

## Descriptions of a New and a Known Species of the Genus *Chronogaster* Cobb, 1913 (Chromadorea:Plectida:Chronogasteridae) from India

NADIA SUFYAN\*<sup>1</sup> AND M. MAHAMOOD<sup>2</sup>

<sup>1</sup>Department of Zoology, School of Science, IFTM University, Moradabad, U.P.

<sup>2</sup>Department of Biology, Qassim University, Buraidah, KSA.

\*Corresponding author; E-mail: nadia.sufyan@gmail.com

Received on 01-12-2018 and Accepted on 17-12-2018

**ABSTRACT:** Various sediment samples were collected from the edge of water bodies located to determine the diversity of aquatic nematodes. During the screening of sediment samples collected from Loktak Lake (a Ramsar Site) in Manipur and an estuary located in Vishakhapatnam a large number of nematodes were found. Of them, a new and a known species of the genus *Chronogaster* Cobb, 1913 were also collected. *Chronogaster loktakensis* sp.nov. is characterised by the presence of vacuolated bodies, crystalloids, faint longitudinal lines, 7-10 µm long cephalic setae, 16-28 µm long radial tubule arising from the base of stoma and tail with a terminal stout mucro surrounded by three spines. While, *Chronogaster citri* Khan & Nanjappa, 1973 is being reported with a difference found in the shape of stoma with additional information on body annules, presence of crystalloid and vacuolated bodies. A key to identification of Indian species has also been provided.

**Keywords:** *Chronogaster citri*; *Chronogaster loktakensis* sp.nov., India; Loktak Lake; Ramsar site.

The genus *Chronogaster* has been reported from a variety of habitats ranging from terrestrial to aquatic, freshwater to salty and thermal springs (Abebe *et al.*, 2006). However, this genus has experienced a lot of lumps and destructors of nematode taxonomy since its first description by Cobb (1913) with the type species *C. gracilis*. De Man (1921) described the genus *Walcherenia* with *W. typica* as type species. However, De Coninck (1935) synonymized *Walcherenia* with *Chronogaster* and accordingly *W. typica* was transferred to *Chronogaster*. Andr ssy (1958) transferred *Cephalobus longicollis* to *Chronogaster*. Heyns and Coomans (1980) gave a detailed taxonomic history and morphology of the genus. They also reported four new species from South Africa. Later in 1983, they added further new species from West Africa, Brazil and Papua New Guinea. Further species were added to the genus by Gerlach (1956), Loof & Jairajpuri (1965), Khera (1972), Khan & Nanjappa (1972), Bajaj & Bhatti (1979), Chaturvedi & Khera (1979), Heyns and Coomans (1983), Maggenti *et al.*, (1983), Raski & Maggenti (1984), Tahseen *et al.*, (1994), Saha & Lal (2001), Mounport, 2005 and Abebe *et al.*, (2013).

Taxonomic keys to the genus have been proposed by Loof & Jairajpuri (1965), Heyns and Coomans (1983) and Raski & Maggenti (1984), all based on females only. Siddiqui (2003) proposed *Keralanema* with its nominal typical species *K. spinicorpus*. However, Holovachov (2004) synonymised *Keralanema* with *Chronogaster*. Holovachov and De Ley (2006) listed 48 valid species belonging to this genus.

The present paper deals with two species of *Chronogaster* collected from two aquatic habitats – freshwater and marine. *Chronogaster loktakensis* sp.nov. was collected from a freshwater habitat while, *Chronogaster citri* from a marine habitat which is a unique habitat for this species as earlier Khan & Nanjappa (1972) reported it from soil around citrus plant.

### MATERIAL AND METHODS

The nematodes were extracted from moist soil samples by the sieving and decantation and modified Baermann's funnel techniques (Flegg, 1967). The extracted nematodes were killed and fixed in FA (4:1)

for 24h and then transferred to glycerine-alcohol (5 parts of glycerine: 95 parts 30% alcohol) for slow dehydration in a desiccator containing fused calcium chloride. Dehydrated specimens were mounted in anhydrous glycerine on glass slides using the wax ring method (de Maeseneer & d'Herde, 1963). All observations, drawing and photographs were made on an Olympus BX 50 DIC microscope.

#### Abbreviations used:

L	=	Total body length
a	=	Body length / greatest body diameter
b	=	Body length / distance from anterior end to the pharyngo-intestinal junction
c	=	Body length / tail length
c'	=	Tail length / anal body diameter
V	=	Distance of vulva from anterior end x 100 / body length
ABD	=	Anal body diameter
VBD	=	Vulval body diameter
diam	=	Diameter

## RESULTS

### *Chronogaster loktakensis* sp.nov.

Fig. (1, 2)

*Measurements:* In Table I

*Females:* Body ventrally curved upon fixation, tapering towards both the ends. Cuticle with prominent transverse striations. Striae 0.5-0.8 µm apart behind lip region, 1.0-1.2 µm at mid-body and 0.5 µm near tail tip. Lateral lines indistinct. Longitudinal lines faint. Lip region truncate, lips being separated at apex not completely fused. Cephalic setae 7-10 µm long. Amphidial apertures transverse, 3-4 µm wide, one to two annules from anterior end. Stoma 7-9 µm in length, cylindrical, with a 16-28 µm long radial tubule arising from the base of stoma. Pharynx cylindrical, terminating in a basal bulb with longitudinally serrated valve plates. Post-bulbular extension 20-35 µm long. Nerve ring at 40-55% of pharyngeal length from anterior

end. Excretory pore present not visible. Cardia bean-shaped. Intestine with wide lumen. Crystalloids seen prominent in pharyngeal region. Vacuolated bodies a few, but a single specimen showed clustered vacuolated bodies below pharyngeal region. Female reproductive system mono-prodelphic, post-uterine sac short, less than one anal body diam. long. Ovary reflexed, on right side of the intestine, oocytes arranged singly in maturation zone while in two rows in germinal zone. Uterus muscular with a wide lumen, single uterine egg is seen in some specimens. Vagina swollen. Vulva transverse not sunken, vulval lips closed. Rectum 1.1-1.3 ABD long. Female tail elongate to conoid 9.6-13.3 VBD long, with three small spines surrounding one stout spike. Caudal glands and spinneret absent.

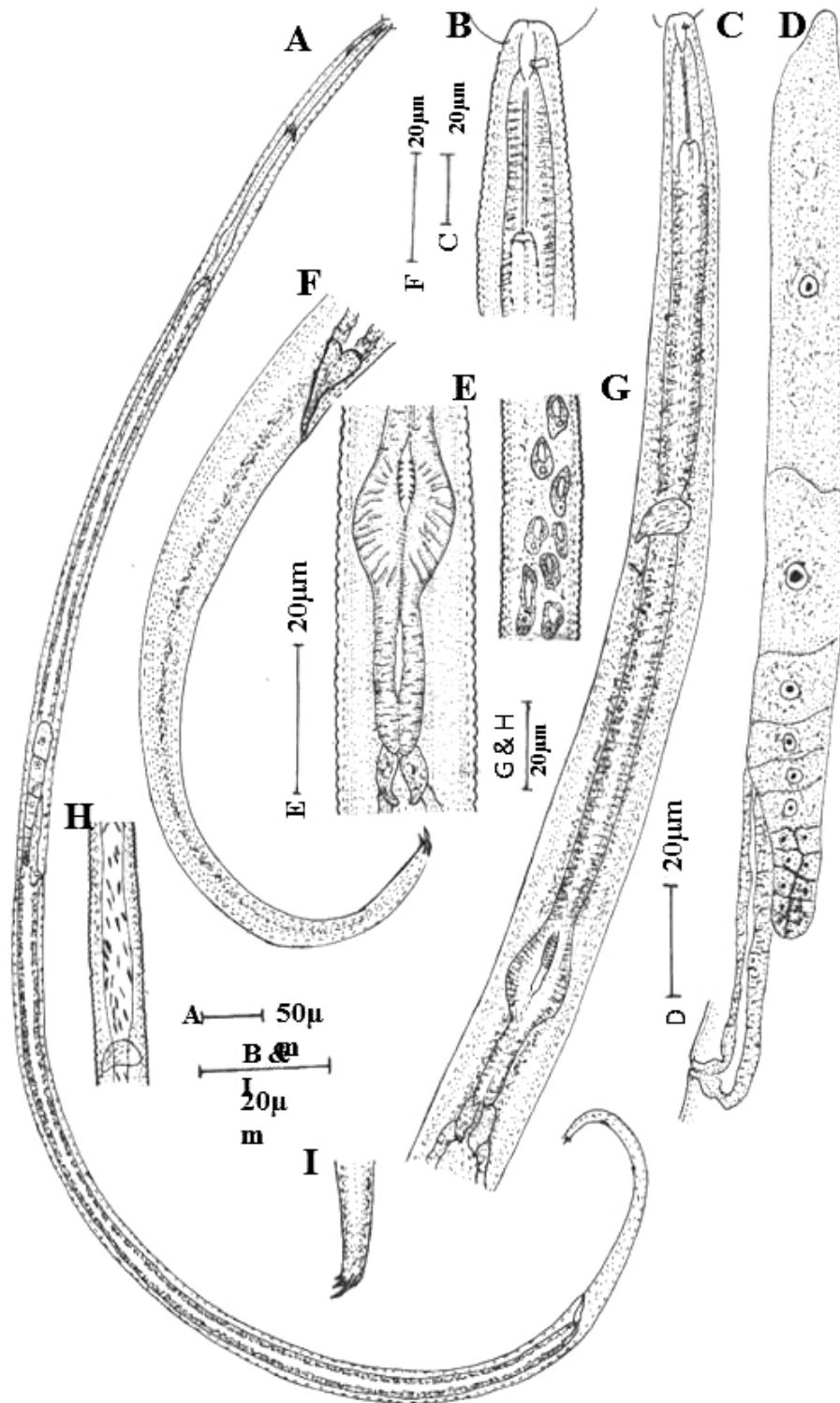
*Type Habitat and locality:* Sediment sample collected from eastern bank of Loktak Lake 24°33'N 93°47'E, Phoubakchao, Manipur, INDIA.

*Type specimens:* Holotype female on slide *Chronogaster loktakensis* sp.nov./1; eight female paratypes on slides *Chronogaster loktakensis* sp.nov./2-6; deposited in the nematode collection of Department of Zoology, Aligarh Muslim University, Aligarh, India.

### Diagnosis and relationship

*Chronogaster loktakensis* sp.nov. is characterised by a medium sized body, transverse amphids, a terminal stout mucro surrounded by three spines.

*C. loktakensis* sp.nov. resembles *C. spinicauda* Tahseen *et al.*, 1994, *C. andrassyi* Loof & Jairajpuri, 1965 and *C. indica* Bajaj & Bhatti, 1979 in general morphology and morphometrics but it differs from *C. spinicauda* in having stouter body ( $a=17-27$  vs 43-58), shorter pharynx ( $b=6-7$  vs 4-5), crystalloid and vacuolated body (present vs absent) and in the number of spines at tail tip (three vs ten). The new species has been reported from an aquatic habitat while the *C. spinicauda* is a terrestrial species extracted from soil around roots of mango. From, *C. andrassyi* Loof & Jairajpuri, 1965 it differs in having fine annules (1-1.2 µm vs 2.5 µm), crystalloid and vacuolated body (present vs absent) and in number of spines at tail tip (3 vs 4). The new species further differs from *C. indica* Bajaj & Bhatti, 1979 in the



**Fig.1.** *Chronogaster loktakensis* sp. n. A. Entire female; B. Anterior region; C. Pharyngeal region; D. Female reproductive system; E. Basal bulb; F. Female posterior region; G. Vacuolated body; H. Pharyngeal region showing crystalloid; I. Tail tip

**Table 1. Measurements (in  $\mu\text{m}$ ) of *Chronogaster loktakensis* sp. nov.**

Mean and S.D. given in parenthesis.

Characters	Holotype female	Paratype females (n = 8)
L	1372	1218–1605 (1462.5 $\pm$ 139.3)
A	20	17–27 (22.5 $\pm$ 3.5)
B	6.3	6–7 (6.7 $\pm$ 0.3)
C	8.8	5–9 (6.8 $\pm$ 0.8)
c $\phi$	9.6	9.6–13 (11.4 $\pm$ 1.1)
V	50	48–53 (50.0 $\pm$ 1.5)
Maximum body width	68	59–79 (65.5 $\pm$ 6.5)
Lip width	7	6–8 (6.5 $\pm$ 0.8)
Lip height	2	2
Length of stoma	8	7–9(8.0 $\pm$ 0.5)
Pharynx	218	190–290 (216.5 $\pm$ 14.0)
Nerve ring from ant end	108	75–115 (85.4 $\pm$ 7.3)
Pharynx base to gonad	270	220–360 (273.5 $\pm$ 28.0)
Anterior gonad	160	100–250 (194.5 $\pm$ 48.5)
VBD	20	17–26 (21.5 $\pm$ 3.0)
Vulva – anus distance	520	440–755 (549.5 $\pm$ 67.0)
Rectum	17	16–25 (18.5 $\pm$ 1.5)
Tail	155	150–230 (174.5 $\pm$ 16.5)
ABD	16	22–25 (23.3 $\pm$ 1.1)

value of *a* (17–27 vs 43–52) and *b* (6–7 vs 4.3–5) and in tail tip (three small spines surrounding one stout spike vs three spines of equal length).

**Etymology:** The species is named after the place it was found.

***Chronogaster citri* Khan & Nanjappa, 1972**

Fig. (2, 3)

**Measurements:** In Table II

**Females:** Body ventrally curved upon fixation, tapering towards both ends. Cuticle transversely striated. Longitudinal lines absent. Annules 1.5  $\mu\text{m}$  apart behind the lip region, 1.8–2.0  $\mu\text{m}$  at mid body and 1.0  $\mu\text{m}$  near tail tip. Lateral lines indistinct. Lip region truncate, lips separated at apex but fused at base. Cephalic setae 8–13  $\mu\text{m}$  long. Amphidial apertures transverse, 3–4  $\mu\text{m}$  wide, located at first annule from the anterior end. Stoma cylindrical, 6–8  $\mu\text{m}$  long, radial tubule 22–30  $\mu\text{m}$  long. Pharynx cylindrical terminating in a basal bulb. Post-bulbular extension 25–30  $\mu\text{m}$  long. Pharyngeal lumen dilated to form a denticulated chamber with longitudinal rows of denticles in basal bulb. Nerve ring at 42–60% of pharyngeal length from anterior end. Excretory pore indistinct. Cardia elongate. Intestine with wide lumen. Crystalloids seen more in pharyngeal region. Vacuolated bodies a few. Female reproductive system monodelphic. Post-uterine sac small, 0.5–0.8 VBD long. Ovary reflexed, on right side of the intestine. Oocytes arranged singly in maturation zone and in multiple rows in germinal zone. Uterus muscular with a wide lumen, single uterine egg seen in some specimens. Vagina swollen. Vulva transverse, not sunken, vulval lips closed. Rectum 1.3–2.0 ABDs long. Female tail elongate-conoid, 10–20 ABDs long. Tail tip with a stout, 2–3  $\mu\text{m}$  long terminal mucro and about 1  $\mu\text{m}$  long two minute spines on each side. Caudal glands and spinneret absent.

**Habitat and locality:** Sediment sample collected from the edge of an estuary, near Rushikonda beach, Vishakhapatnam, Andhra Pradesh, India.

**Voucher specimens:** Seven females on slides *Chronogaster citri* Khan & Nanjappa, 1972 / 1-

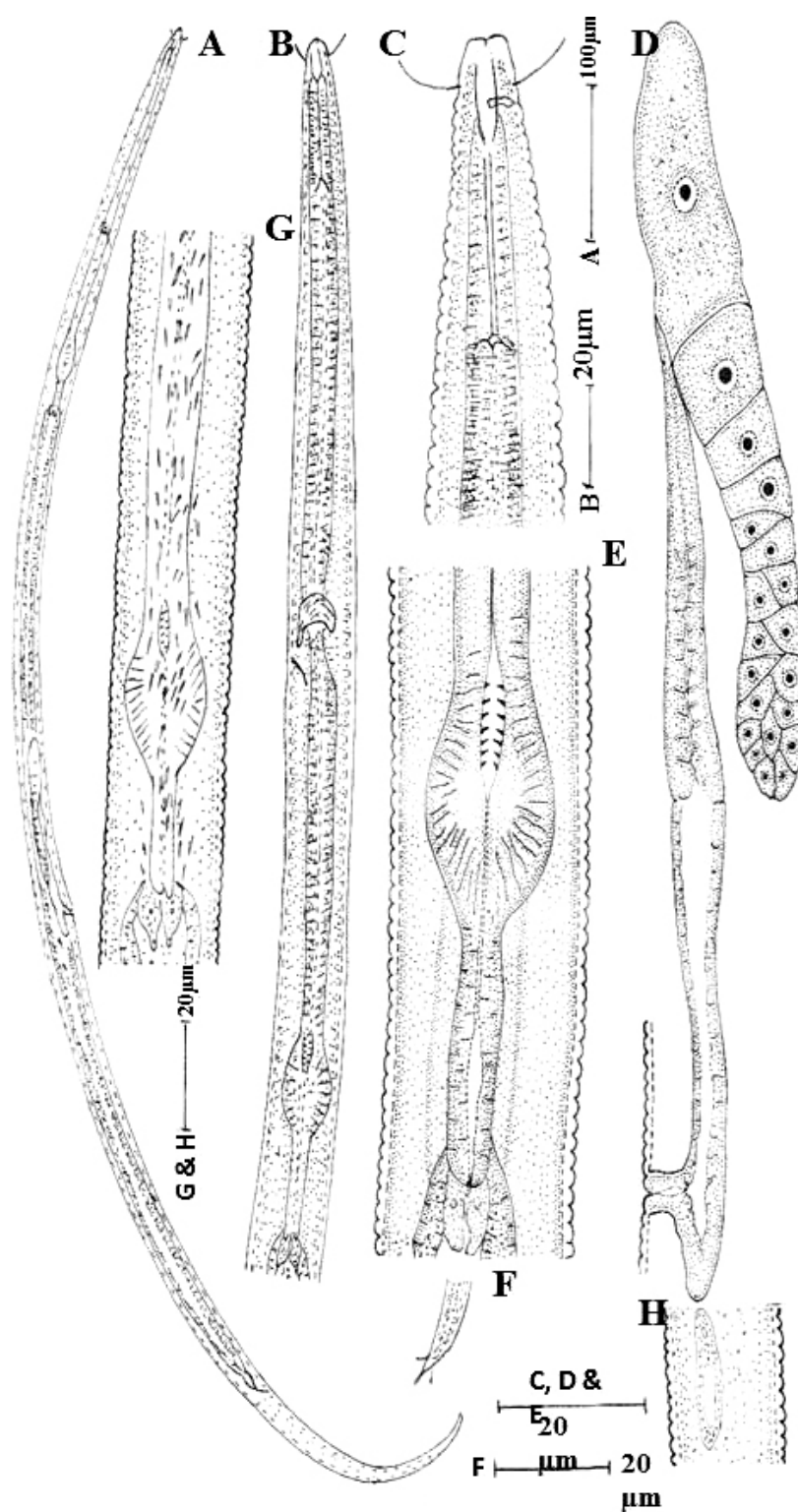


Fig. 2. *Chronogaster citri* Khan & Nanjappa, 1972. A. Entire female; B. Pharyngeal region; C. Anterior region; D. Female reproductive system; E. Basal bulb; F. Tail tip. G. Pharyngeal region showing crystalloid; H. Vacuolated body

**Table 2. Measurements (in  $\mu\text{m}$ ) of *Chronogaster citri* Khan & Nanjappa, 1972**

Mean and S.D. given in parenthesis.

Characters	Females (n=8)
L	1170–1230 (1193 $\pm$ 65.67)
a	43–55 (48 $\pm$ 3.7)
b	4–5 (4.8 $\pm$ 0.4)
c	4–5 (4.7 $\pm$ 0.5)
c $\phi$	10–20 (14.6 $\pm$ 2.8)
V	47–52 (49.6 $\pm$ 1.5)
Maximum body width	22–26 (24.0 $\pm$ 1.5)
Lip width	6–8 (6.5 $\pm$ 0.5)
Lip height	3
Length of stoma	10–15 (13 $\pm$ 1.8)
Pharynx	195–300 (249.5 $\pm$ 34.4)
Nerve ring from anterior end	100–130 (119 $\pm$ 9.9)
Pharynx base to gonad	200–270 (228.0 $\pm$ 24.5)
Anterior gonad	90–120 (105.5 $\pm$ 9.5)
VBD	22–26 (24.9 $\pm$ 1.5)
Vulva – anus distance	345–385 (372.5 $\pm$ 14.5)
Rectum	16–25 (21.5 $\pm$ 2.5)
Tail	145–240 (215.0 $\pm$ 29.5)
ABD	12–16 (14.5 $\pm$ 1.0)

5 deposited in the nematode collection of the Department of Zoology, Aligarh Muslim University, Aligarh, India.

The present population resembles the type population of Khan & Nanjappa (1972) in general morphometric, morphological characters and body size but differs in shape of stoma (barrel shaped *vs* anteriorly constricted stoma), vulva (closed *vs* sunken). Crytalloid and vacuolated body was also observed in our population. Khan & Nanjappa, 1972 described the species as a terrestrial species extracted from soil around roots of grapevine (*vs* marine habitat).

### Key to Indian species of *Chronogaster*

1. Lateral field with four lines.....*C. chilensis*  
Lateral lines indistinct.....2
2. Tail with ventral mucro without spines...*C. neotypica*  
Tail with spines.....3
3. Tail tip (claw-like) with three spines of equal length  
.....*C. indica*  
Tail tip with mucro and spines.....4
4. Tail tip with three spines and a mucro...*C. loktakensis*  
sp.n  
With ten spines and a mucro .....*C. spinicauda*
5. Amphidial apertures circular .....6  
Amphidial apertures stirrup-shaped.....7
6. Tail tip a single mucro and two spines..*C. bengalensis*  
Single axial mucro .....*C. vacouli*
7. Annules coarse, 2.4  $\mu\text{m}$  at mid body, L= 1.25-1.37mm; terminus with four spines, conoid tail tip.....*C. andrassyi*  
Annules fine 2.0, L= 1.07-1.00mm; terminus with two spines, conoid tail tip.....*C. citri*
8. b=4-4.7, c=5-8.....9  
b=4.3-5.3, c=4.6-9.....10
9. Longitudinal incisors 18, tail terminus finely rounded, L= 1.44mm.....*C. alata*  
Longitudinal incisors absent, tail terminus with a large dorsal and small ventral mucro; body length less than 0.8mm.....*C. doai*
9. Annules coarse (<3 $\mu\text{m}$ ), pbl<18, cephalic setae=7-8 $\mu\text{m}$  terminus a spine like extension .....*C. loofi*  
Annules fine (1-2  $\mu\text{m}$ ), pbl<10, cephalic setae=5  $\mu\text{m}$  single mucro.....*C. bigubernaculum*

## ACKNOWLEDGMENTS

This work was financially supported by the University Grants Commission through Maulana Azad National Fellowship, Ministry of Environment and Forests through All India Coordinated Project on Taxonomy and by the Department of Science and Technology (DST) through a Fast Track Project Scheme.

## REFERENCES

- Abebe, E., Traunspurger, W. & Andrassy, I.** (2006). *Freshwater nematodes: ecology and taxonomy*. Wallingford, UK; CAB International. pp. 661.
- Andrassy, I.** (1958). Erdund Siisswassemematoden aus Bulgarien *Acta Zoologica Academiae Scientiarum Hungaricae* **4**: 1-88.
- Bajaj, H.K. & Bhatti, D.S.** (1979). *Chronogaster indica* n. sp. and *C. typical* (Nematoda): Plectidae from Haryana. India. *Indian Journal of Nematology* **81**: 78-81.
- Chaturvedi, Y. & Khera, S.** (1979). Studies on taxonomy, biology and ecology of nematodes associated with jute crop. Technical Monograph, Zoological Survey of India, 105 p.
- Cobb, N.A.** (1913). New nematode genera found inhabiting freshwater and non brackish soils. *Journal of the Washington Academy of Science* **3**: 432-444.
- De Coninck, L.A.** (1935). Contribution à la connaissance des Nématodes libres du Congo belge. 1. Les Nématodes libres des marais de la Nyamuamba (Ruvenzori) et des sources chaudes du Mont Banze (Lac Kivu). *Revue Zool. Bot. Afr.* **26**: 211-232, 249-326.
- de Maeseneer, J. & Herde, C.J.D.** (1963). Methodes utilisees pour l'etude des anguillules libres du sol. *Revue Agriculture, Bruxelles* **16**: 441-447.
- De Man, J.G.** (1921). Nouvelles recherches sur les nématodes libres terricoles de la Hollande. *Capita Zoo* **1**: 3-62.
- Flegg, J.J.M.** (1967). Extraction of *Xiphinema* and *Longidorus* species from soil by a modification of Cobb's decanting and sieving technique. *Annals of Applied Biology* **60**: 420-437.
- George, O.P. & Serban, M.S.** (1994). *Chronogaster troglodytes* sp.nov. (Nemata : Chronogasteridae) from Movile Cave, with a review of cavernicolous nematodes. *Fundam. Appl. Nematol.* **17**: 231-237.
- Gerlach, S.A.** (1956). Brasilianische Meeres-Nematoden. 1. *Bolm Inst. Oceanogr., S Paulo* **5**: 3-69.
- Heyns, J. & Coomans, A.** (1980). Freshwater nematodes from South Africa. 5. *Chronogaster Cobb*, 1913. *Nematologica* **26**: 245-265.
- Heyns, J. & Coomans, A.** (1983). New and known species of *Chronogaster Cobb*, 1913 (Nematoda:Leptolaimidae). *Nematologica* **29**: 245-265.
- Holovachov, O. & De Ley, P.** (2006). Order Plectida. in E. Abebe, W. Traunspurger, and I. Andrassy, ed. *Freshwater nematodes: Ecology and taxonomy*. Wallingford, UK: CAB International. 611-647.
- Khan, E. & Nanjappa, C.K.** (1972). *Chronogaster citri* sp. nov. Nematoda: Plectidae and additional information on *C. typica* De Man, 1921 from India. *Indian Journal of Nematology* **21**: 69-71.
- Khera, S.** (1972). Nematodes from banks of still and running waters. 12. Order Araeolaimida. *Proc. Zool. Soc. Calcutta* **25**: 49-58.
- Loof, P.A.A. & Jairajpuri, M.S.** (1965). Two new species of *Chronogaster Cobb*, 1913 (Nematoda: Plectidae). *Proceedings of the Helminthological Society of Washington* **32**: 181-186.
- Loof, P.A.A.** (1964). Free-living and plant-parasitic nematodes from Venezuela. *Nematologica* **10**: 201-300.
- Maggenti, A.R., Raski, D.J., Koshy, P.K. & Sosamma, V.K.** (1983). A new species of *Chronogaster Cobb*, 1913 (Nemata: Plectidae) with an amended diagnosis of the genus and discussion on cuticular ornamentation. *Revue de Nematologie* **6**: 257-163.
- Mounport, D.** (2005). *Chronogaster tessellata* n. sp. (Nematoda: Chronogastridae) from Senegal. *Nematology* **7**: 53-57.
- Raski, D.J. & Maggenti, A.R.** (1984). Four new species of *Chronogaster Cobb*, 1913 (Nemata: Plectidae) with a key to species of the genus. *Nematologica* **30**: 117-130.
- Saha, M. & Lal, M.** (2001). Two new species of *Chronogaster* (Araeolaimida: Nematoda) from low land paddy field in West Bengal, India. *Annals of Plant Protection Sciences* **9**: 98-103.
- Siddiqui, M.R.** (2003). *Keralanema spinicarpus* (Maggenti et al., 1983) gen. n., comb. n. (Nematoda: Chronogastridae). *International Journal of Nematology* **13**: 236.
- Tahseem, Q., Ahmad, I. & Ahmad, W.** (1994). Descriptions of two new species of *Chronogaster Cobb*, 1913 from India. *Journal of Nematology* **26**: 222-227.