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On the Eurydema species in Hungary III. The phenology of the Eurydema species in Hungary (Heteroptera, Pentatomidae)

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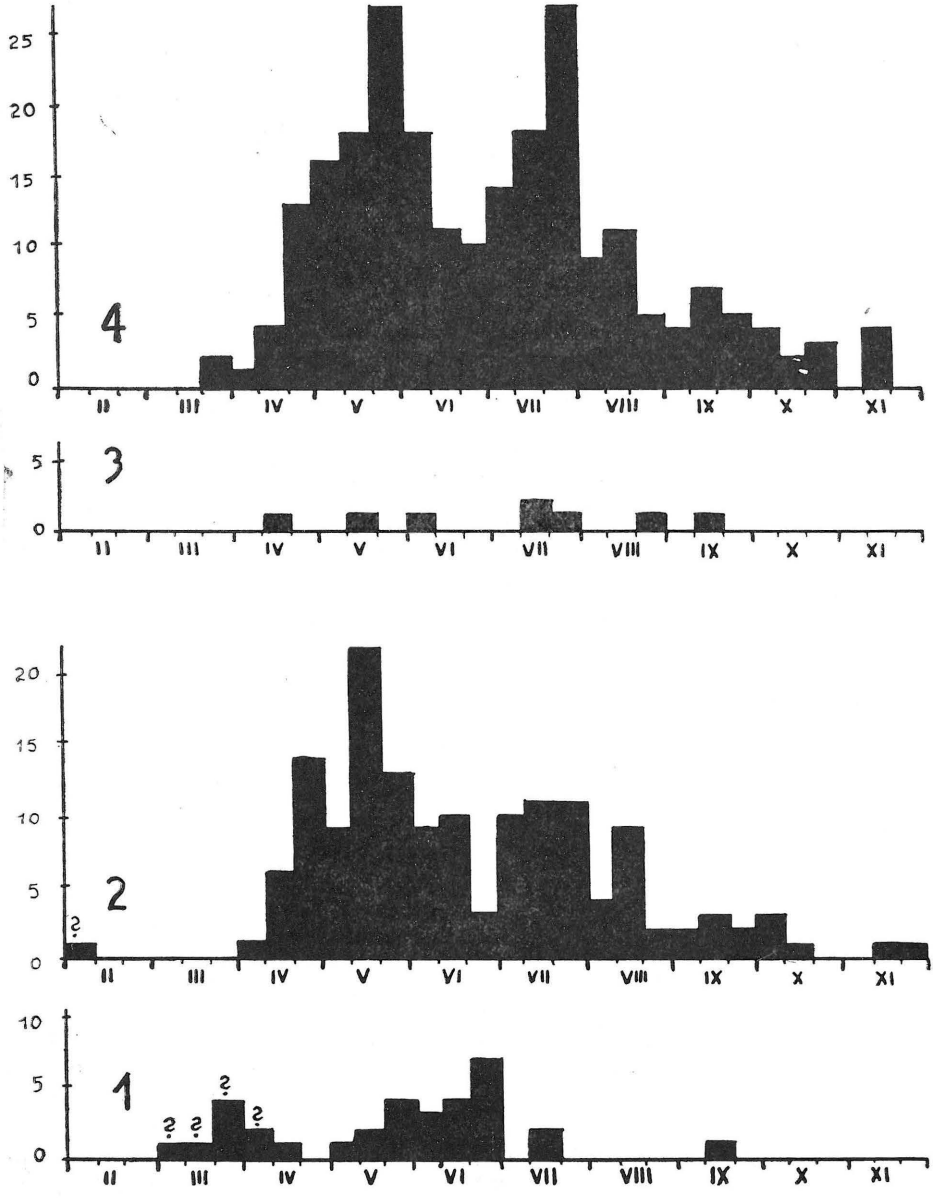
In the course of systematical revision of the *Eurydema* species in Hungary (Benedek: 1965b) I had the opportunity to study the geographical spread and phenology of same. The ethological and faunistical data, as well as the analysis of the geographical distribution will be published elsewhere (Benedek: 1966).

At this stage I want to evaluate the phenological-relations by means of graphs which I have based on the data of specimens found in collections, the method applied having been the usual one (i. e. Soós: 1958, Steinmann: 1959). The months have been dissected into units of 10 days (decades) and the data shown on the labels of the specimens grouped accordingly. Each data represents the data of a specimen or specimens collected on a specific day and on the same spot (irrespective of the quantities), thus "each data shows the presence of the animal at a specific spot, but at different times, or on different spots at a given time" (Steinmann: 1959). On the horizontal lines of the graphs is shown the time, dissected into units of 10 days, and on the vertical line the amount of data. Had the amount of specimens been taken into account, the picture shown would have been false, since, not all of the specimens collected had been stored away, and apart from it, quantitative data may — generally speaking — only then be taken into account, if the survey had always been based on an identical method. Seeing that the material examined originates from several collectors, the above mentioned conditions do not exist.

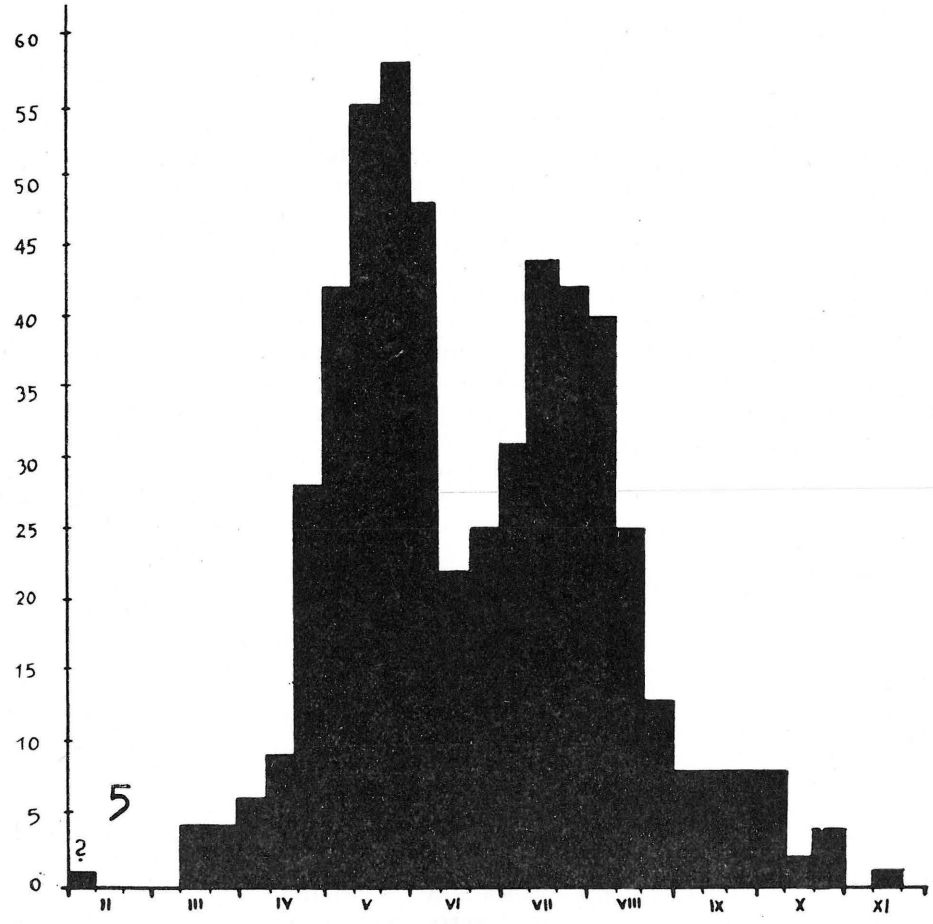
The data examined refer to specimens collected during the past 100 years or so. Specimens with labels without dates have naturally been excluded from the examination. Specimens with tickets showing the year and the month only I have regarded as having been captured in the mid-decade of the respective month (Only a few such incomplete data were found!).

My observations — based on appr. 7000 specimens of *Eurydema* — provided a total number of 957 data (*fieberi* Schml.: 33; *ventrale* Kol.: 148; *dominulus* (Scop.): 8; *ornatum* (L.): 233; *oleraceum* (L.): 535).

E. fieberi Schml. is infrequent in Hungary, it appears sporadically, larger numbers can only be found in the Velence-hills (Benedek: 1966), thus, almost 50 % of the phenological data originate from that area. In view of the limited amount of data (33) no far-reaching conclusions can be drawn by study-



ing the graph showing its swarming (Fig. 1.). Though *fieberi* is a mediterranean type of species (Stehlik: 1955) we posses some rather untimely (March and early April) data about them. Such untimely data may have been obtained either by riddling — which fact was omitted from the labels — or the



specimens have erroneously been labelled. The only untimely data which may be accepted as authentic originates from Nadap (Velence-hills), 20. Apr. 1951. In view of its ecological character the very early appearance of this species is not to be presumed. Swarming is likely to begin early in May i. e.: after the first considerable rise in temperature. Possibly, *fieberi* in Hungary has less — perhaps but one — generations than the other *Eurydema* species, and, therefore, swarming terminates sooner. The latest data of the season comes from mid-September (18th). The start of mass-swarming of *fieberi* may coincide with the period (May) shown by the graph, and the swarming-maximum of the developed new generation may be due in June. The early disappearance of the species (July, or September?) is explained by its mediterranean character.

E. ventrale Kol. is common in Hungary, it may be found all over the country (Benedek: 1966, and is a pest on cultivated-crucifers.) Swarming begins at the beginning of April (Fig. 2.) but the exodus in masses from the hibernating

shelters takes place at the beginning or the middle of May. There exists a single datum coming from the first decade of February, and that — most probably — as a result of riddling since such a nearly appearance of this species is unthinkable. The specimens left the state of diapause begin to perish after oviposition. The graph refers to the swarming of imagines, therefore, a considerable fall in same is noticable as from end of May to June. The maximum-swarming of the "off-spring-generations" takes place in July and August, the swarming — on account of the drawn-out oviposition — lasts as long as to October (or even until end of November?).

E. dominulus (Scop.) is very rare in Hungary, it may only be found in some hilly parts of the country (Benedek: 1966). In view of the few (8) data at our disposal very little may be said about the swarming of this species (Fig. 3.). One can only state that both the beginning (April) and the end (September) of its swarming — roughly speaking — coincides with the respective charateristics of the other local *Eurydemae*. In view of its ecological requirements it may be presumed that the swarming-procedure is similar to that of *E. ornatum*.

The swarming of *E. ornatum* (L.) may begin as early as end of March (Fig. 4.) and lasts until mid-November. The maximum-swarming of the "parental-generation" may be observed in May, mass-swarming starts in April. The maximum-swarming of the "off-spring-generations" is reached in July, and thereafter (August) begins the entry to hibernation*), but the swarming goes on and keeps on — though with a much lower intensity — until September. From October until the end of November all the other adult specimens go into diapause.

In the genus *Eurydema E. oleraceum* (L.) is the most common species in Hungary (Benedek: 1966), its swarming may begin earlier (beginning of March) than is the case with its "genus-relatives" (Fig. 5.). Swarming in its earlier stage is more intensive than with ventrale (similar to that of ornatum). The first swarming-maximum is reached by mid-May, and the vanishing of the parental individuals takes place at a rapid pace (August). The second swarming-maximum occurs — same as with ornatum — in August, but in a more balanced manner. The swarming of this species may also be drawn-out until late in the autumn (November), the number of active (swarming) individuals, however, rapidly decreases after the swarming-maximum.

Studying the graphs it may seem that it is uncommon that the second swarming-maximum is lower than the first, although the first one refers to the hibernated specimens ("parental generation"), while the second shows that of the newly developed imagines (this being the accumulated swarming-maximum of the "off-spring-generations"), and therefore the latter ought to be much greater than the former. Observing the data of the graphs, one may come to the conclusion that these species are condemned to death (!) i. e. the number of specimens ought to diminish rapidly year by year, and more so, because of the perishing of numerous individuals during the diapause as a consequence of the severe winter-conditions. It is not the graphs that are responsible for this peculiar paradox, but it is the result of the particular attitude of the *Eurydema* species. My observations made on open fields in 1962—1964 rendered consi-

*) See in Sáringer's work (Sáringer: 1964)

derable proof of the correctness of the graphs. In view of their peculiar feeding-conditions *Eurydemae* start mass entry into quiescentia*) very early, i. e. as from the month of August, since their main food-plants (some wild-Cruciferae) get ripe and whither by this time. The food-resources — so abundantly at their disposal so far — disappear in a relatively short time, i. e., in 2—3 weeks. Part of the specimens migrate onto other plants now (such possibilities, however, are scarce), and the greater part of them enter into hibernation. Thus, shortly after the appearance of the first "off-spring-generation" a mass entry into hibernation begins and, as a consequence, only a small number of imagos continue with their activity. Considering that the graphs embrace but the active units, and out of these the imagines only, the graphs — in spite of the paradox — show the true picture of the swarming. The explanation for this paradox is, therefore, the early and mass entry into hibernation, the rate of which is rather intensive from the very beginning, and keeps on like that until the end of the swarming, as a matter of fact, the rate of same shows an increasing tendency. The units of the "off-spring-generations" are developing continuously, but the entry into quiescentia is continuous as well. In view of the "mass entry" of „off-spring-specimens" into hibernation the number of units acting simultaneously is always less than that of the "parental-generation". The units of the "off-spring-generations" are still larvae or have gone into hibernation, thus, only limited number of them is active in the open fields, wherefore, the "off-spring-generations" (accumulated) are much smaller in quantity than the "parental-generation". This is why less specimens of the "off-spring-generations" may be captured and this explains the smaller amount of data concerning same. In connection with the "parental-generation" the spring- and early-summer-periods, while in the case of the "off-springs" the summer and autumn periods have, of course, been taken into consideration, since, there exist no "off-springs" in spring and early-summer, just as no "parental-specimen" can be found by the end of the summer or in the autumn (the hibernated "parental-units" and the "off-springs" may be differentiated by the colouring of the abdomen: Benedek: 1965/a).

By studying the swarming-graphs of the *Eurydema* species we may come to the conclusion that these species produce one generation only, whereas, *E. oleraceum* has four, and *E. ventrale* in all probability three generations*) in Hungary. These circumstances call for caution when examining the relations of phenological graphs and/or the number of generations, because, whilest in connection with certain groups (viz: Diptera: Soós: 1958) we may arrive at correct conclusions, with the species of other categories (viz: Heteroptera) it is essential to make controls on the open-fields and in laboratories as well. Before tackling the question of the number of generations it must be made clear whether or not this simple-method (analysis by means of graphs) may be adopted relative to a given group.

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*) Within this series of studies I intend to render a more detailed account of this question.

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