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ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

# A NEW STRONGYLOID FROM MONKEYS IN HIMACHAL PRADESH, INDIA

# UN NUEVO ESTRÓNGILO DE MONOS EN HIMACHAL PRADESH, INDIA

Rakesh Chandel*; Somesh Sharma & Deepak C. Kalia

Department of Biosciences. Himachal Pradesh University, Shimla, India- 171005
*Corresponding Author: rakesh67chandel@gmail.com

## ABSTRACT

*Oesophagostomum (Conoweberia) mandiensis* n.sp. recovered from the stomach of male monkey, *Macaca mulatta* (Zimmermann, 1780) at Narla (Drang) district Mandi of Himachal Pradesh, India is described. This species differs from the other 15 known species of the genus in having an apical triangular lancet on each of the three denticulated oesophageal walls.

**Key words**: Strongyloid – *Oesophagostomum (Conoweberia) mandiensis* n.sp. – *Macaca mulatta*

## RESUMEN

*Oesophagostomum* (*Conoweberia*) *mandiensis* sp. n. recuperada del estómago del mono macho, Macaca mulatta (Zimmermann, 1780) en el distrito de Narla (Drang) Mandi de Himachal Pradesh, India es descrita. Esta especie difiere de las otras 15 especies conocidas del género al tener una lanceta triangular apical en cada una de las tres paredes esofágicas denticuladas.

**Palabras clave**: Estrongiloideo – *Oesophagostomum* (*Conoweberia*) *mandiensis* sp. n. – *Macaca mulatta*

## INTRODUCTION

During the survey of nematode parasites from monkey host, 15 specimens of the present species were recovered from the stomach of male host, *Macaca mulatta* (Zimmermann, 1780), the carcass of which found along the roadside at village Narla (Drang) district Mandi of Himachal Pradesh, India (Zimmermann, 1780). This species has been described and discussed in the light of 15 already known species of the subgenus *Oesophagostomum* (*Conoweberia*) Ihle, 1922 and has been found to be new to science.

## MATERIAL AND METHODS

Specimens of *Oesophagostomum (Conoweberia) mandiensis* n.sp. were recovered from its host at village Narla (Drang), India in May, 2015. The worms were killed and fixed in 3- 4% formalin and bulk cleared in lactophenol for microscopic examination, as per ethical approval of Department of Biosciences, Himachal Pradesh University, Shimla. The sketches incorporated were made with the help of camera lucida and measurements were taken with the help of ocular and stage micrometers and photomicrographs were taken with the help of Leica microscope DML S2 Camera DFC 320 and scanning micrographs JEOL-2601. All the specimens (Holotype and Paratypes) were deposited in Parasite collection of the Parasitology laboratory (PCPL), Department of Biosciences, HPU Shimla, India.

## RESULTS

*Oesophagostomum (Conoweberia) mandiensis* n. sp.
(Figs. 1-3)

Description: (Based on 15 specimen (6 males and 9 females): Body stout, whitish when alive, cuticle with thick striations, having external leaf crown only with 12 elements; cephalic vesicle present; excretory pore at the level of cervical groove, mouth directed straight forward; submedian cephalic papillae 4 and 1 pair of lateral amphids (Fig. 1A, 1B, 2M); buccal capsule closed, shallow, wider posteriorly, without transverse processes internally; oesophagus club- shaped, muscular, with an anterior oesophageal funnel, 0.045-0.063 mm deep, consisting of three denticulated concave walls and each wall provided with an apical triangular lancet (Fig. 1B); cervical papillae at about middle of oesophagus; prebursal papillae and lateral bursal papillae present (Fig.1D, 2N, 2O).

**Male:** Body 9.36-11.61 mm long, 0.27-0.40 mm in maximum thickness; oesophagus 0.54-0.57 mm long; nerve ring 0.15-0.16 mm; excretory pore 0.22-0.23 mm and cervical papillae 0.22-0.28 mm from the anterior extremity (Fig.1A); bursa symmetrical, with weakly differentiated dorsal lobe, each lateral lobe with an anterior and a median papilla (1C, 1D, 2N, 2O); ventral rays parallel, adjoining and extend to bursal margin; externo-lateral rays slightly divergent not extending to the bursal margin; medio-lateral and postero-lateral rays parallel, extending to the bursal margin, externo-dorsal rays arising from the common stem with dorsal; dorsal bifurcated in its distal half, each with a small external accessory branch (Fig.1C, 1D); spicules 0.90-1.008 mm long, equal, alate, with fused tips, spicular termination as ostrich claw-shaped (Fig.1E); gubernaculum 0.081-0.13 mm long and inverted tinner-shaped hammer(Fig.1F); genital cone oblong, with two small, rounded, lateral papillae (Fig. 1D).

**Female:** Body 10.35-15.21 mm long,0.33-0.45 mm in maximum thickness; oesophagus 0.56-0.59 mm long; oesophageal funnel 0.045×0.065 mm; nerve ring 0.18-0.20 mm, excretory pore 0.22-0.27 mm from anterior extremity; tail 0.19-0.22 mm long and conical (Fig. 1G, 2P); vulva 0.31-0.45 mm from posterior extremity; ovejector 0.20-0.22 mm long and 0.09-0.12 mm wide; eggs 0.045-0.060× 0.044-0.060 mm in size (Fig. 1G).

**Taxonomic summary**

Type Host: *Macaca mulatta* (Zimmermann, 1780)
Location: Stomach
Type Locality: Narla (Drang) district Mandi Himachal Pradesh, India
Specimens deposited: Holotype, Cat. PCPL 001 (one male); Paratypes, Cat. PCPL 010 (two males and five females).
Etymology: The specific epithet refers to the locality of collection of host.
Differential diagnosis: Each oesophageal funnel with an apical triangular lancet; spicular termination as ostrich claw-shaped; gubernaculum 0.0831-0.13mm long and an inverted tinner-shaped hammer.
Specific diagnosis: Each oesophageal funnel with an apical triangular lancet; each lateral lobe of caudal bursa with an anterior and a median papilla; spicules 0.90-1.008 mm long, equal, alate, alae ending in small swelling just in front of spicule tip, spicular termination as ostrich claw-shaped; gubernaculum 0.0831-0.13mm long and inverted tinner-shaped hammer.

**Remarks**

The species in having the characterstics, *viz*., external elements; buccal capsule ring-like, without transverse processes internally and the width considerably exceeding its length; oesophagus club-shaped; cephalic vesicle separated from remaining body by ventral groove has been assigned to genus *Oesophagostomum* Molin, 1861 and its corona radiata with 12 (10-15) elements; buccal capsule wide posteriorly; large oesophageal funnel with three concave walls, each with tooth and cervical papillae anterior to oesophageal swelling to subgenus *Oesophagostomum (Conoweberia)* Ihle, 1922 (in agreement with Lichtenfels, 1980; Gibbons, 2010).

The already known species of the subgenus *Oesophagostomum (Conoweberia)* can be grouped on the basis of presence or absence of lancets/denticles on the walls of oesophageal funnel (Molin, 1861; Ihle, 1922; Travassos, 1930; Lichtenfels, 1980; Gibbons, 2010). Phylogenetic tree of species of *Oesophagostomum* (*Conoweberia*) is indicated by Brooks *et al.* (2005).

*Oesophagostomum* (*Conoweberia*) *mandiensis* n. sp. closely resembles *Oesophagostomum (Conoweberia) zukowskyi* Travassos & Vogelsang, 1931 having three lancets on the walls of oesophageal funnel; gubernaculum consisting of strongly chitinized portion, which when viewed laterally has two ends; spicules 0.062mm long; *O.(C.) kherai* Kalia, 1985 having 4 lancets on walls of oesophageal funnel; spicules 1.516 mm long, equal, alate, alae ending in a small tuberculated swellings just in front of the spicule tip; gubernaculum 0.15 mm long, lamina shaped and *O. (C.) amarpurense* Chandel & Kalia, 1995, oesophageal funnel walls with nine lancets; spicules 1.377mm long, alate; gubernaculum 0.12-0.15mm long. The differences between the 15 species of the subgenus are in the Key to species of sub genus *Oesophagostomum* (*Conoweberia*) included below (Kalia, 1985; Chandel & Kalia, 1995).

**Key to species of sub genus *Oesophagostomum (Conoweberia)***

1-(20): Oesophageal funnel with lancets/denticles.

2-(15): Oesophageal funnel with 3 lancets.

3-(12): Oesophageal funnel lancets having chitinized.

4-(7): Oesophageal funnel lancets simple and conical.

5-(6): Oesophageal funnel with its cuticular lining forming 3 alae projecting into the lumen. Spicules 0.832 mm long (from *Sus scrofa* in India).

…….. *O. (C.) maplestonei* (Schwartz, 1931) emend Schwartz, 1932

6-(5): Oesophageal funnel lancets arising from its wall near the base and directed anteriad, having broad bases and pointed tips. Spicules 1.6 mm long (from *Semnopithecus obscurus* in India).

…… *O. (C.) tridentatum* Maplestone, 1932

7-(4): Oesophageal funnel lancets otherwise.

8-(9): Oesophageal funnel lancets hook-shaped. Oesophageal funnel having three slightly hook-shaped lancets (teeth) with their tips directed inwards and somewhat posteraid. (from *Simia satyrus*; *Papio hamadryas* in Switzerland and East Africa).

…… *O. (C.) brumpti* Railliet and Henry, 1905

9-(8): Oesophageal funnel lancets varying in shape.

10-(11): Oesophageal funnel with 3 winding contours at its anterior margin, each carrying a dentiform processes. Spicules 1.29 mm long. (from *Xerus setosus* in London zoo from South African rodents).

…… *O. (C.) xeri* Ortlepp, 1922

11-(10): Oesophageal funnel having 3 chitinized sharply curved sickle-shaped elements connected at their edges, and each one provided with a conoid projection at its base, directed inwards. Spicules 0.062 mm long (male 5.0-5.55 mm long). (from *Papio maimon* in Hamburg zoo).

…….. *O. (C.) zukowskyi* Travassos and Vogelsang, 1931.

12-(3): Oesophageal funnel lancets normally chitinized.

13-(14): Oesophageal funnel having 3 lancets consisting of thickened chitin membrane. Spicules 1.44 mm long. (from *Cercopithecus sabaeus; C. nictitans; C. ruber; C. callitrichus* in Tropical Africa).

…….. *O. (C.) pachycephalum* Molin, 1861

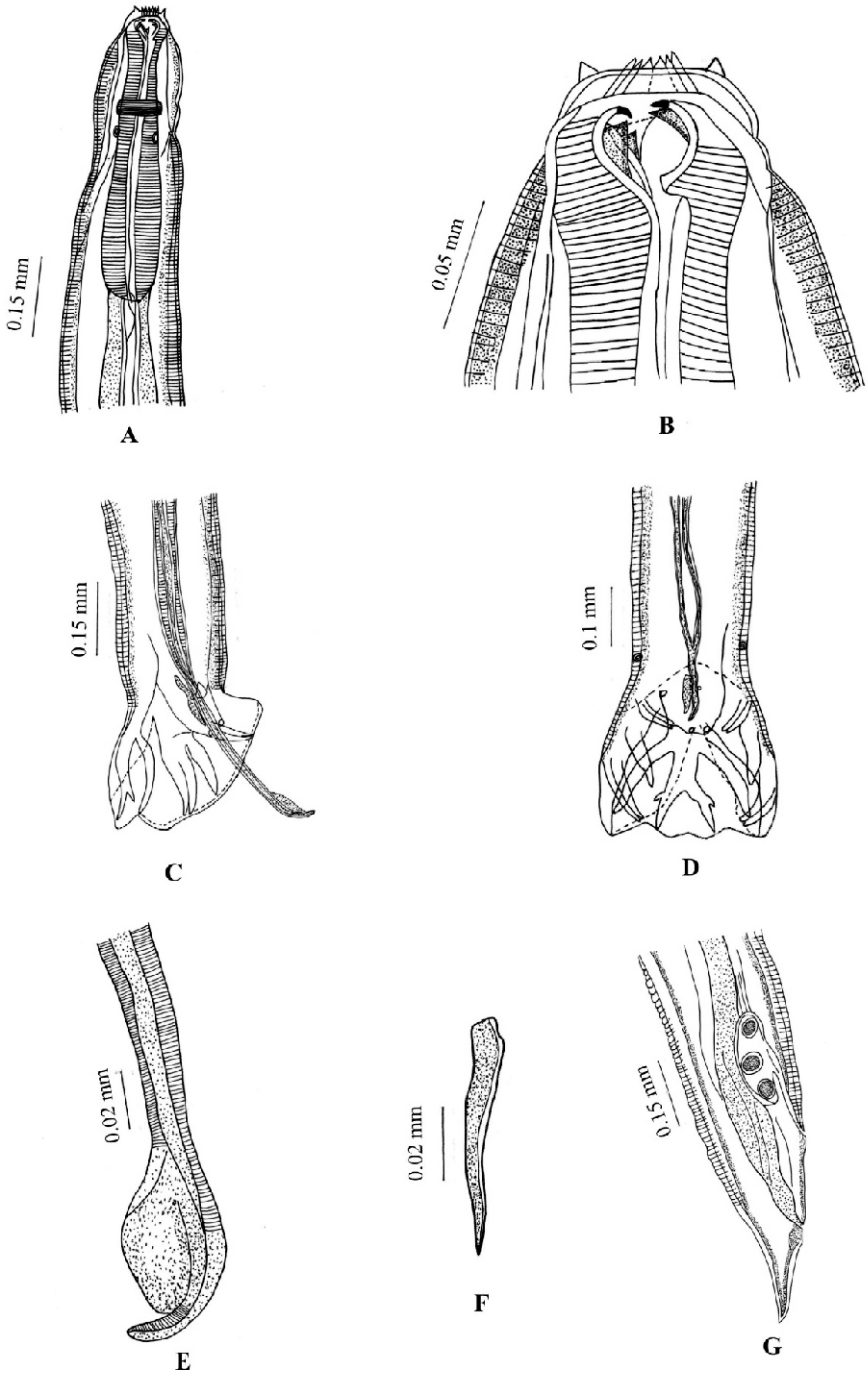


**Figure 1.** *Oesophagostomum* (*Conowevberia*) *mandiense* n.sp.
A. Anterior region, lateral view
B. Anterior region (enlarged), lateral view
C. Posterior region of male, lateral view
D. Posterior region of male, ventral view
E. Spicule tip (enlarged), lateral view
F. Gubernaculum (enlarged)
G. Posterior region of female, lateral view

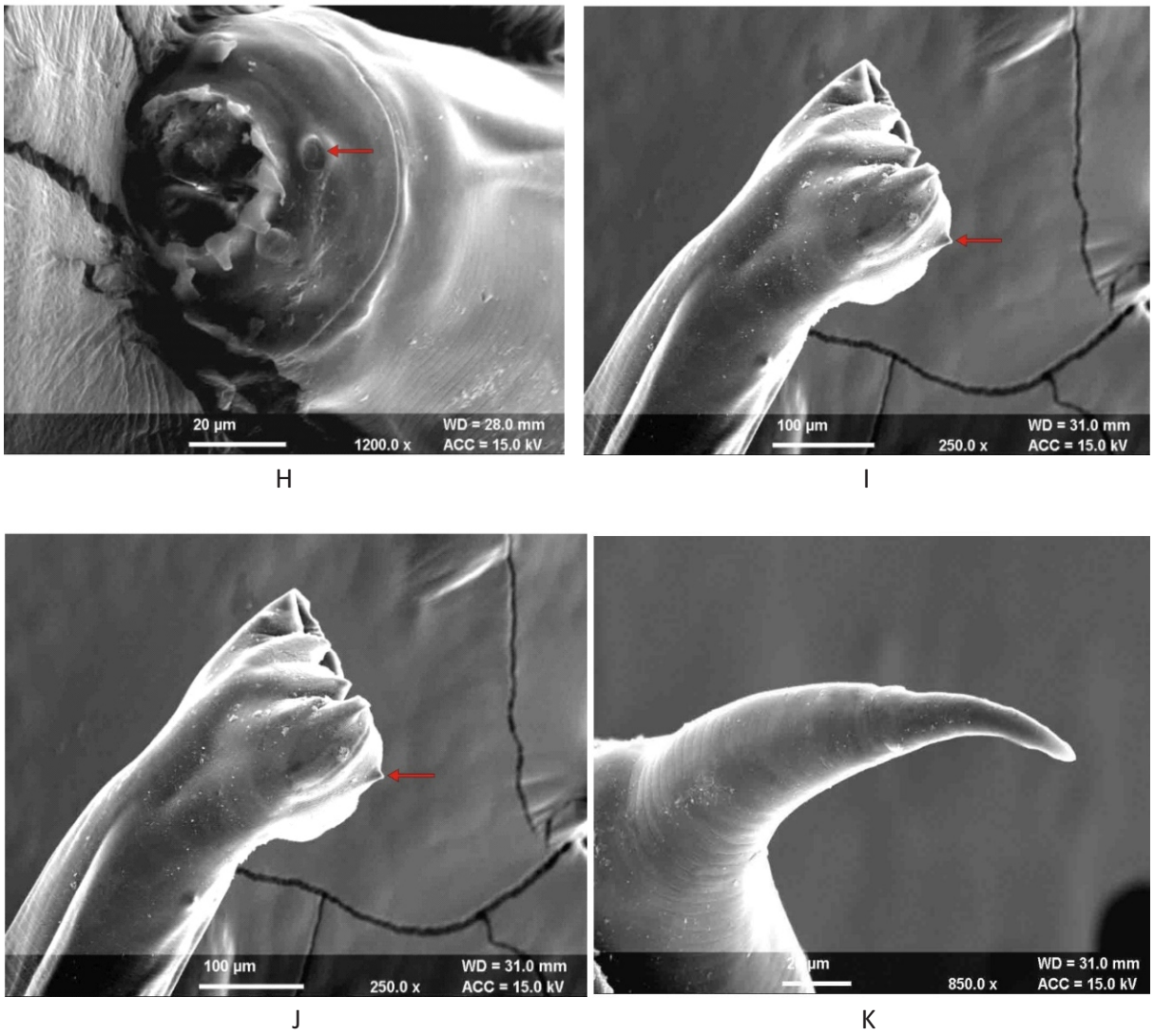


**Figure 2**. *Oesophagostomum* (*Conowevberia*) *mandiense* n.sp.
A. Cephalic view
B. Posterior region of male, dorsal view
C. Posterior region of male, ventral view
D. Posterior region of female

14-(13): Oesophageal funnel with one dorsal and two sub-ventral thin pointed and slightly curved lancets. Spicules 2.00 mm long. (from *Hylobates syndactilus; H. agilis; H. mulleri; H. hoolock* in Africa, Jawa, Borneo and Sumatra).

…….. *O. (C.) Ovatum* (Linstow, 1906) Railliet et Henry, 1912

15-(2): Oesophageal funnel having more than 3 lancets.

16-(19): Oesophageal funnel upto 6 lancets.

17-(18): Oesophageal funnel with 4 lancets, each latero-ventral walls forms with a median bifid one and dorsal wall with two conical ones. Spicules 1.516 mm long. (from *Presbytis entellus* in India).

…….*O. (C.) kherai* Kalia, 1985

18-(17): Oesophageal funnel lined with chitin membrane which forms 6 large lancets with slightly pointed tips directed upwards and inwards. Spicules 1.32-1.47 mm long, non-alate.(from *Felis sp*. in Brazil).

…… *O. (C.) ventri* Thornton,1924
19-(16): Oesophageal funnel with 9 lancets. Oesophageal funnel beset with three lancets (teeth) on each wall, which become progressively larger in size towards the base of the wall. Spicules equal, 1.377-1.567 mm long. (from *Presbytis entellus* in India).
…… *O. (C.) amarpurense* Chandel and Kalia, 1995
20-(1): oesophageal funnel without lancets.
21-(26): Externo-dorsal having common stem with dorsal ray.
22-(25): Spicules helically coiled.
23-(24): Dorsal ray bifurcated twice, each of which giving of very small external processes with outwardly bent convex surfaces. Spicules 0.83-1.14 mm long, gubernaculum boat-shaped in lateral view with rounded proximal and pointed distal ends. (from *Cercopithecus ruber; Papio procarius; P. sphinx; P. cynocephalus; P. hamadryas, P. maimon, P. langheldi;Macacus rhesus; M. murus; Anthropopitecus troglodytes;* man, in Africa and South Asia).
…… *O.* (*C.*) *bifurcum* (Creplin, 1849)
24-(23): Dorsal rays bifurcated twice, secondary external trunk short and curved. Spicules long, with alae extend from cloaca. Gubernaculum groove-shaped, strongly chitinized. (from *Macacus cynomolgus; M. nemestrinus; Cebus capucinus; C. sinicus* in Indo-China, Jawa and Borneo).
…… *O.* (*C.*) *aculeatum* ( Linstow, 1879)
25-(22): Spicules not helically coiled. Dorsal ray bifurcated twice, secondary external trunk bent in an elbow-like manner. Spicules 1.3-1.4 mm long, free portion of spicules with veins. (from *Simia satyrus; Hylobates hoolock* in Indo-China, Jawa and Borneo).
…… *O. (C.) blanchardi* Railliet et Henry. 1912
26-(21) Externo-dorsal arising separately from dorsal ray.
27-(28) Parasites of rodents. (from *Pedetes cafer* in South Africa)
……. *O. (C.) susannae* Le Roux,1929
28-(27) Parasites of Primates. External leaf crown with 14 petals. Spicules 1.98 mm long. (from *Hylobates hoolock* in Indo-China, Jawa and Borneo).
……. *O. (C.) raillieti* Travassos and Vogelsang, 1932
29-(16) Oesophageal funnel with less than nine lancets.
30-(20) Oesophageal funnel wall denticulated, each wall beset with an apical triangular lancet; spicules equal, 0.90-10.8 mm long with fused tips, spicular termination as ostrich claw-shaped.
……. *O. (C.) mandiense n.sp*.

## DISCUSSION

The species under discussion differs from all the known species of this group in its each oesophageal wall with an apical triangular lancet, spicular termination as ostrich claw-shaped; gubernaculum 0.0831-0.13mm long and inverted tinner-shaped hammer. Hence, in view of the above differences, this species has been considered new to the science and named after the locality of the host (Railliet, 1916; Travassos & Vogelsang, 1931; Skryabin *et al*., 1952). However, identification of all species of *Oesophagostomum* using DNA sequence analysis is required (Ota *et al*., 2015).

## BIBLIOGRAPHIC REFERENCES

Brooks, DR & Ferrao, AL. 2005. The historical biogeography of co-evolution: emerging infectious diseases are evolutionary accidents waiting to happen. Journal of Biogeography, vol. 32, pp. 1291–1299.

Chandel, R & Kalia, DC. 1995. *On a new strongylid* Oesophagostomum (Conoweberia) amarpurense *n. sp. from Langur*, Presbytis entellus *(Dufresne) in Himachal Pradesh and key to the species of subgenus.* Journal of Parasitology and Applied Animal Biology, vol. 4, pp. 89-95.

Gibbons, LM. 2010. *Key to the Nematode Parasites of Vertebrates, supplementary*

*volume*. CAB International, Wallingford (UK).

Ihle, JEW.1922. *The adult strongylids (sclerostomes) inhabiting the large intestine of the horse. Report of the Commission appointed to enquire into sclerostomiasis in Holland*. I. Zoological Part, VolI, pp 118

Kalia, DC. 1985. *On a new strongylid (Chabertidae: Oesophagostomatinae) from Langur*, Presbytis entellus *(Dufresne)*. Research Bulletin (Science) Panjab University, vol. 36, pp.405-407.

Litchenfels, JR. 1980. *Keys to genera of Superfamily Strongyloidea. In: CIH keys to Nematode Parasites of Vertebrates (*eds: Anderson, RC, Chabaud, AG & Willmott, S). Commonwealth Agricultural Bureux Farnham Royal Bucks England, vol.7, pp. 1-41.

Molin, R. 1861. *II Sottordine degli acrofalli ordinato scientificamente secondo i risultamenti* della *indagini anatomiche ed. Embriogeniche*. Memorias Researche Instituto Veneto. di Science, vol. 9, pp. 427-633.

Ota, N, Hasegawa, H, McLennan, MR, Kooriyama, Sato, TS, Pebsworth, PA & Huffman, MA. 2015. *Molecular identification of* Oesophagostomum *spp. from 'village' chimpanzees in Uganda and their phylogenetic relationship with those of other primates*. Royal Society of Open Science, vol. 2, pp. 1-12.

Railliet, A. 1916. *Nematode parasites des Rongeurs*. Recueil de Medecine Veterinaire, vol. 92, pp. 517-521.

Skryabin, KI, Shikhobalova, NP, Shultz, RS, Popova, TI, Boev, SN & Delamure, SL. 1952. *Key to Parasitic Nematodes*. Vol. 3. *Strongylata*. Izd. Akademii Nauk SSSR, Moscow, 800 pp. (In Russian).

Travassos, L. 1930. *Fauna helminthological dos Psittacidae do Brasil*. Archivos do Instituto Biologico de Defesa Agricola e Animal, vol. 3, pp. 5-20.

Travassos, L. & Vogelsang, E.G. 1931. *Sobre um novo* Oesophagostomum *de primates* (O. zukowskyi) *nematode*. Boletin Biologic Rio de Janerio, vol. 18, pp. 24-27.

Zimmermann, EAW. 1780. *Geographische Geschichte des Menchen, und der allgemein verbreitenten vierfußigen thiere Zweiter Band. Enthalt ein Vollstandiges Verzeichniß aller bekannten Qudrupeden*. – pp[1-6] 1-432. Leipzig Weygand.

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