

# REDESCRIPTION AND NEW RANK OF *THERMOCYCLOPS* *TCHADENSIS* DUSSART ET GRAS, 1966 (COPEPODA: CYCLOPOIDA)

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**Abstract.**— *Thermocyclops tchadensis* Dussart et Gras, 1966 is redescribed. Comparison to the closest species and specially *Th. iwoyensis* Onabamiro, 1952 lead to the conclusion that *Th. tchadensis* must be considered as a subspecies of *Th. iwoyensis*, as *Th. iwoyensis tchadensis*.



**Key words.**— Copepoda, Cyclopidae, *Thermocyclops iwoyensis tchadensis* new rank, Africa.

## INTRODUCTION

The cyclopid genus *Thermocyclops* Kiefer, 1927 (Herbst 1986; Defaye et al. 1987) comprises more than fifty species and subspecies. It is represented all around the world, appearing the most diversified in Africa. Only a very few species, such as *Th. crassus* (Fischer, 1853), are cosmopolitan, while some others such as *Th. oithonoides* (G. O. Sars, 1863) and *Th. dybowskii* (Landé, 1890), are restricted to the Palaearctic region. *Th. emini* (Mrázek, 1895), *Th. consimilis* Kiefer, 1934, *Th. neglectus* (G. O. Sars, 1909), *Th. macracanthus* (Kiefer, 1929), *Th. schmeili* (Poppe et Mrázek, 1895) inhabit the African region (Dussart and Defaye, 1985). *Th. decipiens* Kiefer, 1929 has a pantropical distribution. Two other groups can be distinguished, the Asian group with *Th. vermifer* (Lindberg, 1935), *Th. tinctus* Lindberg, 1936, *Th. taihokuensis* Harada, 1931 and the American group represented by *Th. tenuis* (Marsh, 1910), *Th. minutus* Lowndes, 1934), *Th. inversus* Kiefer, 1936 (Reid 1989). Finally, some species are known only from a restricted area, reduced almost to their "type locality" as *Th. tchadensis* Dussart et Gras, 1966, *Th. hooki* Löffler, 1968, *Th. dalmaticus* Petkovski, 1956, *Th. parvus* Reid, 1989.

A taxonomical key using all the data known on the *Thermocyclops* species was published by Herbst (1986). However, the characteristics of some taxa remain confused, probably because their original descriptions lack details, according to the standards of recent taxonomy. *Th. tchadensis* Dussart et Gras, 1966, is here redescribed and its taxonomical status is reexamined, after comparison to closely related species.

## MATERIAL AND METHODS

Three paratype specimens (adult females) of *Thermocyclops tchadensis* collected by R. Gras in Lake Tchad (Dussart and Gras, 1966) and deposited at the Muséum National d'Histoire Naturelle, Paris (registration number: MNHN-Cp939) have been studied and measured using a Medilux-12 microscope (with oil immersion lens). One of them was dissected and drawn with the aid of a camera lucida. As comparative material, the following material has been also studied:

■ *Thermocyclops iwoyensis* Onabamiro, 1952: 2 paratype specimens (adult females) (registration number 1952.11.28.1,2) and 5 adult females from Nigeria, Mkpani Village, collected by Dr. E.I. Braide and deposited at the Natural History Museum, London (England).

■ *Thermocyclops incisus* Kiefer, 1932: 2 females, registration number: 8612, from Lake Volta, Ghana, 1968, F. Kiefer's Collection, in the Staatliches Museum für Naturkunde, Karlsruhe (Germany); 3 females, registration number: 4330-4336, from Lake Victoria, 18.12.1990, U. Einsle's Collection, and 2 females from Lake Ukuruba, Uganda, 05.03.1992 U. Einsle's Collection, registration number: 4278-4279, deposited at the University of Oldenburg (Germany).

■ *Thermocyclops incisus circusi* Dussart et Gras, 1966: type specimens: 1 dissected female, Lake Tchad, 01.01.65, Coll. R. Gras, MNHN-Cp 619 and 2 females and 1 male, preserved in ethanol, Lake Tchad, coll. R. Gras, MNHN-Cp934, from B. Dussart's collection housed in the Muséum National d'Histoire Naturelle, Paris (France).

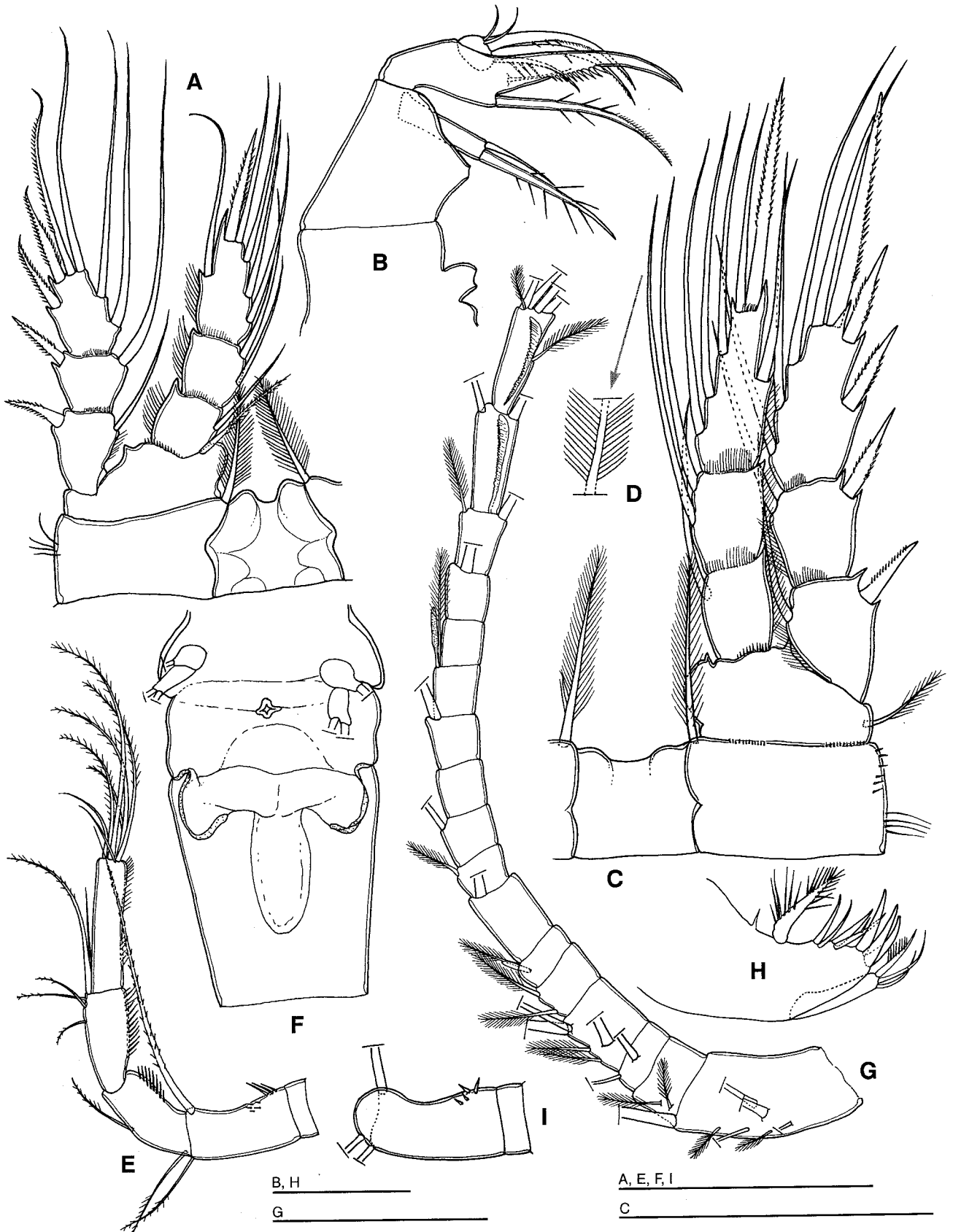


Figure 1. *Thermocyclops ivoyensis tchadensis*, new rank, female. A: P1; B: maxilla; C: P2; D: ornamentation of the setae on natatory legs; E: antenna (frontal side); F: pediger 5 and genital double-somite; G: antennule; H: maxillula; I: basipodite of antenna (caudal side).

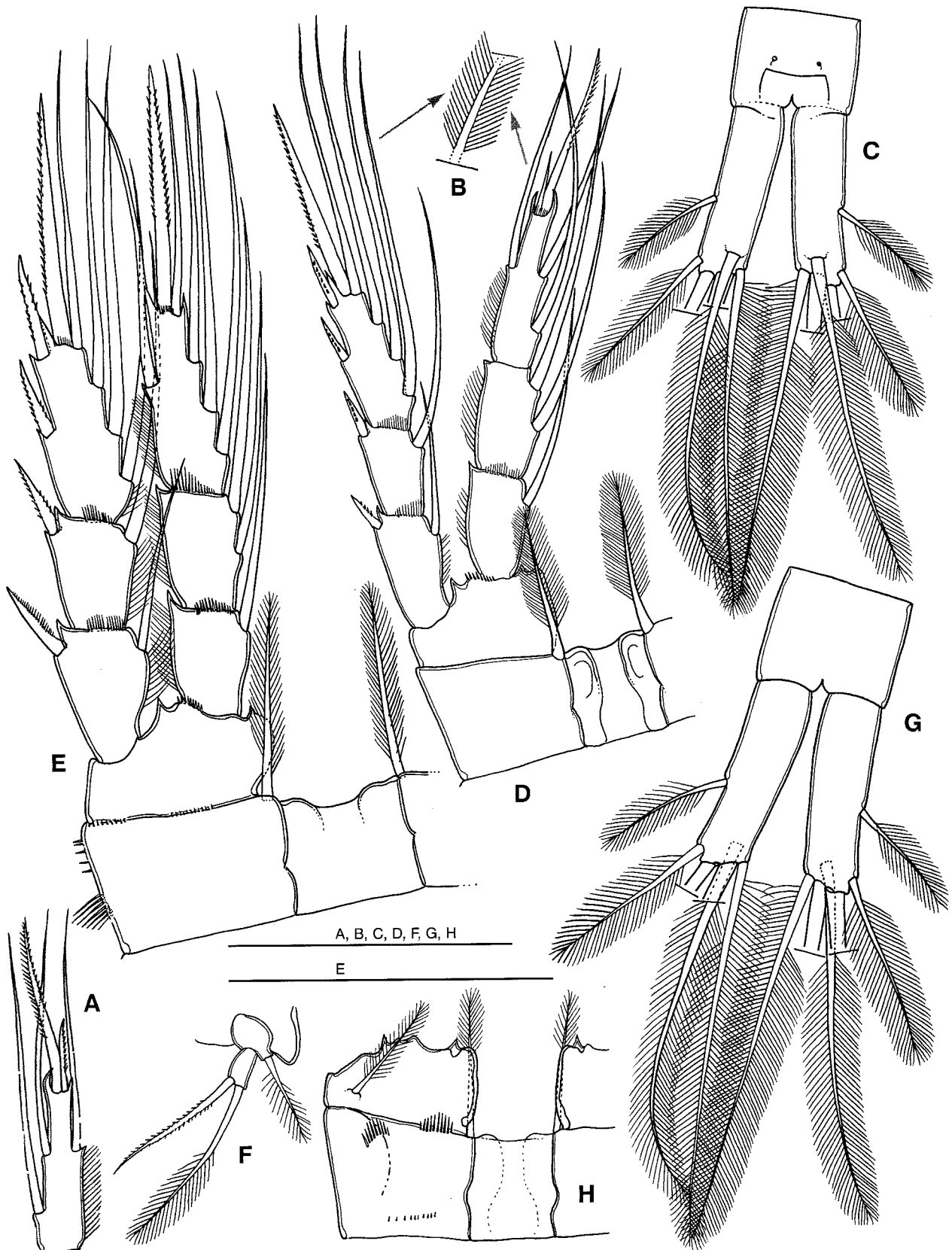


Figure 2. *Thermocyclops tchadensis*, new rank, female. A: Enp3P4; B: ornamentation of the setae on natatory legs; C: anal somite and caudal rami (dorsal side); D: P4 (frontal side); E: P3; F: P5; G: anal somite and caudal rami (ventral side); H: intercoxal plate, coxopodite, and basipodite (caudal side).

Abbreviations used: Enp: endopodite, P1–P4: first to fourth natatory legs.

## RESULTS

### Redescription of female.

Body length without furcal setae : 810  $\mu\text{m}$ .

Body elongated and slender in dorsal view, without ornamentation at dorsal margin of the somites; urosome narrow, about 0.4 times total length of female.

Pediger 5 devoid of spinules on its lateral parts.

Antennule (Fig. 1G): long, 17-segmented, reaching middle of 4<sup>th</sup> pediger. First segment devoid of spinules, 6<sup>th</sup> segment bearing seta and short stout spine, 10<sup>th</sup> and 13<sup>th</sup> segments naked, 12<sup>th</sup> segment with an aesthetasc longer than 13<sup>th</sup> segment. Hyaline lamella finely denticulated, developed on segments 16 and 17.

Antenna (Fig. 1 E, I): basipodite ornamented as follows: on caudal side, four strong spinules located on basal internal edge; on frontal side, group of five setae, inserted near internal edge at mid-length of segment. Second endopodite bearing 5 setae (two specimens studied). Third segment of endopodite markedly longer than second segment of endopodite and terminating with 7 setae.

Maxillule (Fig. 1H): Basis of maxillular palp devoid of spinules.

Maxilla (Fig. 1B): Outgrowths of coxopodite with two strong unequal setae; shorter seta half length of longer. Claw-like endite with row of strong denticles, bearing strong feathered seta at basis.

Maxillary palp with five distal setae; three strong and long and two small and spinous. The general structure of the maxilla is the same as in other *Thermocyclops* and *Mesocyclops* species (Holynska and Fiers 1994).

Natatory legs. Outer margins of coxopodites P1–P3 haired, margins of P4 naked. Spinule pattern on P4 coxopodite bearing, on the caudal side, three rows of spinules arranged as in Fig. 2H. Intercoxal plates of P1–P4 without ornamentation and with barely developed smooth prominences (Fig. 1A,C; Fig. 2D,E,H). Inner distal margin of basipodite of P1 with long spine, barely reaching second segment of endopodite (Fig. 1A). Inner margin of basipodite with setules on P1, without setules on P2 to P4 basipodites. Spine formula of third exopodites: 2.3.3.3; setae formula: 4.4.4.4. Apical spines of exopodites P2–P4 with spinules only on outer margin. Enp3P4 3.15–3.25 times as long as wide; its slightly curved inner apical spine 1.05–1.10 times as long as segment and 2.37–2.42 times as long as outer spine (Fig. 2A,D).

Spine and setae ornamentation of P1 to P4 as follows:

	Coxopodite	Basipodite	Exopodite	Endopodite
<b>P1</b>	0-1	1-1	1-1; 1-1; II,4	0-1; 0-2; 1,1,4
<b>P2</b>	0-1	1-0	1-1; 1-1; III,4	0-1; 0-2; 1,1,4
<b>P3</b>	0-1	1-0	1-1; 1-1; III,4	0-1; 0-2; 1,1,4
<b>P4</b>	0-1	1-0	1-1; 1-1; III,4	0-1; 0-2; 1,II,2

P5 (Fig. 2F): Seta on apical segment slightly longer than spine.

Genital double-somite (Fig. 1F): about 1.5 times as long as wide. Seminal receptacle composed of two parts giving a cross-shaped aspect, a part in T-shape with broad lateral parts showing anterior edge almost straight and slightly bulging at its distal edge, a median posterior part slightly wider than each arm, and an apical concave part.

Anal somite: Distal margin glabrous (two specimens studied, Fig. 2C,G) or bearing two groups of three spinules on ventral side (one specimen observed).

Candal rami: slightly divergent, 3.24–3.37 times as long as wide with naked inner margins (Fig. 2C,G). Innermost apical caudal seta 1.98–2.12 times as long as caudal rami, 0.68–0.71 times as long as outer medial seta, 2.24–2.43 times as long as outermost seta, and 1.0–1.05 times as long as dorsal seta. Distal extremities of inner medial apical caudal setae strongly curved ventrally. No spinules at the insertion of outermost seta or at insertion of median external seta.

## DISCUSSION

*Thermocyclops tchadensis* is close to *Th. emini* (Mrázek, 1895), *Th. incisus* Kiefer, 1932, and *Th. iwoyensis* Onabamiro, 1952. All these species are characterised by the very long antennules, the reduced number of setae on the second segment of endopodite of antennae (5–6, whereas it is 8–9 in most of their congeners), very long dorsal caudal setae, low glabrous prominences on intercoxal plates devoid of ornamentation, and the inner margins of P2–P4 basipodites without setules.

*Thermocyclops tchadensis* is probably closer to *Th. iwoyensis* when we consider the shape of the seminal receptacle, whereas *Th. emini* has a hammer-shaped receptaculum seminis, which is a more common feature within the genus (Baribwegure and Dumont 1999).

*Thermocyclops tchadensis* differs from *Th. incisus* by other following characters:

- second segment of endopodite of antenna bearing 5 setae, whereas there are 6 setae in *Th. incisus*;
- innermost apical caudal seta 2.2–2.5 times as long as outermost seta, whereas this ratio is 2.9–3.4 in *Th. incisus*;
- innermost apical caudal seta about as long (0.9–1.1) as the dorsal seta, whereas it is usually longer than the dorsal seta in *Th. incisus* (1.0–1.4);
- presence of very strong spinules on the distal spines of P5 and endopodites P2–P4 in *Th. incisus* (Kiefer 1933; Van de Velde and Dumont 1982).

The presence of spinules on the distal edge of the anal somite is variable, according to the observations that we have made on both species, and therefore represents a character common to the two species. In all these aspects, *Th. tchadensis* coincides with *Th. iwoyensis*, differing from it mainly by the length ratio of the apical spines of Enp3P4. The ratio is 2.2–2.4 in *Th. tchadensis*, and 2.4–3.1 in *Th. iwoyensis* (Onabamiro 1952; Boxshall and Braide 1991).

In examining the different characters of *Th. iwoyensis* and *Th. tchadensis*, the similarities observed are such that they can be considered as belonging to the same species. However, taking into account the small differences discussed above, we conclude that *Th. tchadensis* must be considered as a subspecies of *Thermocyclops iwoyensis* Onabamiro, 1952, as *Thermocyclops iwoyensis tchadensis* Dussart et Gras, 1966, new rank.

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