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# THE PHENOLOGICAL AND ECOLOGICAL RELATIONS OF THE ACENTRIA NIVEA OLIVIER, 1971; LEPIDOPTERA: ACENTROPIDAE) IN THE BACKWATERS AT MÁRTÉLY-KÖRTVÉLYES

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## Abstract

Attention was drawn to the *Acentria nivea* OLIVIER by an up to now unknown phenomenon, on the basis of lepidopterologic observations carried out continuously since 1969 in the environment protection area at Mártély-Körtvélyes. Since the starting of the observations till 1981 only a minimal number of the species could be observed, then in the following year it was detectable in large numbers. Searching for explanation in this concern, the paper contains a brief review on the development of the species, as well as the hypothetical and real effect of the local circumstances which influenced or may have influenced the development of this species.

## Introduction

The selection of the topic has two aims.

The Mártély-Körtvélyes Research Programme has come to an end, the studies in this regard have been prepared. Since the phenomenon being the subject of this report had commenced even before 1969 and had only become noteworthy in 1982, it therefore requires to be included in the terminated programme.

The other aim is to call the attention, arouse the interest of scientists, who will be carrying out further Tisza-research studies in other areas, to the possibility profitable in environment and nature protection of this organism having such peculiar habits — and in all likelihood — filling a part as good indicator. Although this organism is a microlepidoptera, its studying is nevertheless mainly hydrobiologic, biochemical or ecological task.

## Results of the research

On the basis of the continuous lepidopterologic observations carried out since 1969 at the Mártély-Körtvélyes environment protection area, it was striking that the *Acentria nivea* — this water-moth having such characteristic habits — was observable in only few number despite the fact that even two generations fly yearly. However, following their minimal occurrence for over ten years, it was even more striking that in August, 1981, 100—120 specimens — opposite to the earlier 5—10 — flew on the lamp-illuminated sheet used for the collection. In the year following its occurrence was mass (Fig. 1). Searching for an explanation to this, let us look into the biology and phenology of the species.

Throughout the world, the Acentropidae family is represented by a single sex, and in Europe this is represented by several subtypes of a single species.

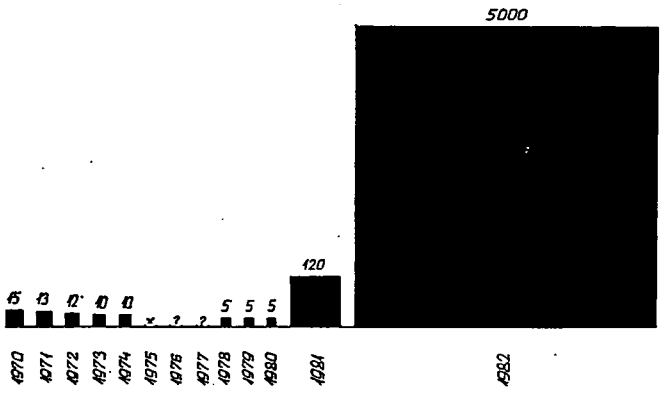


Fig. 1. The years of the study, where the occurring animals are demonstrated by squares proportional to their amount. (In 1975 not a single animal could be collected; in 1976—1977 quantitative studies were not carried out).

Even before the turn of the century a number of well-known researchers dealt with this species, however, many false data and divergent opinions came to light upon their studies. Even around the turn of the century it was debated whether it should be ranked among the *(Trichopteras or Lepidopteras)* due to its strange character. One of the most significant studies was carried out by NIGELL (1908), which is quoted in detail also by HERING (1926) in his book written on the biology of *Lepidopteras* resolving many myths, amending false observations and conclusions about the life of the species. Following this WOJTUSIAK (1935) Polish, and BERG (1941) Danish researchers took a significant step towards the knowledge on the biology of the species. The English scientist, WHALLEY (1966) threw light on its synonymics, since the earlier literary data discuss it using various terms; most of them the term *Acentropus niveus*. The various features of the species were made more clear in so many objects by the forwardness of the research works that in 1978 KUCHLEIN, Dutch scientist, had every cause to raise the species into subfamily rank. The revelation of the species' biological and ecological relations was made even more difficult by the fact that first, in 1925, it was detected by LE CERF in the Mediterranean sea of Spain, and later by others in the warmer seas throughout Europe. It became a matter of general knowledge within the circles of the specialists that the species is firstly native in sea-water.

The differing studies, however, agree in one point; namely, where this species is present, its occurrence is in large numbers.

The eggs are ovoid, yellowish-green in colour, finely indented. The imagos place them close to each other on the host-plant, mainly on the abaxial surface of the underwater leaves. One imago lays 100—140 eggs.

The hatching caterpillars are 0,8 mm long, the developed ones are 10—12 mm, completely adapted to the underwater manner of living. Their stomata are closed, thus they breath through the skin. Their digestive system filled with the green nutriment is visible through their thin skin. They have sixteen legs, their body is whitish-yellow, their annuli are swollen from 4 to 8, their sides are brownish in colour.

The freshly hatched caterpillars make themselves a secure lurking hole. It is not rare that two caterpillars build themselves a common place, neither that they spin back the edge of the leaves with their web, or they only bore themselves into the

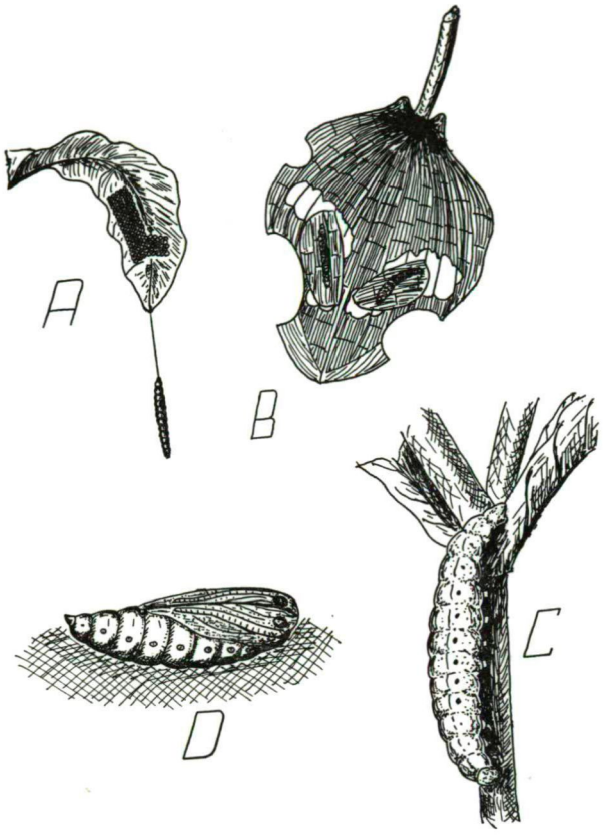


Fig. 2. Acentria nivea O.; A — egg pile; B — lurking-place of young caterpillars; habit-sketch of caterpillar (C) and puppet (D).

plant stem. They mostly favour smooth leaves if possible, and — especially in young state — they avoid leaves that are dirty or not wholly clean due to their algal coating (Fig. 2).

The more developed ones interweave two leaves by their apex and sides, and strengthen this further to the stem of the plant, or to other objects. Their living places are backwaters, on the bottom of which they pupate in air-filled webs.

The breathing of the puppets happens through the stigma. The imago hatching from the puppet comes to the surface of the water with the help of the elevating power of the small bubbles found among the hairy wing-scale (GOZMÁNY 1963). Its wings are opaline-white, but brownish shade can frequently be observed on the upper wings. The wing-span of the females is 18—22 mm, that of the males is 13—15 mm.

A particular sexual dimorphism is characteristic of the species, according to which the females have two forms; one having developed wings capable of flying, and one with rudimentary wings, which form lives under water and only thrusts out its abdomen from the water surface at the period of copulation. It occurs that males and rudimentary winged females fly in copula, just the same as it is frequent that these females drag the copulating males with themselves into the depth of the water (Fig. 3).

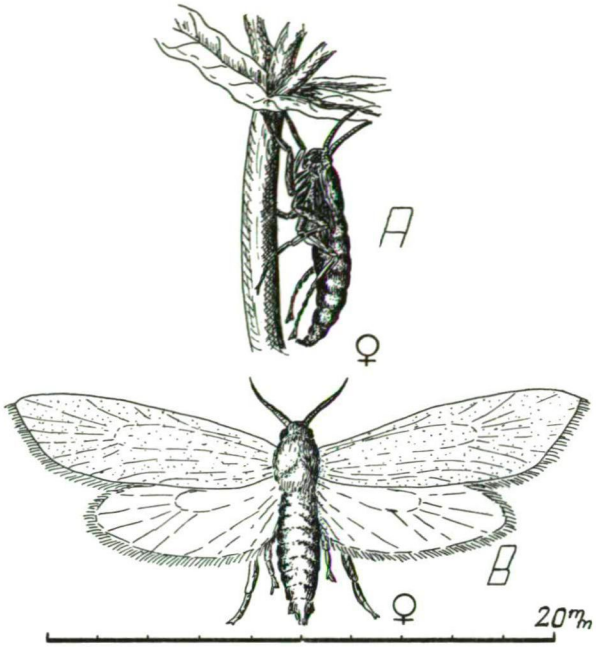


Fig. 3. Female *Acentria nivea* O., — form having rudimentary wings (A), and form capable of flying (B).

The life of the imagos is extremely short. They mostly hatch from pupation period in the evening hours. The copulation takes place during the night, then by morning the exhausted animals rest on the water-plants. The males mostly perish there, and the females under the water, shortly after oviposition. Roving males can only rarely be observed during the day above the water.

The annual two generations fly from the end of March and the beginning of August, respectively, but the two flying periods generally meet. The offsprings of the August generation overwinter as caterpillars. From the offsprings of the vernal generation, not each becomes imago for the Summer population; one part of them overwinter as caterpillars and only take part as imagos among the first generation of the next year.

In the Mártély-Körtvélyes backwaters significant changes took place in the living circumstances of the species; such a process started in 1981, respectively, which increased more in the following year and made possible the mass swarming characteristic in general to the species. The cause of this phenomenon could be made comprehensible by numerous assumptions, from which the most important and perhaps most realistic are the followings.

The development of the species' mass gradation could not have been hindered by the lack of nourishment, since the most common host-plants of the species is known: *Ceratophyllum, Myriophyllum, Potamogeton* (ZELLER, KENNEL, RITSEMA, ENTZ and SEBESTYÉN 1942, GOZMÁNY 1963); and *Elodea canadensis* and *Peplis portula,* resp. (SCHNEIDER, NOVÁK); which can all be found in the backwaters in smaller-larger quantities, but some of them even in high amount.

Let us label the presently unknown factor "K" (Figs. 4A, B).

In the Figure the unknown factor has optionally given theoretical values, to which a few thoughts should by all means be added due to the ascertained being of the sex. The phenomenon detectable in Figures 1 and 4 may have unpredictably many chemical and biological causes. If this factor is of biological nature, such organisms living in water should be counted upon, which with their existence or disappearance changed the ecological conditions necessary for one of the stages of development of the species.

During the period of the long-standing observations the minimal number of the animals may perhaps be explained by the regular malady of the populations, nevertheless, the appearance of the sudden, undiseased stock is difficult to reason. Furthermore, several biological factors can be taken into account. On the other hand, in case the factor searched for is of chemical origin a lot more alternatives can be propounded. Considering the time-points of swarming, there might have been such a change in water quality which did not occur during the last 12 years till 1981, or was present for only a short period, not being able to show an effect on the populations of the *Acentria nivea.*

The possibility of a long-lasting, regular toxicity arose, however, this fact would have been known before the specialists from the analysis of the water samplings. Otherwise, the bacteria living in the water are the most sensitive against various toxicities. Nevertheless, toxicity of such high degree which would have lasted for over ten years was not demonstrable.

Figure 4A shows a considerable change, in which case if it were realistic the "K" factor would have gone through such a great change till the reaching of the high amount of the animals, which would have produced spectacular consequences in several other areas at the backwaters. The studies would be largely facilitated by the finding of such organisms which in the same medium went through similar great changes, correlating with the changes observed in case of *Acentria.*

Widening further the row of characteristics conferred on the unknown factor, it is possible that as the consequence of an effect the dimorphous ratio of the females greatly shifted to the benefit of the rudimentary winged animals. To accept this, the opinion of an insect-hormonal specialist is necessary, however, in case of positive opinion the "K" factor could according to the sense result from the behaviour of the females. They wait for copulation by thrusting out their abdomen from under the water surface. Oil pollution in a thickness of a few microns on the surface would be enough to harm the imagos, which pollution did occur due to the minimal, but unavoidable contamination by grease of the holiday resort motor-boat engines, water conservancy pumps and other machines. These oil stains generally accumulate where dense vegetation rises from the water, and this is mostly where the mentioned females can also be found. A shift in such direction would evidently influence the scope of the male animals, too. This area would mainly be stricted to the surface of the water, therefore — using traditional lepidopterologic instruments — their estimation and collection, respectively, are not possible.

The physical or chemical disintegration of the cocoon walls leads by all means to the death of the puppets, since — as it is known — their breathing takes place through the stigma.

The damage caused by carnivores should not be disregarded either, although the opinion is becoming more and more general that if a population sets out, carnivores are then unable to veritably overtake it, break it down. Yet, in case the damage

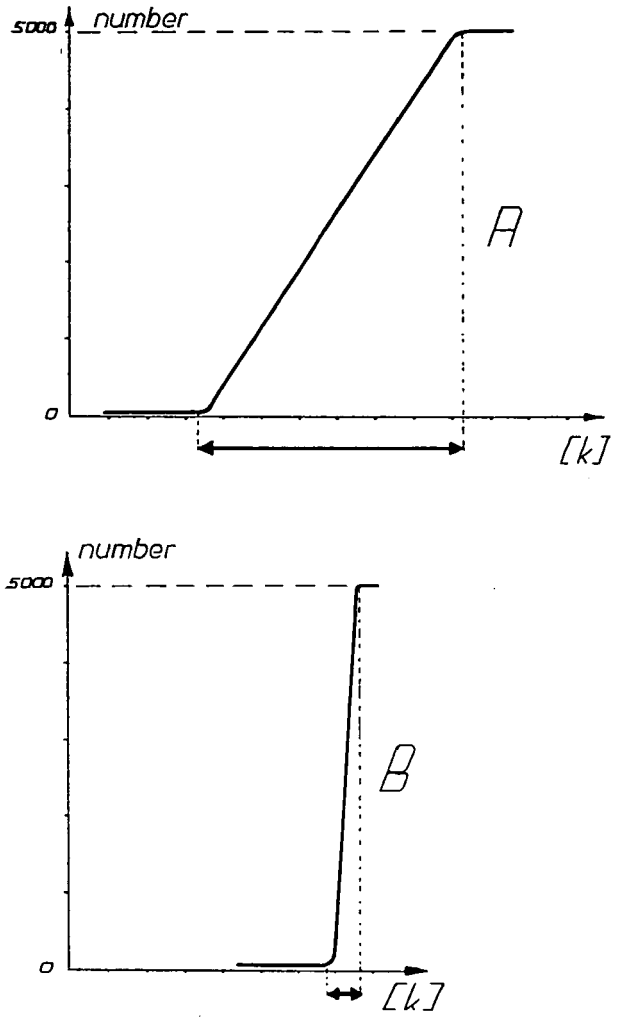


Fig. 4. Factor inhibiting the development of *Acentria nivea* O., and the formation of the number of animals, shown on curves. The development of gradual gradation (A), and gradation without transition (B).

caused by the carnivores was so great, it should have affected the animals of other orders significantly also. However, this was not demonstrable either.

A study demonstrating the ratio of the species' copiousness and mortality due to any causes would be of importance. If the "K" factor is interpreted by the gradual discontinuance of the motive causing the mortality, then a milder curve would be gained after the bottom, latent section of the curve representing the number of animals, nevertheless, this case cannot be compared to the presently reviewed state of the *Acentria* (Fig. 4A).

Every factor which can altogether be taken into account, and of which only very small changes were detectable by specialists participating in the research activity of

the Tisza, may have possibly been capable in their total effect to inhibit till a critical limit the normal development of the species, which fact should also be mentioned as an agglomerational relationship. In 1981 this complex factor came close to, then shortly even passed the critical limit-threshold, and resulted a population dynamic, which could be illustrated by a hysteresislike front curve (Fig. 4B).

In the frame of the newer Tisza Research Programme there would be need for a laboratorial experiment series and for one carried out between natural circumstances so that further light could be thrown on the afore-mentioned, unsolved problems. These problems, the favourable and unfavourable effects as to the species, may have probably been long ago determined during the course of the regular bed-related and associate studies, merely their reference to each other with the matter of the *Acentria* had not been accomplished, since the sheer existence of this strange species had not been followed with adequate interest.

The question arises: what if there is no "K" factor? On the basis of the works of KASZAB, KOVÁCS and SCHMIDT the material of the National Museum gives evidence of mass swarming from the regions of Zalavár, Vörs, Királyhalom and Tarhos, however, swarming period is not demonstrable. Beyond our knowledge so far, it comes to light that where it occurs, the *Acentria nivea* is not mass everywhere, and consequently it is also likely that a so far unknown, strong periodical tendency is manifested in the gradation of this species. The complete settling of the expectable gradation period in the area of the Mártély-Körtvélyes backwaters is certainly to be waited for till years.

## References


ENTZ, G.—SEBESTYÉN, OLGA (1942): A Balaton élete (The life of Lake Balaton). — Budapest.

GOZMÁNY, L. (1963): Molylepkék VI. (Mikrolepidoptera VI.) — Magyarország Állatvilága *16*, 170—171. Budapest.

LAMPERT, K. (1904): Az édesvizek élete (Life of the fresh waters). — Budapest.

NOVAK, I.—SEVERA, F. (1980): Schmetterlingsführer. — Praha.


## Az Acentria nivea Olivier, 1791 (Lepidoptera: Acentropidae) fenológiai és ökológiai viszonyai a Mártély-Körtvélyesi holtágakban


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**Kivonat**

A Mártély-Körtvélyesi Tájvédelmi Körzet területén 1969 óta végzett folyamatos lepkészeti megfigyelések alapján egy eddig nem ismert jelenség hívta fel a figyelmet az *Acentria nivea* OLIVIER-re. A megfigyelés kezdetétől 1981-ig a fajnak csupán minimális példányszáma volt megfigyelhető, majd a következő évben előfordulása már tömeges volt. Ennek okára keresvén magyarázatot, a tanulmány tartalmazza a faj fejlődésének rövid ismertetését, valamint a helyi körülmények feltételezett és valós hatását, amelyek a faj fejlődését befolyásolták, vagy befolyásolhatták.

## Фенологические и экологические условия (Acentria nivea Olivier, 1791 Lepidoptera: Acentropidea) в мёртвых руслах Мартей-Кёртвейеш

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**Резюме**

На территории заповедника в Мартей—Кёртвейеш начиная с 1969 года нами систематически проводятся наблюдения над бабочками, в ходе которых неизвестное до сих пор явление обратило наше внимание на *Acentria nivea* Olivier. С начала наблюдений до 1981 года наблюдалось лишь минимальное количество особей вида, а на следующий год их появление стало массовым. В поисках ответа на вопрос о причинах этого, статья останавливается на кратком описании развития вида, а также на предполагаемом и действительном влиянии местных условий на развитие вида.

## Fenološki i ekološki odnosi Acentria nivea Olivier, 1971 (Lepidoptera, Acentropidae) u mrtvajama Mártély-Körtvélyes

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**Abstrakt**

Tokom kontinuiranih ispitivanja Lepidoptera, započetih u 1969. godini, obratili smo pažnju na dosada nepoznatu pojavu kod *Acentria nivea* Olivier. U periodu od 1969—1981. godine vrsta se javljala sa minimalnom brojnošću, dok je u 1982. godini došlo do masovne pojave ovog leptira. U cilju objašnjenja te pojave, u radu je prikazan tok razvoja vrste kao i uticaj pretpostavljenih stvarnih faktora sredine, kojisu mogli uticati i pod čijim je dejstvom realizovan razvoj populacije