once again. One month after the spinning of the cocoon an opening was cut out and it was found that the prepupa had already become a pupa libera. This pupa remained alive up to the 9th of July 1969, when it cut its way out of the cocoon, but failed to change into an imago. The other adults could not emerge fully, too. Although they had only partially left the pupal skins, the species was determined after the markings on the head and the prothorax.

What was observed in this case was a prolongation of the diapause over its normal duration, which occurs frequently with the pupae of moths, and rarely with caterpillars. This prolongation appears to be a form of adaptation for survival under unfavourable conditions, but the cause of its appearance has not been sufficiently clarified. The larva of *Myrmecaelurus trigrammus*, with a lengthening of its pupal period, has been reared under identical conditions (temperature, humidity, light) alongside with the other larva without an extended pupal stage. Probably an explanation of this extension could be found in the potentially lesser activity of the larva, which had accepted smaller quantities of food (given to the larvae in the same quantities). Should that be the case, it was ready to spin its cocoon later than the other larvae, namely at the end of August, when all the remaining pupae had emerged long ago. Had the cocoon period continued in this case as long as that of the remaining reared specimens, the imago would have emerged in the beginning of October and would have been doomed by nature. As the temperature and the other environmental factors in September are more unfavourable than those in June and July, the months when the prepupa and the pupa normally develop, it is evident, that the processes of metamorphosis in the pupa would run at a delayed rate and would go on until the beginning of the winter, practically ceasing after that. Thus we arrive at the emerging of the imago in July and simultaneously with the pupae with a normal length of the pupal period.

The duration of the normal development of *Myrmecaelurus trigrammus* under conditions in South Bulgaria is two years, contrary to DOFLEIN's claim of a one year cycle at similar climatic conditions, barely 75 to 150 km from the Bulgarian locality. The second moult of the larva occurs exactly one year before the emerging of the imago.

In conclusion I would like to present a summary of the life cycle of *Myrmecaelurus trigrammus:* imago – egg – first instar larva, and first moult – during the first year; second moult in June-July during the second year; cocoon in May-June and the emergence of imago in July of the third year. In other words, the cycle covers two years. In case of an extension of

the pupal stage the cycle is three years. The duration of the separate stages is as follows: from egg to second larva – 11-12 months, third larva – 11 months, cocoon – normally 39-49 days, with the prolongation 321 days, i. e. seven to eight times longer.

References

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