(COPEPODA, CYCLOPOIDA)

by A.V. Monakov   Translation by Peter Marck.

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In the last decade there have appeared several works on the feeding of marine and freshwater copepodal crustaceans (Fryer, 1957a; Kozhova, 1953, 1956; Beklemishev, 1954; Mironov, 1941, Yanovskaya, 1956, and others). Nevertheless, the feeding of freshwater copepods, especially cyclopoida, has been poorly covered. The majority of existing special works on the feeding of cyclopoida illustrate this question only from the qualitative side.

The food content of the nauplius of freshwater cyclops has not been studied at all, also the feeding of adult entomostracans on bacteria. Moreover the question of the suitability of vegetable food for cyclops is not clear enough.

Quantitative data on the predatory feeding of cyclopoida occur only in the work of N.A. Dzyuban (1937), where the average daily intake figures, expressing the number of entities consumed, are quoted. The degree of use of different foods, however, and the influence of temperature on the intensity of feeding of cyclops have up to this time remained unexplained. All this has also defined the object of our work to a significant extent: to elucidate as fully as possible the nutrition of Acanthocyclops viridis (Jur.) - a large cyclops, inhabiting the mass of demersal layers of the open parts of the Rybinsk reservoir and its foreshore.

The present work is devoted only to the predatory feeding of A. viridis, and includes data from the content of the intestines of cyclops, collected in natural conditions, and also the results of experimental observations carried out in a laboratory during 1958.

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The method and mechanism of feeding.

The feeding methods of cyclops have been described long ago, and the majority of authors include them in the active predators. According to Dietrich (1915) and Naumann (1923), the capture of food takes place with a definite choice. V.M. Rylov (1948) assigns all cyclops to active snatchers. N.A. Dzyuban (1937), however, remarks that cyclops never pursue prey, but seize it at the moment of meeting. In the work of Fryer (1957a) there is a good description of the hunting methods of cyclops. In his opinion, the general character of the behaviour of predators (with non-pelagic forms in view) is that in the pursuit of prey they move about over the substratum in short jerks. With this in view the author disclaims the directing role of smell and vision and considers that cyclops react to the presence of prey only after collision with it. The not always successful attempt to seize its prey is a reaction to the accidental collision. Upon this the cyclops actively attacks its victim, which is in close proximity to it.

Our observations on the feeding methods of A. viridis were carried out under a ~~microscope~~ binocular in Petri dishes, into which various nutritive objects were introduced: infusorians, young and adult forms of crustaceans, larvae of tendipedidae, oligochaetae. It appeared that whenever a cyclops collided with moving organisms (copepodites of other copepods, a few cladocerans) and its attempt to seize its prey resulted in failure, it never pursued its victim. Its reaction to the unsuccessful attack is usually shown by its more agitated movements in the area of the collision. The cyclops begins intensive searches, moving rapidly in spirals or in concentric circles. This is natural, since in such a case the success of the hunt depends on the first attack. On colliding with slow-moving forms (larvae of tendipedidae, oligochaetae) the cyclops usually disposes of them quickly. The basic grasping organs of cyclops, according to Fryer (1957a) are the maxillas.

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The role of the mandibles is mainly to tear the victim to pieces. The swimming legs are extended forwards, and frequently the first pair of these, as we were able to observe, seemed to support the victim's body. The antennae do not take part in the taking of food.

The act of feeding of cyclops has been sufficiently well described in the work of N.A. Dzyuban (1937) and T.M. Meshkova (1953). There is, however, no single opinion on the cyclops' method of taking food. Thus, N.A. Dzyuban shows that Acanthocyclops viridis when feeding on daphniae(?) of up to 1.3 mm. eats its victim whole, while Macrocyclops albidus sucks its prey dry. T.M. Meshkova in her experiments with Cyclops strenuus and Acanthocyclops gigas only observed the sucking. Fryer (1957a), experimenting on Macrocyclops albidus, M. fuscus and Acanthocyclops viridis, maintains that only the inside of a large victim is eaten, and that the skin remains. Small objects are usually swallowed whole. In evidence Fryer brings forward Myuller's experiment, where a cyclops Acanthocyclops bicuspidatus was fed with coracidae(?) sestode(?) and in this way was poisoned.

Our observations have shown that the large, simplest nauplius of copepods are usually swallowed whole. On bringing up A. viridis on a culture of Blepharisma infusorians, possessing a light lilac coloration, it was possible to observe the passage of the infusorians through the intestinal tract and even to produce an approximate account of the specimens which had been swallowed. The juvenile stages of cladocerans, the early copepod stages of 0.2-0.4 mm. and also oligochaetae (tubificids and naididae) are rarely swallowed whole. As a rule, they are first torn to pieces. Large specimens of crustaceans, and also the larvae of tendipedidae are sucked.

The feeding of Acanthocyclops viridis in natural conditions.

The collection of material for analysis of the intestinal contents of cyclopoida took place in the summer of 1958. Cyclops were collected with a scraper on the foreshore of Rybinsk reservoir. The modified herring trawl of Greze-Markovsky was employed on the deeper stations of the open parts of the Volga reach (Monakov and Mordukhai-Boltovsky, 1959). The collected cyclops were delivered alive to the laboratory. Under binoculars the crustacean was dissected and the gut exuded, which was then transferred into a drop of distilled water , covered with a protective lens, and the content analysed under a microscope. In all the contents of 200 intestines were analysed (fig. 1). It appeared that for the greater part of the cyclops (62.5%) the intestinal contents lacked any kind of particles having form. As a rule these presented a thoroughly digested mass of different shades from light yellow and greenish to dark brown, with many fatty substances. Almost always with dissection algae were encountered, mainly protococci. A significant portion of the intestines (22.5%) contained bristles of oligochaetae, chiefly Naididae and in a lesser amount Tubificidae. Fryer (1957b) observed an almost equal amount of oligochaetae (21.6%) in the intestines of cyclops of this kind, after examining 50 specimens. A significantly rare amount of the remains of crustaceans and the larvae of tendipedidae - from 2 to 5% were encountered in the intestines.

Fig 1. The feeding of A. viridis in natural conditions.

Питание A. viridis в естественных условиях

Пищевые остатки Food remnants	Количество кишечников, содержащих остатки (No of intestines containing remains)	%	Пищевые остатки Food remnants	Количество кишечников, содержащих остатки (No of intestines containing remains)	%
Неопределяемая, бесформенная переваренная масса (Indetermined formless completely digested mass)	125	62.5	Остатки Cladocera (Remnants)	10	5.0
Неопределяемые остатки членистоногих (indetermined remains of arthropoda)	4	2.0	Остатки Copepoda	6	3.0
Неопределяемые остатки насекомых (Undet. remains of insects)	4	2.0	Остатки Tendipedidae	6	3.0
			Щетинки Oligochaeta (Bristles)	45	22.5
			Всего (Total)	200	100

The feeding of A. viridis under experimental conditions.

The feeding of A. viridis on Oligochaetae.

The high percentage of bristle content in the intestines can either indicate the cyclops' preferential feeding on oligochaetae, or result from the fact that bristles are retained in the digestive tract of cyclops longer than the remains of other organisms. To decide this question two experiments were conducted. The first consisted of 25 cyclops which had been kept hungry for 48 hours before the experiment being placed in water which had been filtered previously. As food 50 entities of Polyphemus pediculus (0.7-0.9 mm. in size), 20 Daphnia longispina (0.9-1.1 mm.), 20 Tubifex tubifex (7-9 mm.) and 20 Paratendipes albimanus (3-5 mm.) were introduced. After 48 hours the remaining creatures were counted, and the intestines of all the cyclops examined. The results are collated in fig. 2, from which it is evident that cyclops clearly prefer polyphemi. On dissection of the cyclops, however, it appeared that out of 25 intestines 14 contained a thoroughly digested mass with fatty substances, 10 contained the bristles of oligochaetae, one the remains of daphnia and bristles, but not one of the intestines disclosed the remains of polyphemi.

The second experiment was designed to reveal the duration of the presence of bristles of oligochaetae in the digestive tract of cyclops. For this a quantity of 31 adult specimens of A. viridis were fed during the course of 120 hours on the oligochaetae Tubifex tubifex. After this the cyclops were dispersed into vessels containing filtered water (10 in each) without food, and after 24 hours the intestinal contents of 10 cyclops were analysed. 72 hours after the first dissection a second part of the cyclops was examined and again after 48 hours, the third part. From fig. 3 it can be seen that already after 48 hours the intestines of only two individuals contained bristles, but that after 5 to 7 days they did not occur in one creature. A parallel review of the experiments revealed the presence of bristles there.

Thus the frequency of bristles of oligochaetae in the intestines of cyclops taken from the reservoir is explained not by their preference for oligochaetae, but by the fact that these are swallowed, while their favourite prey - cladocerans - is sucked.

Fig. 2. The consumption of A. viridis of different nutritive objects.

Таблица 2

Потребление A. viridis различных кормовых объектов

Вид корма (Type of food)	Количество особей (No. of individuals)	Из них съедено (No. of those eaten)
Polyphemus . . .	50	50
Daphnia	20	7
Tubifex	20	13
Paratendipes . .	20	3

Fig. 3. Duration of presence of oligochaetae bristles in the digestive tract of A. viridis.

Время голодания (в сутках) (Period of hunger (in days))	Число вскрытых кишечников (No. of dissected intestines)	Число пустых кишечников (No. of empty intestines)	Число кишечников, содержащих щетинки (No. of intestines containing bristles)
2	10	8	2
5	10	10	0
7	11	11	0

To generalize on the given facts, it may be remarked that the analysis of the intestinal contents of cyclops collected in natural conditions gives us only a very approximate idea of the composition of their food. It is impossible to speak about their favourite food only from the material obtained in dissections. In connection with this we consider that careful attention should be paid to Fryer's deductions (1957b) on the interspecific competition of predatory cyclops, based only on an analysis of the intestinal contents of cyclopoids.

The significance of the availability of prey.

In order to elucidate the question of favourite food the following series of experiments was conducted: varied living food with a concentration estimated as nearly as possible to that in natural conditions was introduced into vessels with filtered water of a capacity of 100 to 200 cubic cc. After this 10 cyclops of identical size were introduced. As food Polyphemus pediculus, Daphnia longispina, Tubifex tubifex and Paratendipes albimanus were offered. Regularly every 24 hours an estimate was made of how many living organisms remained. In all six series of such experiments were made. The results of the experiments are set out in fig. 4, from which the preference for polyphemi to other types of food is quite distinct (in three experiments the figures are very close). Oligochaetae are consumed to a lesser extent, and daphniae and tendipedidae are hardly used at all. Analogous facts were received in an experiment to elucidate the causes of the frequent occurrence of oligochaetae bristles in the intestines of cyclops (fig. 2). In experimental conditions all kinds of food were equally accessible, which the conscious artificiality of the experiment determined. Vegetation and layers of soil were removed from the vessels in the experiment. Attetntive observation of the behaviour of predators and victims, however, showed us the cause of the favourite feeding on polyphemi. The lastxx ones to be accommodated in the vessel are always concentrated in small groups. Their movements are relatively fast, but at the same time quite smooth, which we did not observe with the daphniae, which move about in short jerks. These circumstances also determine to a significant extent the success of the search for polyphemi. On colliding with a cyclops the polyphemus almost always becomes its victim.

Non-mobile oligochaetae, like the polyphemi, are concentrated in definite parts of the tank, and this significantly lightens the predator's quest. In this way, the more intensive preying on polyphemi and oligochaetae is explained by the ability of these and others to form clusters. Having prey such as polyphemi and oiligochaetae in such a sufficient quantity the cyclops, naturally, consume less daphniae and tendipedidae. The first are less accessible thanks to the nature of their movements, the second because of their more durable coverings. In all the experiments the cyclops showed a preference for organisms of a smaller size.

Fig. 4. Feeding preference of A. viridis (1st series of experiments - in vessels without vegetation and silt)

Таблица 4

Пищевое предпочтение A. viridis (1-я серия опытов — в сосудах без растительности и ила)

Вид корма (Type of food)	Количество (в особях) (No. of individs.)	Из них съедено (No. of those eaten) — experiments: 1-й опыт	2-й опыт	3-й опыт
Polyphemus pediculus	25	25	22	22
Daphnia longispina	25	1	1	1
Tubifex tubifex	10	4	4	3
Paratendipes albimanus	10	0	0	2

Fig. 5. Feeding preference of A. vir. (2nd seried of experiments - in vessels with vegetation and silt)

Пищевое предпочтение A. viridis (2-я серия опытов — в сосудах с растительностью и илом)

Вид корма (Type of food)	Количество (в особях)	Из них съедено: 1-й опыт	2-й опыт	3-й опыт
Polyphemus pediculus	25	19	25	24
Daphnia longispina	25	2	5	0
Tubifex tubifex	10	2	2	4
Paratendipes albimanus	10	0	0	0

In order to verify if such were the preference for these or other types of food in conditions close to nature, we conducted in parallel exactly the same experiments, with this difference, that a layer of silted sand and some shoots of hornwort were introduced into the tank (fig. 5). Comparing the figures in 4 and 5, it is possible to see that the changed conditions of the experiment have said little on the character of feeding of cyclops. As before, the polyphemi were consumed more intensively than anything else. The tendipedidae which rapidly hid themselves in the soil were completely untouched. Obviously, in natural conditions the larvae of tendipedidae, which inhabit the upper layer of soil, can scarcely serve as food for the cyclops; most probably only larvae of the first stage can become victims of predators, when they are leading a plankton form of life (Mordukhai-Boltovskoi and Shilova, 1955). In the experiments with silt the consumption of oligochaetae fell somewhat, but, as our observations showed, the cyclops sometimes succeed in grasping the protruding tail section of a worm, and the worm is bodily pulled out of the soil. Naididae inhabiting the watery area amongst the macrophytes are naturally more accessible to cyclops than the tubificidae living in the soil. Nevertheless, the latter, especially their young, come within the diet of A. viridis.

It should be noted that the diet of cyclops is not restricted to the organisms which have been enumerated. Direct observations have shown that A. viridis will greedily eat almost all crustaceans. Only some Chydoridae (Chydorus sphaericus, Alona sp. etc.), possessing a close, chitinous covering are exceptions to this.

Cannibalism amongst cyclops of the same age has been very rarely observed, even in a high concentration of them. But in the event of the natural death of one of these, its body is quickly eaten by other members. With the restriction to one vessel of adult cyclops and their larvae, the latter are often victims to the adults.

In the selection of cyclops's food the factor of availability has great significance, namely: the victim's degree of mobility, the strength of its integument, and the size of its body. In one combination of food, for example oligochaetae + polyphemi, cyclops choose the lesser forms; in another (Chydorus + Tubifex) the strength of the integument is the deciding factor.

Intensity of feeding and the degree of use of kinds of food.

As is well known, under the intensity of feeding the amount of food consumed by an animal for a definite space of time must be understood (Ivlev, 1955). In our experiments the daily consumption of food was calculated, the so-called daily ration. The above-mentioned four kinds of organisms served as food for the cyclops. The main point of the experiments consisted in the following: One or another kind of food was offered to the cyclops, which were dispersed in crystallisers [in some cases 10 cyclops were placed in each vessel, in others one per vessel]. Articles of food were chosen in succession. If these were oligochaetae or tendipedidae, these were dried on filter paper until the damp patches disappeared and weighed on analytical scales with an accuracy up to four figures. Whenever crustaceans were chosen as food, not bearing the drying very well, we selected four groups of organisms of one size of fifty members each. The first fifty were introduced into a vessel with the cyclops, while each of the remaining groups were separately dried and weighed, after which the average weight of the fifty nutritive objects was calculated.

The experiments lasted from 48 to 96 hours at a temperature of 20 degrees C, after which the remaining living creatures and their remnants (cladoceran conches, fragments of tendipedidae and oligochaetae) were dried and weighed. Then the daily ration of one cyclops was calculated.

Before going over to a discussion of the results, it is necessary to remain on the following: as has already been said, cyclops mainly suck their prey dry. Therefore after the conclusion of the experiment there remained a great deal of dead, but not consumed, creatures on the bottom of the vessel. Together with the empty conches and skins it is possible to encounted fragments of tendipedidae and oligochaetae. Naturally when these remains are dried, losses in weight are completely inescapable. On account of this we deliberately raised the estimate when calculating the daily rations. Therefore the indexes of the weight of daily rations listed below give only a relative, quantitative characteristic of feeding. Nevertheless, for the comparison of sizes of the daily consumption of different types of food (for example, daphniae and oligochaetae) the indexes of weights are more convenient than rations expressed in the number of individuals eaten. Finally, these figures express the difference in the sizes of daily rations of cyclops in experiments at various temperatures sufficiently correctly. This also caused us to count not only the number, but also the weight of the articles of food eaten.

In order to explain the role of predatory cyclopoida in general trophic connections together with the facts on the degree of use of different types of food, a knowledge of the potential hunting capacity of the cyclops has great significance, namely: how many organisms of a definite shape and size it can kill in 24 hours.

<u>Dia. 1. Daily ration of A. viridis in individual (1) and mass (2) feeding.</u>

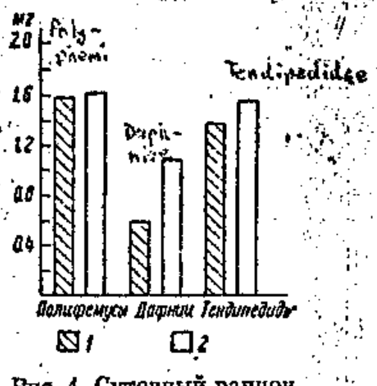


Рис. 1. Суточный рацион A. viridis при индивидуальном (1) и массовом (2) кормлении.

<u>Dia. 2. Daily ration of A. viridis with different foods.</u>

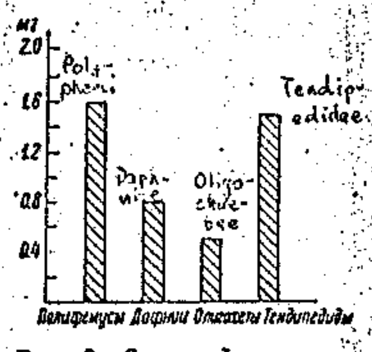


Рис. 2. Суточный рацион A. viridis при различных кормах.

In diagram 1 is shown the fluctuation of the daily ration of oné specimen of A. viridis in two different experiments. In one case 10 cyclops were kept separately with one in each vessel, and the shaded columns of the diagram indicate the average ration of one A. viridis. In the other case 10 cyclops were kept together - the unshaded columns. The concentration of food per unit of size in the second case was correspondingly larger. As is evident from the diagram, the size of the ration of cyclops xxx hardly changes when they are fed with polyphemi and tendipedidae, but on feeding with daphniae there is some increase in mass content.

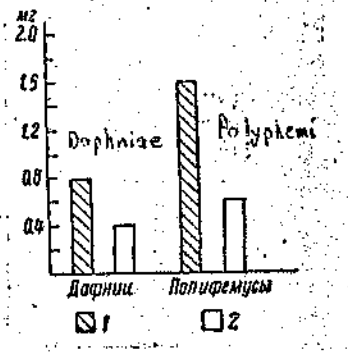
Individual fluctuations in the daily ration of cyclops are just as insignificant when fed with polyphemi and tendipedidae, and appear more rarely in experiment s with daphniae (fig. 6). Obviously this is explained by the fact that the latter are more mobile than polyphemi and tendipedidae, as a result of which the individual hunting abilities of the predators have some significance.

In diag. 2 are listed the average daily rations of cyclops fed with four kinds of invertebrates. In these experiments the polyphemi and tendipedidae were consumed more intensively than ever, and daphniae and oligochaetae significantly worse. The daily ration of one cyclops fed with polyphemi consisted of 1.62 mg. by weight of the predator itself according to the tables of standard weights 0.2mg (Mordukhai-Boltovskoi, 1954). There was almost the same ration in experiments with xxx feeding with tendipedidae. When oligochaetae served as food, it exceeded the weight of one cyclops by 2.5 times. The lowering of the size of the daily ration on feeding with oligochaetae is connected with the fact that, as we have already noticed above, these organisms, as distinct from crustaceans and tendipedidae, are not sucked dry but mainly swallowed. Therefore when the sizes of the daily ration are calculated by the method of weighing the remains we get less excessive figures than for crustaceans and tendipedidae.

Fig. 6. Individual differences in size of daily ration of A. viridis on feeding with different kinds of prey.

Daily ration / Суточный рацион (в мг)		
Polyphemi / поли-фемусы	Daphniae / дафнии	Tendipedidae / тенди-педиды
1.7	1.3	1.5
1.7	0.1	1.0
1.8	0.2	1.6
1.8	0.8	1.5
1.7	0.8	1.5
1.9	0.1	1.6
0.6	0.8	1.1
1.2	—	2.0
1.9	—	1.1
1.4	—	1.1

Dia. 3. Daily ration of A. viridis, calculated by methods of direct weight (1) and by tables of restored weights (2)



In dia. 3 are depicted the daily rations of cyclops, calculated by two methods: by the direct weighing of nutritive objects and by the means of counting the dead organisms by their restored weights. As is apparent, an error made in weighing the remains on account of the lossin in weight while drying exceeds the error which we make as a consequence of calculating by the tables the weight of all the dead members (of which many are not completely eaten). The sizes of the daily rations received by the second method, although overestimated, are nearer to the genuine ones.

In calculating the numbers of creatures which were eaten it appeared that for one cyclops the average daily consumption of daphniae (size 0.9-1.1mm.) consists of 3.3 individuals (from 1 to 7), of polyphemi (0.7-0.9 mm.) - 5 individuals (from 1 to 9), of tendipedidae (5-7 mm.) - 2 individuals (from 1 to 3) and of oligochaetae (7-12 mm.) - one individual. N.A.Dzyuban (1937), feeding cyclops with daphniae, received close figures: the average daily ration of A. viridis in his experiments comprised 2 specimens of daphniae of size 1.1-1.3 mm.

Thus the ration of the predatory A. viridis is quite large in relation to its bulk.

In order to elucidate what part of the food killed by the cyclops is used by it, we conducted experiments applying the isotopic method. Their main point is that the cyclops were offered as food a definite quantity (50 - 75 members) of different kinds of filter-feeders(?), marked C^{14}, namely: Daphnia longispina (size 1.5–1.7 mm.), Diaptomus gracilis and D. graciloides (0.9–1.1 mm.), Diaphanosoma brachyurum (0.7–0.9 mm.)x and Ceriodaphnia quadrangula (0.7–0.9 mm.). These entomostracans were marked by breeding them in a culture of protokocci algae, marked C^{14} (Sorokin and Meshkov, 1958).

After 48 hours the number of dead and partially consumed individuals was counted, and the quantity of organic substance (to a mg. C) was calculated, transferring from the victim's body to that of the predator (Monakov and Sorokin, 1958). The relation of this quantity to the carbon content in the entomostracans killed by the cyclops gave us the coefficient of the use of food. The carbon content in the bodies of the entomostracans was determined by the method of damp burning (Sorokin, 1958).

The results of the experiments are collated in fig. 7, from which it is apparent that the coefficient of usage is small, and fluctuates from 9.4 to 27.7% from the general weight of the victims killed by the cyclops, i.e. consists of an average of one fifth of this. Thus the intensiveness of feeding expressed in the daily rations exceeds the feeding requirements of the predator by 5 times, if we accept that the figures of the coefficient of usage obtained furnish the normal growth and development of cyclops. A similar assumption is possible as long as, in the experimental conditions where the cyclops do not feel any shortage of food, their development carries on normally (Monakov, 1958a, 1958b).

Taking into account the high trophic plasticity of A. viridis – its ability to consume bacteria (Monakov and Sorokin, 1958), protozoa (Bogatova, 1951; Monakov, 1958a, 1958b), the majority of marine invertebrates – it is difficult to imagine that in natural conditions A. viridis feels a shortage of food. The areas of its habitat in Rybinsk reservoir are the demersal layers of the exposed parts (Monakov, 1958b) and the shallow waters of the foreshore (Mordukhai-Boltovskoi and others, 1958), where the concentration of nutritive material is considerable. Probably the intensity of its feeding in nature is determined for the most part by the availability of prey and the individual capacities of the predators. In that case, if the factor of availability loses its significance (under experimental conditions or on account of high natural concentrations of food), then the assimilability of food also influences the size of the ration, as is apparent to some extent from fig. 7. Under assimilability in the example given, we understand the amount of organic substance transferred to the predator's body on account of the feeding on marked food.

Fig. 7. Degree of usage of different kinds of food by cyclops.

Степень использования различных кормов циклопами

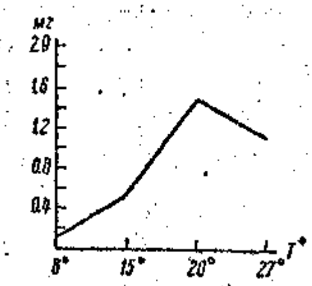
Продолжительность опыта (в сутках) / Length of experiment (in 24 hrs.)	Вид корма / Type of food	1. Содержание углерода в 1 экз. кормового объекта (в γ C)	2. Число заданных кормовых объектов	3. Число циклопов в опыте	4. Убито кормовых объектов (всего)	5. Количество органического углерода вещества, перешедшего в тело рачка в 1 сутки (в γC/1 экз.)	6. Убито кормовых объектов в 1 сутки 1 циклопом	7. Суточный рацион (в γC/1 экз.)	8. Коэффициент использования корма (в %)
2	Daphnia longispina .	6.0	75	23	53	0.65	1.15	6.9	9.4
2	Diaptomus gracilis и D. graciloides . .	6.8	50	19	38	1.65	1.10	6.8	24.2
2	Diaphanosoma brachyurum	3.3	50	10	39	1.40	1.95	6.4	21.8
2	Ceriodaphnia quadrangula	6.8	50	8	28	3.3	1.75	11.9	27.7

1) Carbon content in 1 spec. of food object
2) No. of given food objects
3) No. of cyclops in experiment
4) No. of food objects killed
5) Quantity of organic carbon in substance passing into body of entomostracan in 24 hr
6) No. of food objects in 24 hrs
7) Daily ration
8) Coefficient of food usage

The influence of temperature on the intensity of feeding.

There is no doubt that physical factors, in particular temperature, influence the intensity of feeding. This distinctly appeared in experiments where cyclops were fed with tendipedidae (dia. 4). On conducting experiments with four temperature values (8, 15, 20 and 27° C) the maximum consumption of food was observed at 20°. With further increase in temperature the intensity of feeding begins to decrease, but still remains higher than at a temperature of 15°.

Dia. 4. Influence of temperature on daily ration of A. viridis.



Conclusions.

1. Acanthocyclops viridis is a predator, actively attacking its prey. Its food in natural conditions is composed of many forms of marine invertebrates, with the exception of some chydoridae(?), ostracods and molluscs.
2. The selectivity which A. viridis shows to various forms of food is determined to a significant extent by the accessibility of prey - its mobility, structural covering and dimensions of its body.
3. The intensity of feeding of A. viridis is fairly high; each cyclops is in the course of 24 hours capable of killing and eating, in parts, an animal which significantly surpasses it in height and weight. With the help of the isotopic method, however, it has been established that the coefficient of usage of food is small and fluctuates from 9.4 to 27%.
4. A. viridis comes out as the direct rival to many game fish, therefore it is undesirable to examine the mass development of this species in small, fish-pond based economies, where a shortage of feeding material may be felt.

Assessing the reservoirs from the point of view of their production of fish, account should be taken of the presence there of predatory cyclops, distinguished by their high trophic plasticity.

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