

Morphology of Helminth Parasites in *Salmo Trutta Fario* and *Schizothorax Plagiostomus* in Gurez Valley of Jammu & Kashmir, India



Bashir Ahmad Sheikh*, Fayaz Ahmad and Tanveer A Sofi

Department of Zoology, University of Kashmir, Srinagar, India

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*Corresponding author: Bashir Ahmad Sheikh, Department of Zoology, University of Kashmir, Srinagar-190006, India

Abstract

The present study was carried out from May 2013 to May 2015 on helminth parasites of *Salmo trutta fario* and *Schizothorax plagiostomus* of Gurez Valley. Out of 210 specimens of *Salmo trutta* and 126 specimens of *Schizothorax plagiostomus* examined during the present study, 49 and 35 respectively were infected with different types of helminth parasites. The recovered parasites during the study include *Adenoscolex oreini*; *Rhabdochona guptii* in *S. trutta* and *Adenoscolex oreini*; *Rhabdochona guptii* and *Camallanus fotedari* in *S. plagiostomus*. These parasite species were identified on the basis of whole worm recovery for the first time from this region; collected from fishes of Gurez valley and the different localities of Gurez Valley viz.; Baktoor, Dawar, Achoora, Barnai, PTL form new locality records for these Helminth species, as mentioned against each.

Keywords: *Salmo Trutta Ffario*; *Schizothorax plagiostomus*; Gurez Valley; *Adenoscolex*; *Rhabdochona*; *Camallanus*

Introduction

Gurez, as geographically isolated from the Valley of Kashmir with diverse topographical features, has attained a unique position in the state of Jammu and Kashmir so far as its natural beauty, less anthropogenic load, high altitude, less pollution of natural resources, high altitude lakes, series of mountain peaks and the mighty Kishenganga River is concerned. Two main human activities viz; industrialization and urbanization are among the risk factors of devastating the environment which seem to be a dream here, and as such will not deteriorate the environment. The origin of Kishenganga river is at Koubal from Krishansar Lake in the vicinity of Sonamarg and runs northwards to Badoab village where it meets a tributary from the Drass side and runs westwards along the Line of Control in Jammu and Kashmir. The Neelum River is 245 kilometers long; it covers 50 kilometers in Jammu and Kashmir and the remaining 195 kilometers in Azad Kashmir. Kishenganga River, 150 kms in length is famous for having world class trout in it. There are many varieties of trout and other fishes in it. The most prominent amongst them are Snow Trout (*Schizothorax*), found predominantly in Tilail area *Schizothorax plagiostomum*, Heckel, 1938 locally known as 'Khont'.

Fishes are hosts to representative of three major groups of helminthes- the Platyhelminths (flatworms), Nematodes (round

worms) and Acanthocephalans (spiny headed worms). The life cycles of most fish nematode parasites require an intermediate host for their completion, The *Rhabdochona* spp. require an intermediate host to complete their life cycle. Morphological, taxonomical and ecological studies of fish parasites are important areas of research. Although taxonomy and ecology of helminth parasites has been studied and elucidated all over India, including Kashmir but no attention has been paid in this field in Gurez valley of Jammu and Kashmir. In fact this is a virgin area with regard to parasitic information and need to be explored thoroughly.

Materials and Methods

Study Area and Sampling

During the present study the fish host examined for helminth parasite infestation includes Brown Trout (*Salmo trutta fario*) and Snow Trout (*Schizothorax plagiostomus*) in Gurez valley. The Fishes were collected from the Kishenganga River at different sites viz.; PTL (Tulail, Barnoi, Budoab & Kashpat), Dawar (Dawar, Mastan and Achoora) and Buktoor, with the help of local experienced fishermen and common people. The fishes were brought alive or fresh to the temporary laboratory maintained at Dawar- the capital of Gurez. The collection was done on seasonal basis, and about 80 specimens were dissected per season. For the collection of endoparasites,

the fishes were dissected mid-ventrally and before removing the internal organs, the body cavity was thoroughly examined for parasites. Various organs like liver, bladder, heart, etc were removed and kept in separate petridishes containing normal saline (0.65% NaCl) [1]. The alimentary canal being the obvious part of entry for many kinds of parasitic infestations was removed completely and split open longitudinally and placed in petridishes containing saline water to which a few crystals of menthol were added so that the parasites which were firmly anchored to the lumen of the intestine were easily detached without causing any damage or distortion to the body of the parasite. Other organs were examined in the same manner by dissection and teasing with the help of brushes and needles. However, maximum numbers of parasites were collected from the alimentary canal of fish. Parasites collected from each fish were counted separately and regular record of the collection was maintained.

Photography & Photomicrography

Light microscopy was conducted under Olympus Research microscope (Magnus MLM; 100705686) with lens combination of, 10X, and 15X eye pieces and 4X, 10X, 20X, 40X and 100X objectives. The drawings for identification purposes were made to scale with the help of prism type camera-lucida. The Photographs were taken with the help of Sony Digital SLR Camera Model Number (DSLR - A200). Photomicrography was conducted with DP - 12 Digital Camera attached to Olympus Research Microscope in the department of Zoology. The measurements were made with the help of objective (stage) micrometer only, by drawing the scale of the objective micrometer under different lens combinations and then taking measurements directly from the drawings drawn under the same magnifications. Objective and ocular micrometers; by standardizing the ocular micrometer with the objective (stage) micrometer and later measuring the parasites or part/s with the help of ocular micrometer only.

Results and Discussion

The recovered parasites during the study include *Adenoscolex oreini*; *Rhabdochona guptii* in *S. trutta*; and *Adenoscolex oreini*; *Rhabdochona guptii* and *Camallanus fotedari* in *S. plagiostomus*.

Cestoda

***Adenoscolex Oreini* Fotedar, 1958 [2] (Figures 1 & 2)**

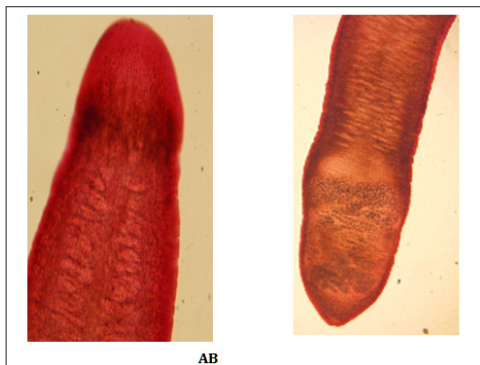


Figure 1: Photomicrographs of *Adenoscolex oreini*: A- Anterior portion, B-Posterior portion.

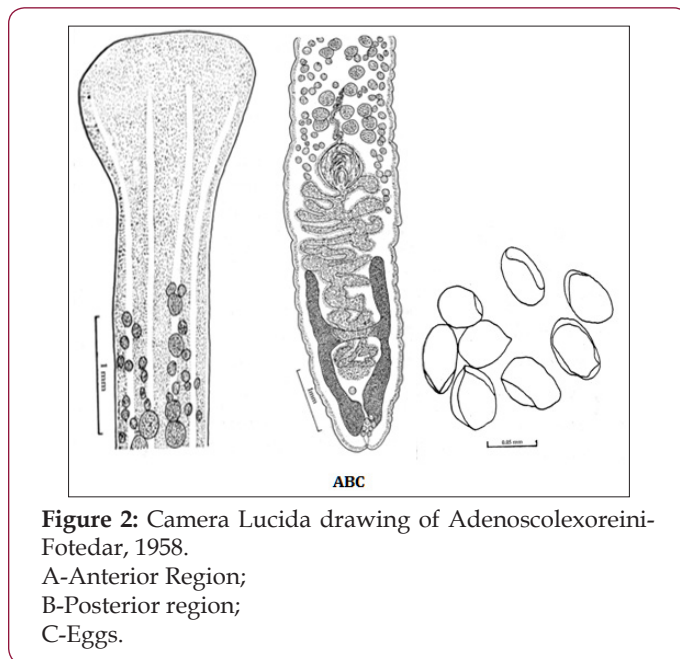


Figure 2: Camera Lucida drawing of *Adenoscolex oreini*-Fotedar, 1958. A-Anterior Region; B-Posterior region; C-Eggs.

- i. Generic Diagnosis:** Smooth scales with well marked gland cells which are continued in body region, cirrus sac and utero-vaginal canal open separately at the beginning of posterior seventh of the body; lower horns of ovary bent inwards giving the appearance of inverted 'A', uterine coils extended beyond anterior horns of ovary but never anterior to cirrus sac; well developed receptaculum seminis; vitelline fields partly cortical and partly medullary being mostly at the level of inner longitudinal muscle layer; post-ovarian vitelline follicles present [3].
- ii. Species Diagnosis:** Comparatively smaller than *Adenoscolex fotedari* (about 38mm); No. of excretory vesicles 14-18; Shape of ovary like inverted 'A' lower horns of which are strongly bent inwards. While as in *Adenoscolex fotedari* ovary is H-shaped and the two horns of 'H' are not bent on either side; no. of excretory vesicles 18-30 (Table 1).
- iii. Description:** Body elongated with unarmed scolex. Mature worm broader and thicker in posterior part of the body. Gland cells developed extensively in scolex region being visible to naked eye, extended posterior in 3 well-developed columns for more than 3 quarter of anterior body length. A single set of male and female genital organs open separately to posterior end through male and female genital openings. Testis and vitellaria scattered while other genital organs restricted to posterior 1/7th of body. Testis rounded, extended from scolex to cirrus pouch, bounded by vitelline follicles, vas deferens loosely convoluted tube, median anterior to cirrus sac. Cirrus sac muscular, pear shaped. Vitellaria numerous. Ovary single at 1/7th posterior end of the body more or less H shaped. Two long limbs connected by a transverse ovarian isthmus. Uterus coiled structure containing ova at different stages of development unite with vagina forming a utero-vaginal chamber to open exterior by female genital aperture. Capsules operculate ovoid, boat shaped with a small protuberance near basal region.

Table 1: Comparative characteristics (measurements in mm) of *Adenoscolex oreini* Fotedar, 1958.

Particulars	Fotedar [2]	Fayaz [3]	Ashiq [4]	Akhter et al. [5]	Present Study
Total body length	30-35x1.45-1.75	49.5	30.5	51	32-37
Scolex	Nearly 2	0.87-1.64	1.38 x 0.90	0.84-1.06	0.90-1.40
Neck	1.2-1.7x1.3-1.7	1.0-1.1	-----	1.0-1.1	0.9-1.1
Testes	-----	0.144-0.224 x 0.048-0.192	0.18-0.21 x 0.09-0.16	0.15-0.24 x 0.050-0.19	-----
Vas deference	-----	-----	0.5 x 0.45	-----	-----
Ovary length	-----	-----	2.15	-----	-----
Ovary width	-----	-----	0.5	-----	-----
Wings of ovary	1.9-2.2x0.25-0.37	1.4-2.7 x 0.17-0.3	-----	1.46-2.5 x 0.17-0.5	-----
Ovary isthmus	-----	0.31-0.71 x 0.07-0.16	-----	0.35-0.73 x 0.07-0.18	0.33-0.71 x 0.06-0.15
Egg	-----	0.052-0.076 x 0.028-.056	0.52-0.06 x 0.23- 0.26	0.059-0.074 x 0.028-0.059	0.050-0.071 x 0.027-0.055
Host	<i>Schizothorax</i> spp.	<i>Schizothorax</i> spp.	<i>Schizothorax</i> spp.	<i>Schizothorax</i> spp.	<i>Salmo trutta fario</i> and <i>Schizothorax plagios-tomus</i>
Site	Intestine	Intestine	Intestine	Intestine	Intestine

iv. Location: Intestine; Host: *Salmo trutta fario* and *Schizothorax plagios-tomus*; Locality: Buktoor, Achoora, Dawar, Markoot, Barnai, Budoab (PTL)

v. Remarks: From the above observations with regard to morphological characteristics/measurements of the parasite, it shows close resemble with *Adenoscolex oreini*. The identifying characters include; scolex and neck, Body length 32-37 mm, ovary isthamus and egg size. The studies are in close confirmity with that of (2-5). The identified parasite *Adenoscolex oreini* is first record of its nature from the Gurez valley of Jammu and Kashmir [4,5].

Nematoda

***Rhabdochona* Guptii Chishti & Bakshi [6], (Figures 3 & 4)**

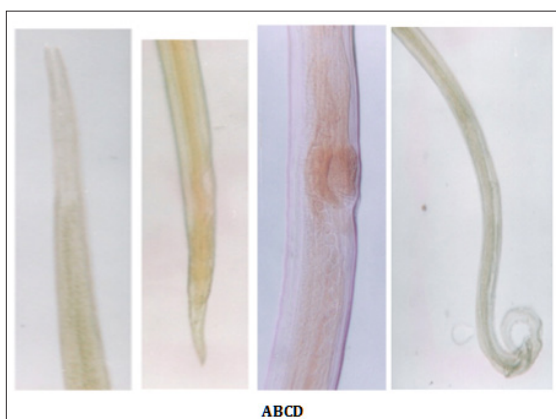


Figure 3: Photomicrographs of *Rhabdochonaguptii*, A-Anterior end of Female, B-Posterior end of Female, C-Vulva of Female, D-Posterior end of male.

I. Generic Diagnosis: Head and body bare, mouth with two lips. Buccal capsule funnel shaped anteriorly and provided in this region with longitudinal ribs terminating anteriorly in point-

ed teeth; oesophagus of moderate length, composed of two distinct parts.

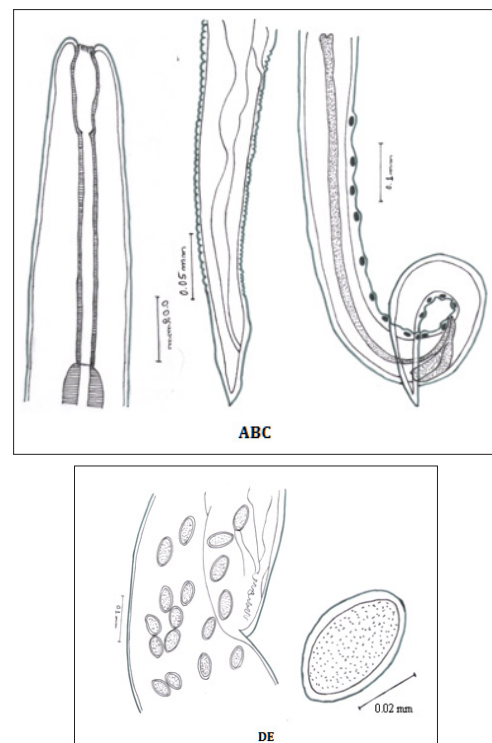


Figure 4: Camera Lucida drawing of *Rhabdochonaguptii*, Chishti & Bakshi, 1990. A-Anterior end of Female, B-Posterior end of Female, C-Posterior end of male, D-Vulvar region of Female, E-Egg

a) Male: Tail conical, pointed, curved ventrad; caudal alae narrow; numerous, simple, pre-anal papillae and 3 to 6 pairs of post-anal papillae; spicules unequal.

b) Female: Tail straight and elongate; vulva in middle region of body; uterine branches opposed. Oviparous, eggs elliptical. Parasitic in intestine of fresh water fishes.

II. Species Diagnosis: Comparatively smaller than other known species; Unequal spicules; 14 pairs of caudal papillae with length ratio 1:10; tail length 0.4-0.42 and 0.2-0.23 in males and females respectively.

III. Description: *Rhabdochona* is the nematode parasite in the intestines of fish. Head is somewhat truncated and broader than tail end. Head is bare, mouth with 3 lips. Buccal capsule funnel

shaped anteriorly and provided in the region with longitudinal ribs, terminating anteriorly in pointed teeth. Tail is pointed and sharply tapering behind the anus. Oesophagus is of moderate length, composed of two digestive points. In male tail are conical, pointed, ventrally curved and caudal alae narrow. There are numerous simple pre-anal papillae and post-anal papillae. Spicules unequal. In females, tail is straight and elongated. The vulva is located behind the middle level of the body in a shallow depression surrounded by swollen lips. It lies close to the tail. Uteri are well developed and filled with numerous eggs. The eggs are without any polar filament or projections on the shell (Table 2).

Table 2: Comparative characteristics (measurements in mm) of *Rhabdochona* spp.

Particulars	R. oreini Dhar [7]	R. jammuensis Dhar [7]	R. tori Dhar [7]	R. imalayai Dhar [7]	R. guptii Chishti and Bakshi [6]	Present study
Body size male	6.89 - 7.95	6.36	6.89 - 7.42	6.059 - 9.54	5.13 - 6.09	5.01-6.15
Body size female	12.19 - 15.10	7.5	9.0 - 11.13	10.6 - 15.9	5.16 - 6.12	5.20-6.25
Male caudal papillae-Pre cloacal	13	7	9	10	9	9
Male caudal papillae-Post cloacal	6	5	5	5	5	5
Spicule size- longer	470-500	300	595	295	500	475
Spicule size- small	85-100	50	119	85	50	45
Spicule length ratio	1:5	1:6	1:5	1:3.5	1:10	1:10.5
Tail length male	0.58	0.11	0.55	0.58	0.4 - 0.42	0.4-0.45
Tail length female	0.48	0.5	0.38	0.23	0.2 - 0.23	0.18-0.22
Site	Intestine	Intestine	Intestine	Intestine	Intestine	Intestine
Locality	Jammu	Jammu	Jammu	Kargil	Hokersar wetland	Gurez

IV. Location: Intestine; Host: *Salmo trutta fario* and *Schizothorax plagiosomus*; Locality: Buktoor, Achoora, Dawar, Markoot, Barnai, Budoab (PTL)

V. Remarks: The worm under reference resembles *Rhabdochona guptii* in having its unequal spicules at the tip and the number of caudal papillae being 14 pairs (9 pre-cloacal and 5 post-cloacal) but show some variations from the known description. The length ratio being 1:10 in earlier reported specimens and 1:10.5 in the present specimens. The body size of the female being 5.16-6.12mm as against the present specimens which is 5.20-6.25. The present specimens show many important morphological features in accordance with the previously described species, *Rhabdochona guptii* Chishti and Bakshi, 1990 to which it is assigned. However, the variations recorded which may be attributed to the change of locality and host species [6].

Camallanus Fotedari Raina & Dhar [7]; (Figures 5 & 6)

I. Generic Diagnosis: Mouth slit like, buccal capsule consisting of two lateral chitinous valves with longitudinal rib like thickenings internally. From the point of junction of the valves, dorsally and ventrally, a trident-shaped chitinous process is directed backwards. A chitinous ring is at junction of valves and oesophagus. Esophagus consisting of a short anterior muscular portion and a long posterior glandular portion enlarged posteriorly.

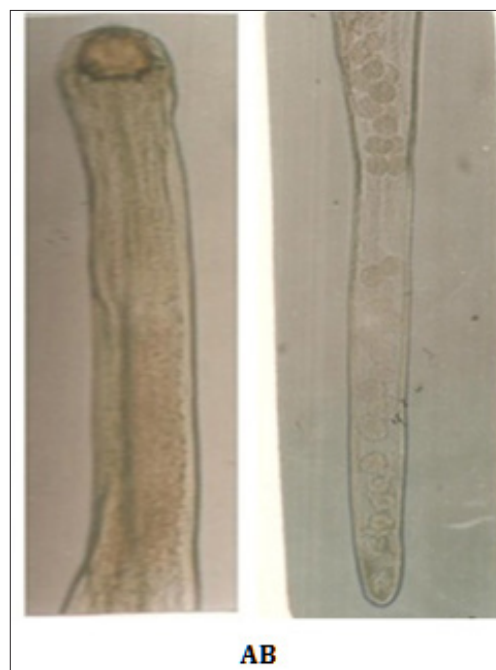


Figure 5: Photomicrographs of *Camallanus fotedari*, A- Anterior end, B-Posterior end

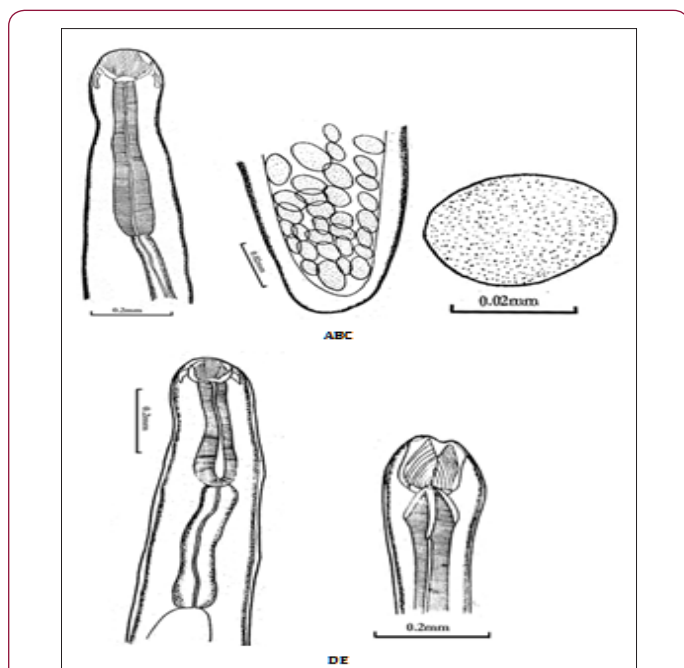


Figure 6: Camera Lucida drawing of *Camallanus fotedari* Raina and Dhar, 1972.

- A - Anterior end of female;
- B- Posterior region of female;
- C - Eggs;
- D- Anterior end of male;
- E- Posterior end of male.

a) Male: Posterior extremity rolled ventrally; small caudal alae present; about 7 pairs of costiform pre anal papillae, 2 pairs of small adanal and a number of postanal papillae; spicules usually unequal and dissimilar, one feebly chitinized, gubernaculum absent.

b) Female: Vulva about middle of body; utri opposed; posterior ovary lacking, viviparous. Parasites of stomach and intestines of fishes, amphibians and reptiles. Larvae in crustaceans.

II. Species Diagnosis: Small worms, measuring 5.700-7.20x0.12x0.20 mm and with a broad anterior and tapering posterior end. Mouth terminal, slit-like, with a pair of papillae on each side. Buccal capsule with two lateral chitinous valves. Oesophagus long measuring 0.08mm. Tail with a characteristic rounded tip; uterus extending upto the tip of the tail and ending blindly. Vagina directed posteriorly. Vulva is located posterior to the middle of the body over a raised area.

III. Description: The worms are long and light brown in colour when alive, with broader anterior end and tapering posterior end. Body small, cylindrical, cuticle finely striated. Thick cuticle covers the body which bears transverse striations. Mouth surrounded by a pair of papillae on each side. A well-developed buccal capsule is present. It is cylindrical and broad in the middle with slight decrease in diameter anteriorly and broad in the middle with only slight decrease in diameter anteriorly and posteriorly. It is continuous without any differentiation into paired lateral valves. Its wall is smooth showing no ridges or striations, except at the anterior end where there are minute and fine vertical ridges. Two pairs of buccal papillae, sub median in position. Anterior oesophagus long, muscular and differentiated into anterior muscular and posterior glandular portions. A nerve ring is present posterior to the buccal capsule (Table 3). Females are stout and very long, ranging in size from 38-58mm. Maximum breadth from 0.45-0.77mm. Tail is bluntly rounded, bearing two projections at its tip. Uterus extended up to posterior end of tail. Vulva at posterior equatorial level. Cuticle around the vulva is swollen at both ends.

Table 3: Comparative characteristics (measurements in mm) of *Camallanus fotedari*.

Particulars	Raina and Dhar, 1972	Parveen, 1985	Present study
Female specimens			
Total length	1.98-11.92	5.700-7.200	6.80-9.50
Max. Breadth	0.12-0.52	0.12-0.20	0.12-0.40
Oesophagus length (anterior)	0.16-0.66	0.32-0.08	0.25-0.50
Oesophagus length (posterior)	0.28-0.87	0.5-0.09	0.25-0.70
Buccal capsule (Length)	0.07-0.50	0.08	0.1-0.20
Buccal capsule (Breadth)	0.5-0.13	0.06	-----
Distance from anterior end to vulva	2.17-6.82	2.24	2-3
Tail length	0.28-1.45	0.16-0.20	0.30-1.10
Site	Intestine	Intestine	Intestine
Locality	Dal Lake, Sgr.	Srinagar	Gurez

IV. Location: Intestine; Host: *Schizothorax plagiostomus*; Locality : Buktoor, Achoora, Dawar, Markoot, Barnai, Budoab (PTL)

V. Remarks: Raina and Dhar, 1972 reported *Camallanus fotedari* n.sp. from the intestines of *Nemachilus kashmirensis* in Kashmir. The present specimen shows its morphological features in close accordance with that of (7,8) with some minor variations.

Thus the present species is assigned to the *Camallanus fotedari*.

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