Lauterbornia H. 14: 17-22, Dinkelscherben, September 1993

Description of antennal deformation in larvae of *Micropsectra* (KIEFFER) (Diptera; Chironomidae) from the river Rhine, The Netherlands

[Beschreibung von Antennenmißbildung bei Larven von *Micropsectra* (KIEFFER) (Diptera; Chironomidae) im Rhein, Niederlande]

Marianne Greijdanus-Klaas

With 1 Figure and 4 Tables

Schlagwörter: Micropsectra, Chironomidae, Diptera, Makrozoobenthon, Rhein, Niederlande, Antenne, Deformation, Mißbildung, Gewässerverschmutzung, Toxizität

Antennal deformation in the chironomid genus *Micropsectra* was found in the Dutch part of River Rhine. The top of the first and second antenna segments was engarged. In consequence the length of these segments was decreased to about half of the normal length.

Bei einer Untersuchung im Rhein, wurde Antennenmißbildung bei Mückenlarven von der Gattung *Micropsectra* angetroffen. Die Spitzen des ersten und zweiten Antennengliedes waren aufgedunsen. Hierdurch war die Länge dieses Antennengliedes bis zur Hälfte reduziert.

1 Introduction

In the family of the Chironomidae several types of morphological deformations are known. Most of the described deformations are mentum and ligula deformations. Other deformations are those of the paraligulae, hypopharyngeal pecten, epipharyngeal pecten, dorsomenta, mandibles and antennae in Tanypodinae, and labral lamellae, mandibles, premandibles, ephiparyngeal pecten, mentum and antennae in Chironominae and Orthocladiinae (WARWICK 1990). In general observations of mentum deformations are most common. Types of deformations found in Chironomidae are summarized in Tab. 1.

Antennal deformation in the genus *Micropsectra* was unknown. However, this type of deformation was found in *Micropsectra* spec. in the Dutch part of the River Rhine.

2 Materials and methods

The chironomid larvae were collected from an artificial substrate placed on the river bottom. This substrate consists of glass marbles (diam. 20 mm) in stainless steel wire baskets (size 20*20*20 cm). Colonization period was 4 weeks (BIJ DE VAATE & GREIJDANUS-KLAAS in prep). After this period the macroinvertebrates were collected on a 500 µm sieve placed under an 18 mm sieve on which the marbles were washed. The chironomids were preserved in 96% alcohol, and studied at a magnification of 400 times.

Sampling site was the international sampling station in the vicinity of Lobith, where the River Rhine enters The Netherlands (km 865). At this station water quality is monitored.

Tab. 1: Different types of deformation in Chironomidae

taxa	ligula/ mentum	antenna	other	author
Tanypodinae				
Procladius (Holotanypus) type sp. 2				WARWICK 1990
Procladius (Psilotanypus) bellus				WARWICK 1990
Procladius spp.				WARWICK 1990
Procladius sp.				KERKUM unpubl.
Clinotanypus sp.				WARWICK 1990
Coelotanypus sp.				WARWICK 1990
Prodiamesinae				
Prodiamesa olivacea				KERKUM unpubl.
Orthocladiinae				
Psectrocladius (Psectrocladius) sp. 2				WARWICK 1990
Chironominae				
Chironomus anthracinus	+			DERMOTT 1991
C. muratensis	+			VAN URK & al. 1992
C. plumosus	+			WARWICK 1990
C. plumosus	+			VAN URK & al. 1992
Chironomus sp.	+			WARWICK 1990
Cryptochironomus digitatus	+			DERMOTT 1991
Cryptochironomus sp. 1	-			WARWICK 1990
Cryptotendipes sp.	+			WARWICK 1990
Dicrotendipes modestus	+			DERMOTT 1991
Dicrotendipes gr. *nervosus*	+			KERKUM unpubl.
Dicrotendipes sp.	+			WARWICK 1990
Glyptotendipes sp.	-			KAISER 1990
Harnischia sp.	+			DERMOTT 1991
Parachironomus arcuatus gr. sp. 1	+			WARWICK 1990
Paralauterborniella sp.	+			WARWICK 1990
Paratendipes sp.	+			WARWICK 1990
Phaenopsectra jucundus	+			DERMOTT 1991
Polypedilum gr. *nubeculosum*	+		-	KERKUM unpubl.
Polypedilum sp.	+	-	+	WARWICK 1990
Tribelos sp.	+	+	+	WARWICK 1990
Tanytarsini type a	+	+	+	WARWICK 1990

3 Results

In the period March-May 1989, antennal deformation was found in the species *Micropsectra* spec. The top of the first and second antenna segments was engarged (Fig. 1). In consequence, the length of these segments was decreased to about half of the normal length. When antennal deformation in *Micropsectra* spec. was found, it concerned only the right antenna (from ventral view).

Numbers of *Micropsectra* spec. larvae found in the period March-May 1989, and the percentages of antennal and mentum deformation are given in Tab. 2. The two different deformations were not observed in the same animal.

Mentum deformations observed in *Micropsectra* spec. were the so-called "Köhn gaps", a deformation characterized by a large gap in the mentum which may include the loss of some teeth (KÖHN & FRANK 1980). During the sampling period mentum deformations in other chironomid species were noticed as well (Tab. 3).

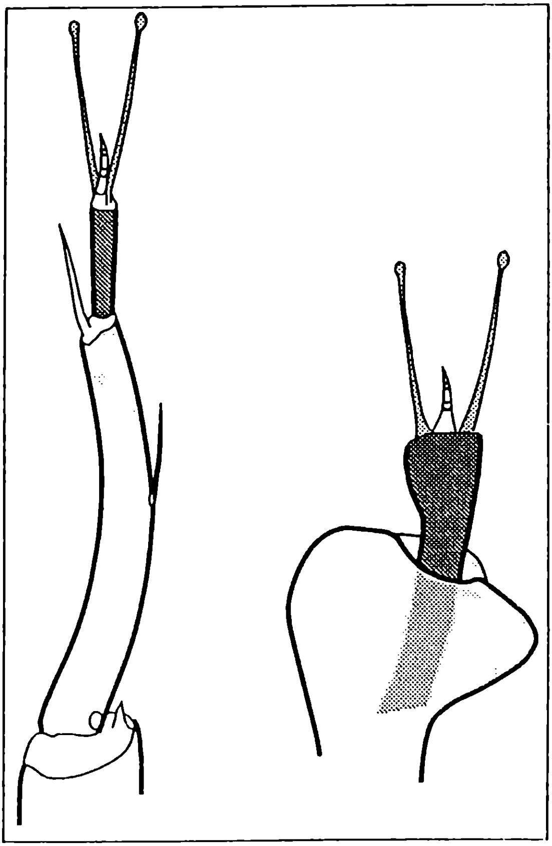

Fig. 1: Antennal deformation in *Micropsectra spec.*
left = normal shape, right = deformed antenna

Tab. 2: Numbers (n) of *Micropsectra* spec. observed, and percentages deformation

date	n	deformation antenna		mentum	
		n	%	n	%
03/03/89	40	4	10,0	2	5,0
17/03/89	41	2	4,9	2	4,9
14/04/89	259	1	0,4	1	0,4
28/04/89	248	2	0,8	0	
12/05/89	259	2	0,8	0	

Tab. 3: Taxa with mentum deformations, found during this study

Prodiamesinae
Prodiamesa olivacea
Chironominae
Chironomus sp.
Dicrotendipes gr. *nervosus*
Rheotanytarsus sp.

4. Discussion

In literature deformations in chironomid larvae are suggested to be caused by pollution of their habitat (WARWICK 1989; WARWICK & TISDALE 1988; WARWICK 1990; KAISER 1990; DERMOTT 1991; VAN URK & al. 1992). Experiments with contaminated sludge and water using cultured chironomid larvae did not establish a direct relationship between pollution and deformations. HAMILTON & SÆTHER (1971) found a negative relationship between antennal deformation and the dichlordifenylethene concentration.

From field studies it is impossible to prove relationships between pollution with specific chemicals and the occurrence of deformations in chironomids. In general, no information is available about important factors like combined effects of contaminants, and the contribution of physical parameters (e. g. pH, O_2, temperature) on the effect of these substances. Apart from the effects of chemicals (HAMILTON & SÆTHER 1971; HARE & CARTER 1976; WARWICK 1980), low oxygen concentrations too have an effect on the deformation of chironomid larvae (FRANTZEN 1989). The type of deformation in chironomid species, caused by specific substances is (still) unpredictable. The different types of deformations are assumed to be dose dependent. In general, effects seem to become manifest first in antennal deformation followed by mandible, mentum and ligula deformation (WARWICK 1990). Also the further development of deformed larvae is not clear. VAN URK & KERKUM (1986) found an increase in the percentage of deformated chironomid larvae in the period of pupal development. This indicates a delay in pupal development of the deformed larvae. However, from laboratory experiments it is known that deformed chironomid larvae are able to pupate (JANSSENS DE BISTHOVEN & OLLEVIER 1989).

Although pollution of the River Rhine decreased during the last two decades (VAN DER KLEI & al. 1991), accidental spillages of chemicals or unknown substances influence water quality considerably. During the period of this study (March-May 1989), several incidents took place (Tab. 4).

The percentages of antennal deformations found in this study are relatively low. It is not possible to give conclusions about relationship with pollution.

Aknowledgements

I gratefully like to thank the following persons for textual or contextual criticism: Bram bij de Vaate, Liesbeth Grootelaar, Frans Kerkum, Sandra Rientjes and Elke Dykmann.

Tab. 4: Substances influencing the water quality of the River Rhine, January-May 1989. (Concentrations have been measured at km 865).

date	location	substances	application
18/01/89	km 76.5	gasoil	fuel
19/01/89	km 170	Norflurazon	herbicide
24/01/89	km 430	2,9 µg/l N,N Dimethylaniline	basic compound color production
30/01/89	km 424	2,7 µg/l 1,3,5-Trioxan	solvent
05/02/89	unknown	1,3 µg/l Toluene	solvent
05/02/89	km 424	Bazazol	unknown
08/02/89	unknown	Choline-esterase inhibitors	pesticide
08/02/89	km 809	ammonium sulphate, 2,4 µg/l	
12/02/89	km 733	chloronitrobenzene	compound synthesis
14/02/89	km 766	several pollutants, fire accident Bayer	
23/02/89	unknown	Aniline	basic compound color production
27/02/89	km 157	tri-chloroethylene	industrial fat solvent
01/03/89	km 424	NaOH + PO_4^{2-}	
08/03/89	km 123	1,5 ton coolant	
10/03/89	Birsfelden	diesel oil	fuel
17/03/89	km 768	aniline	basic compound color production
18/03/89	unknown	diesel oil	fuel
30/03/89	km 768	gasoline	fuel
30/03/89	km 630	fuel oil	fuel
30/03/89	km 478	bilge oil	carter oil
03/04/89	km 478	fuel	oilfuel
12/04/89	km 511	diesel oil	fuel
12/04/89	unknown	N, N, dimethylchloro-aniline	basic compound color production
13/04/89	km 434	di-methoxy-methane	unknown
18/04/89	Karlsruhe	oil from ship	
29/04/89	km 871	6 ton Mecoprop	herbicide
07/05/89	km 713	oil	
09/05/89	km 734	5 µg/l 2,6 di-tertiarbutylmethylphenol	unknown
12/05/89	km 700	dichloromethanesolvent	
13/05/89	km 710	2,4 & 2,6 dinitro-toluene	basic compound explosives
18/05/89	km 818	gasoline	fuel
23/5/89	km 733	dichloroethane	solvent
30/05/89	unknown	triphosphate	fire retardant
		tributyl n-butylbenzene	unknown
		sulfonamide	unknown

References

BIJ DE VAATE, A. & M. GREIJDANUS-KLAAS (in prep.): A standardized artificial substrate for monitoring macroinvertebrates.

DERMOTT, R. M. (1991): Deformities in larval Procladius spp. and dominant Chironomini from the St. Clair River.- Hydrobiologia 219: 171-185, Den Haag.

FRANTZEN, N. (1989): De invloed van enkele abiotische parameters op het ontstaan van morfologische afwijkingen bij Chironomus riparius (Diptera).- DBW/RIZA stageverslag afd. Ecotoxicologie, Lelystad.

HAMILTON, A. L. & O. A. SÆTHER (1971): The occurence of characteristic deformities in the Chironomid larvae of several Canadian lakes.- Can. Entomol. **103(3)**: 363-368, Ottawa.

HARE, L. & J. C. H. CARTER (1976): The distrubution of Chironomus (s.s.) cucini (salinarius group) larva (Diptera: Chironomidae) in Parry Sound Georgian Bay, with particular reference to structural deformities.- Can. J. Zool. **54**: 2129-2134, Ottawa.

JANSSENS DE BISTHOVEN, L. & F. OLLEVIER (1989): Some experimental aspects of sediment stress in Chironomus gr. thummi larvae (Diptera: Chironomidae).- Acta Biol. Debr. Hung. **3**:147-155, Debrecen.

KAISER, U. (1990): Morphologische Abnormitäten bei Zuckmückenlarven (Diptera: Chironomidae) im Rhein: Mißbildungen der Antenne bei Glyptotendipes.- Mainzer Naturw. Arch **28**: 81-87, Mainz.

KÖHN, T. & C. FRANK (1980): Effects of thermal population on the Chironomid fauna in an urban channel.- In: MURRAY, D. A. (ed.) Chironomidae. Ecology, systematics, cytology and physiology: 187-194, (Pergamon press) Oxford.

KÖHN, T. & C. FRANK (1980): Effects of thermal population on the Chironomid fauna in an urban channel.- In: MURRAY, D. A. (ed.) Chironomidae. Ecology, systematics, cytology and physiology: 187-194, (Pergamon press) Oxford.

VAN DER KLEI, W., R. H. DEKKER, H. KERSTEN & J. A. W. de WIT (1991): Water management of the river Rhine: past, present and future.- J. Europ. Water Poll. Contr. **1**: 9-18, Amsterdam.

VAN URK, G. & F. C. M. KERKUM (1986): Misvorming bij muggelarven uit Nederlandse oppervlaktewateren.- H_2O **19(26)**: 624-627, Ryswyk.

VAN URK, G., F. C. M. KERKUM & H. SMIT (1992): Life cycle patterns, density, and frequency of deformities in Chironomus larvae (Diptera: Chironomidae) over a contaminated sediment gradient.- Can. J. Fish. Aquat. Sci. **49**: 2291-2299, Ottawa.

WARWICK, W. F. (1980): Pasqua Lake, Southeastern Saskatchewan: a preliminary assessment of trophic status and contamination based on the Chironomidae (Diptera).- In: MURRAY, D. A. (ed.) Chironomidae. Ecology, systematics, cytology and physiology: 255-267, (Pergamon press) Oxford.

WARWICK, W. F. (1989): Morphological deformities in larvae of Procladius Skuse (Diptera: Chironomidae) and their biomonitoring potential.- Can. J. Fish. Aquatic. Sci. **46**: 1255-1271, Ottawa.

WARWICK, W. F. (1990): Morphological deformities in Chironomidae (Diptera) Larvae from the Lac St. Louis and Laprairie Basins of the St. Lawrence river.- J. Great Lakes Res. **16(2)**: 185-208, Ann Arbor, Michigan.

WARWICK, W. F. & N. A. TISDALE (1988): Morphological Deformities in Chironomus, Cryptochironomus and Procladius larvae (Diptera: Chironomidae) from Two Differentially Stressed Sites in Tobin Lake, Saskatchewan.- Can. J. Fish. Aquat. Sci. **45**: 1123-1144, Ottawa.

Determination literature

KLINK, A. G. (undated): Determinatietabel voor de poppen en larven der Nederlandse Tanytarsini. Deel 1: Tabellen tot geslacht. Verslag Landbouw Hogeschool, vakgroep Natuurbeheer, Wageningen

WIEDERHOLM, T. (ed.) (1983): Chironomidae of the Holartic region: keys and diagnoses. Part 1: Larvae.- Entomologica Scandinavica suppl. **19 (1-10)**, Lund.

Anschrift der Verfasserin: Marianne Greijdanus-Klaas, Institute for Inland Water Management and Waste Water Treatment, P.O. Box 17, NL-8200 AA Lelystad, The Netherlands

Manuskripteingang: 07.04.1993