Further Data to the Daily Migration of the Larvae of Aquatic Insects

By

S. ANDRIKOVICS*

Abstract. The author conducted examinations aimed at measuring the activity in 24-hour cycle of the insect larvae of the pondweed habitats *(Utricularia vulgaris* and *Potamogeton pectinatus)* of Lakes Fertő and Velence. He measured the circadian vertical motion of the frequently occurring insects and larvae (Ephemeroptera, Odonata, Chironomidae, Heteroptera), as well s of *Asellus aquaticus*. He did the examinations with the aquatic funnel-trap developed by PIECZYŇSKI (1961) (1).

The young larvae of the mayfly species found in the weedy habitats of Lake Velence do not perform a „pulsating" vertical locomotion as described in the literature. The maximum of their motion intensity can rather be put to a shorter period. The author observed considerable vertical motion in the Agrionidae larvae during the night and at dawn. The data obtained for the Chironomidae and Heteroptera larvae showed a fair agreement with those found in the literature. An interesting new result is the description of the circadian locomotion of *Asellus aquaticus:* by means of plastic traps it could be demonstrated that the nocturnal motion activity of that animal was nearly the threefold of the mean value obtained during the day.

Antecedents

Similarly to the members of the terrestrial fauna, also the aquatic organisms perform mostly well-definable motions. Part of these are incidental, e. g. the movements of feeding, flight or migration. All these and also the other less known motions show a definite seasonal and daily periodicity. The 24-hour activity of terrestrial insects is mostly well-known. ČERNYŠEV (1963) in: PIECZYŇSKI (1964) distinguishes e. g. 12 insect groups by motion activity during the various parts of the day. Generally, the primitive insects are moving all over the day, while the more developed ones suspend activity for a definite time (3).

Of the diurnal rhythm one can say in general that it is connected with the daily changes of physical factors like light intensity, relative humidity and evaporation. It is generally known for example, that the vertical motion of the plankton crustaceans is directly or indirectly connected with the daily periodicity of light.

**Dr. Sándor Andrikovics*, ELTE Állatrendszertani és Ökológiai Tanszék) Zoosystematical and Ecological Institute of the Eötvös Loránd University), 1088 Budapest, VIII. Puskin u. 3.

The description of the motion activity of the invertabrate meso- and macro organisms during the various parts of the day can be found in the first place in PIECZYŇSKI's works (1, 2, 3, 4, 5, 6).

The most important findings of that author can be summed up as follows: the motion activity of the water mites and ostracods is higher during the day, and of the mayflies is significantly higher at night.

During the day the motion activity of the Ostracoda is more or less unchanged, on the other hand, the locomotion maximum of the Hydracarina falls on the hours before noon. PIECZYŇSKI broke down his 24 hours' indexes of activity given for the orders also to species with the Hydracarina.

According to his investigations, *Piona coccinea*, *Branchypoda versicolor* and *Hydrobates longipalpis* are much more active in the daily-, while *Hydrodroma despiciens* and *Unionicola crassipes* are somewhat more active in the nightly hours. Out of the Hungarian hydrobiological literature the author of the present paper could mention the paper dealing with the migration of the plankton algae and of the zooplankton in the twenty four-hour cycles (7).

After these antecedents of the literature on the subject, the author has set himself the task of describing the locomotion in the twenty four-hour cycles of some frequent insect larva and of *Asellus aquaticus* (Isopoda) living in the pondweed fields of the Lakes Fertő and Velence, as well as of comparing it with the results obtained in Lake Mikolajskie.

Place, date and method of the investigations

The examinations were carried out in two steps, in two different lakes. The model field of the preliminary investigations consisted of a stand of *Potamogeton pectinatus* not in touch with the reed screen, of about 6 m² extent, as well as one of *Utricularia vulgaris* contiguous with the reed screen and approx. identical in extent with the former, in the Fertőrákos recreation area (Lake Fertő, Hungarian area, Western part). The dates of the exploratory investigations were 6 – 7 August and 15 – 16 August, 1977.

For following the activity of the aquatic insects to be found in the two habitats, we adopted the aquatic funnel trap method developed by E. PIECZYŇSKI (1961) (1).

This simple appliance consists of a funnel of which the stem has been cut off and of a corresponding vessel, which we joined with a rubber band and a simple metallic clamp.

Using 3 hours each of diurnal and 12 hours of nocturnal exposition times for the examinations, we placed 2 traps each in various depths from the water surface (water depth of 15 to 75 cm). Parallelly with the traps made of synthetic material, we occasionally also applied glass traps. As at present the night stay out is not possible on Lake Fertő, we repeated the investigations at another site – in Lake Velence – chossing and ensuring similar circumstances. The detailed trapping experiments in Lake Velence were carried out in a dense *Utricularia vulgaris* field in the canal in front of the nature conservation watch-house. The depth of the water was about 1 m here. At the site of the examination, on the occasion of a preliminary netting, among the elements of the macrofauna we found very much young larvae of *Cloeon dipterum*, *Caenis* sp., Agrionidae, Heteroptera

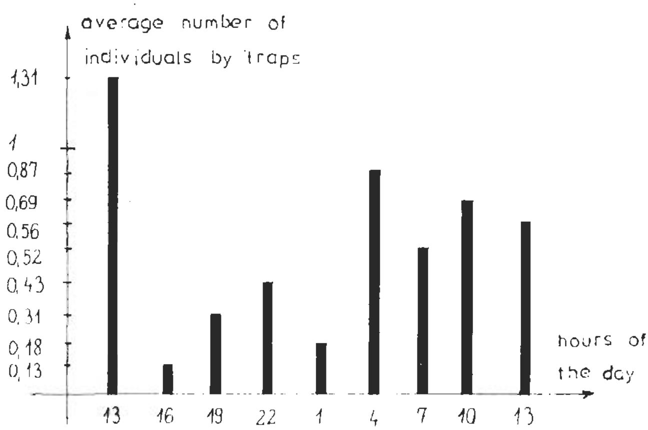

Fig. 1. The change by the single parts of the day in the motion activity of the larvae of *Cloeon dipterum*

and Chironomidae, as well as the *Asellus aquaticus*. On the other hand, we could not collect caddis-fly larvae.

The investigations were begun on 3rd September, 1977, at 10 o'clock in the morning; applying 3 hours' exposition times we continued them through 27 hours. For each sampling we used 16 traps.

We placed the traps about 30 cm above the mud among the dense vegetation. Founded on the results of the preliminary examination (see in more detail later) the traps were made of transparent plastic funnels and glasses. At the time of the examination the temperature of the water fluctuated between 19.9 and 26.5° C.

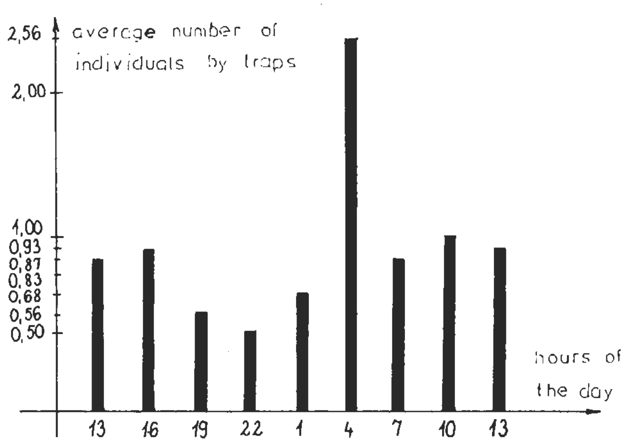

Fig. 2. The change by the single parts of the day in the motion activity of the larvae of the *Caenis* sp.

Examination results and their valuation

From the preliminary examinations conducted in Lake Fertő it appeared that the aquatic funnel-trap, similarly to the Polish results (PIECZYŇSKI 1964) clearly reflects the abundance conditions. By its means the mosaickedness also characteristic of the zoocenoses of the various pondweed fields can be demonstrated. Similarly to the results of the nettings done at the same time, from the *Utricularia vulgaris* stand of Lake Fertő mainly larvae of Chironomida and *Caenis* sp., as well as the *Asellus aquaticus* turned up in significant numbers of individuals. On the other hand, in the spot of *Potamogeton* pectinatus the various species of the water-bug (*Sigara striata, Cymatia coleoptrata,* Corixidae larvae) occurred in great quantities.

Founded upon our investigations results we could also demonstrate a close connection between the phytofauna and the sediment. It was at all times the traps at 15 – 30 cm depth from the mud surface that caught the greatest number

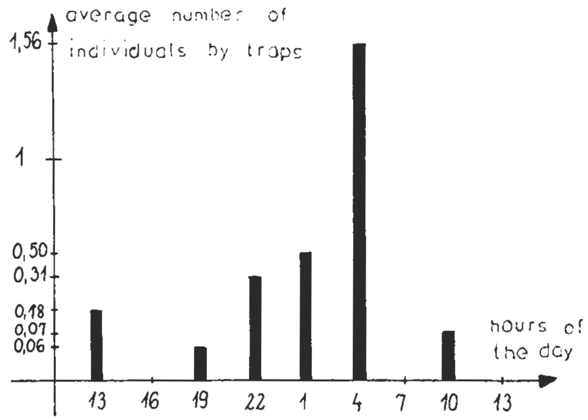

Fig. 3. The change by the single parts of the day in the motion activity of the Agrionidae larvae

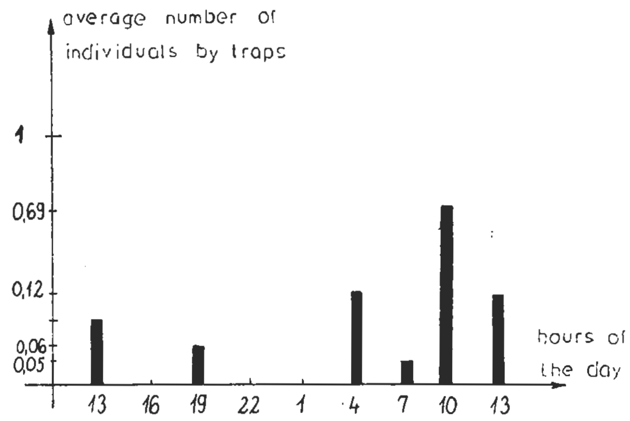

Fig. 4. The change by the single parts of the day in the motion activity of the Corixidae larvae

of animals. Again, the traps set at the same habitat in various parts of the day indicated a difference in motion activity. The relatively small number of traps and the lack of observation during the nocturnal hours did, however, not permit to draw conclusions that could be referred to an exact periodical daily activity. At the end of the presentation of our preliminary investigations, may we come to discuss the connection between the material of the trap and the numerical results of the catches.

Even PIECZYŃSKI (1961) makes mention of the fact that the glass material of the traps exerts a repellent effect on *Asellus aquaticus* and has, on the other hand, probably an attractive one on the snails.

Confirming PIECZYŃSKI's results, our preliminary examinations proved that, as compared to the control traps made of glass, the traps of synthetic material caught more water mites and less snails. In the other groups we did not observe demonstrable changes. The exact explanation of the phenomenon is not yet known.

We present the results of our detailed examinations performed at the various periods of the day and referring to the frequent macro-organisms in the following figures (Fig. 1 – 6).

From the data of the figures it appears, that in the motion activity of the young *Cloeon dipterum* larvae we could not demonstrate any definite daily and nightly periodicity. From the data we could observe a somewhat more intensive movement directed towards the lower layers of water between 10 – 13, as well as 01 – 04 o'clock. Similarly during the day, the young (2nd larval stage) larvae of the *Caenis* sp. perform a fairly even motion towards the mud. Their motion activity has increased significantly only between 01 – 04 o'clock.

If we try to compare our results with the Polish data, we can draw the conclusion that the motion activity during the various parts of the day of the various may-fly larvae also varies by species and larval stages, and that in the young individuals of *Cloeon dipterum* also direct locomotion is quite considerable. Highly interesting are the results of the examination of the motion activity of the young Agrionidae larvae. The motion of the dragonfly larvae directed towards the lower

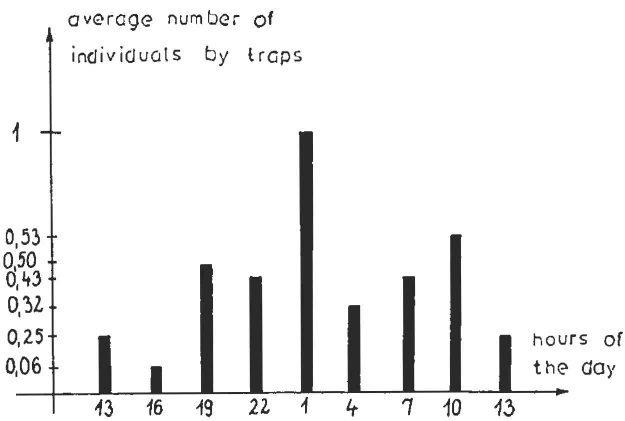

Fig. 5. The course of the locomotion by the single parts of the day of the Chironomidae larvae

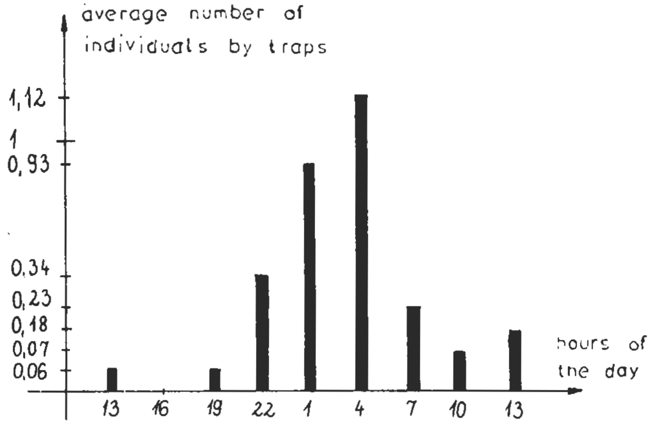

Fig. 6. The change by the single parts of the day in the motion activity of *Asellus aquaticus*

layers of the water is generally slight during the day, then in the night it revives, and reaches a maximum between 01 – 04 o'clock.

During the day, the Chironomidae larvae move with slight activity and more or less evenly. The maximum of their motion towards the lower water layers fell on 22 – 01 o'clock at night. For an exact valuation of the results an identification up to species would be especially important in this group, since as shown by our observations, the generally predatory Tanypodiinae and the mostly herbivorous species of the suborder Orthocladiinae sharply separate also in motion activity.

As shown by our collections, the Corixidae larvae can generally be found in the upper aquatic layer. Their motion towards the lower water layers becomes lively only between 7 and 10 o'clock (Fig. 4).

Ultimately, although taxonomically it belongs the crustaceans, we still discuss the circadian dynamism of *Asellus aquaticus*. Into our traps made of glass came a much smaller number of specimens than accounted for by the actual conditions of abundance and motion activity. On the other hand, we did not observe this phenomenon when using traps made of synthetic material.

It was clearly revealed that the nocturnal motion activity of the *Asellus aquaticus* was nearly the threefold of the value measured in the day. This high activity extends over the whole night and is more or less rising till dawn. A maximum it reaches between 01 – 04 o'clock.

If compared with the findings of the international literature on water trapping, our results modifying these statements and/or being new to science may be summed up as follows.

The young larvae of the mayfly species found in Lake Velence do not perform vertical locomotion of expressly diurnal-nocturnal dynamism. The maxima of their motion activity can rather be fixed on a shorter period (Fig. 1, 2).

Contrary to our expectations, the nocturnal motion of the Agrionidae larvae was also considerable.

Interestingly, the motion maximum of these predatory larvae is nearly identical with those of several groups of significant abundance value (01 – 04 o'clock).

If one compares the small numbers of individuals of the Chironomidae observed in the traps with their high abundance value, then the low motion activity of the species living here appears unambiguously. Again, the situation is reversed with the Corixidae larvae, with which the preliminary examinations in Lake Fertő confirmed PIECZYŃSKI's (1964) results that namely a group of high motility is in question here. However, their abundance value in the stand of *Utricularia vulgaris* is rather low, therefore naturally also the number of individuals caught by one trap is low.

A new finding is the description of the motion dynamism of *Asellus aquaticus*, which is missing from the Polish literature on account of the negative selective effect of the glass traps.

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