154. On the Relative Activities of *Diaptomus chaffanjonii* and *Cyclops strenuus* at Different Temperatures.

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1.

Diaptomus chaffanjonii Richard and *Cyclops strenuus* Fisher are main components of plankton at Senshun Pond in the compound of the Tokyo Literature and Science University; the former is abundant in summer and the latter in winter every year.¹⁾

The author has made several experiments on these Copepoda. The present paper deals with the relative activities of these organisms at different temperatures.

As the standard of quantitative measurement of relative activity of the Copepoda, the author employed Pekarek's method of mittlere doppelseitige²⁾ Erstpassagezeit, which has been used in the study of Brownian movement of minute granules in the protoplasm.

The materials were kept about 40 minutes in the water of experimental temperature before the observation.

2.

The results of these experiments are shown in table 1 and Fig. 1.

TABLE 1.

<i>D. chaffanjonii.</i>		<i>C. strenuus.</i>	
Temp. Exp. II	Seconds for 10 crossing	Temp.	Minutes for 30 crossing
8.2	270.5	3.5	3.7
9.7	235.5	5.8	3.5
12.3	189.7	8.2	2.7
14.4	170.3	10.0	3.0
16.7	192.4	11.0	2.8
18.5	158.6	13.0	2.8
20.0	117.3	15.5	2.3
22.0	105.6	19.0	1.8
24.6	89.0	20.5	2.0
27.0	88.0	21.5	1.7
29.0	85.3		

The temperature coefficients of these reactions have been calcu-

1) Horasawa, I. 1932. The relation between the periodicity of Plankton and the nature of the water in Sotobori and Senshun-ike Pond (in Japanese). Japanese Jour. limnol. Vol. 2, p. 29-43.

2) The parallel lines were at intervals of 9 mm at the first experiment and at the second were of 10 mm.

lated with the application of Bělehrádek's¹⁾ formula $y = \frac{a}{x^b}$ as follows.

TABLE 2. Temperature coefficient (b).

<i>Diaptomus chaffanjonii</i> .			<i>Cyclops strenuus</i> .	
range of Temp.	Exp. 1. XII 13-14, '34.	Exp. 2. X 6, '35.	range of Temp.	Exp. 1. XII 13-14, '34.
9-16° C	0.56	0.70	3- 9° C	0.106
17-24° C	2.39	2.27	10-21° C	0.77

These values of b are coincident with other reactions of the two Copepoda, such as that of heart beat, contractile movement of alimentary canal etc. Those of *Diaptomus chaffanjonii* of Exp. 1 and 2 slightly differ in their values, probably due to the error of experiment and the seasonal difference of the time of experiments, as in the case of Lang,²⁾ Crozier and Stier³⁾ etc.

The critical points of *Diaptomus chaffanjonii* are distributed as follows, namely, 8-10° C, 16-17° C and 24° C and at the second one of these, that is, at 16-17° C, the peculiar mode of

Fig. 1. The relative activity of *Diaptomus chaffanjonii* at different Temperatures.

Fig. 2. The relative activity of *Diaptomus chaffanjonii* at different Temperatures.

reaction has occurred as shown in Fig. 1. Such a sudden retardation of the biological processes may be due to the peculiarity of the colloidal state of protoplasm.

The temperature coefficients of *Cyclops strenuus* are lower than those of *Diaptomus chaffanjonii*, the critical point being 8-10° C.

The above-mentioned critical temperature suggests

1) Bělehrádek, J. 1926. Influence of temperature on biological processes. Nature. Vol. 118, p. 117-118.

2) Lang, A. 1910. Über den Herzschlag von *Helix pomata* L. während des Winterschlafes. Festschr. z. 60. Geburtst., Rich. Hertwigs, 3, S. -A. (abter Kaniz. 1915).

3) Crozier, W. J. and Stier, T. B. 1925. Temperature characteristics for heart beat frequency in limax. Journ. Gen. Physiol. Vol. 7, p. 705-708.

Fig. 3. The relative activity of *Cyclops strenuus* at different Temperatures.

season when the water temperature is above $16-17^{\circ}\text{C}$, namely, above the peculiar critical temperature of *Diaptomus* and with the cooling of the pond water below this point, gradually decreases in number of individuals.

The periodicity of *Cyclops strenuus* is opposed to that of *Diaptomus*. It increases in number in the cold season and reaches the maximum number at the time when the water is cooled below the critical temperature of the present species, $8-10^{\circ}\text{C}$. These relations are shown in Fig. 4 in the text.

As described above, the range of optimum temperature of *Diaptomus* is $17-24^{\circ}\text{C}$ and that of *Cyclops strenuus* below 10°C . In closing the author has much pleasure in tendering his thanks to Prof. Y. Okada for the valuable criticism.

us the important significance of analysing the ecological habitudes of *Diaptomus chaffanjon* and *Cyclops strenuus* in Sen-shunen Pond.

The *Diaptomus chaffanjon* is one of the steno-warm water forms widely distributed in the South-western part of Japan and is plentiful in the pond aforementioned and actively propagates in the warmer

Fig. 4. The relation between the temperature and the periodicity of *Diaptomus chaffanjon* and *Cyclops strenuus*.