



# Review of cestode parasite of genus *tylocephalum* Linton, 1890 of marine fishes from west coast of Maharashtra state, India

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## ABSTRACT

A survey of adult tapeworms from marine fishes from coastal area of Maharashtra, India. It is presented on the basis of the taxonomic evaluation of freshly collected fishes from different coastal regions of Maharashtra. The cestode parasites are collected from various parts of Maharashtra from June, 2009 to December, 2013. They are having 750 fishes of 14 species. Thirty one species of helminthes are recovered, the eight monogeneans, nine nematodes and fourteen cestodes. A detailed report is on the tapeworms *Tylocephalum yorkei* Southwell, 1925, *T.minimum* Subhadrpradha, 1955, *T.elongatum* Subhadrpradha, 1955, *T.madhukari* Chincholikar and Shinde, 1980, *T.singhii* Jadhav and Shinde 1981, *T.bombayensis* Jadhav 1983, *T.aurangabadensis* Jadhav et. al., 1987, *T.hanumanthraoae* Shinde et. al., 1989, *T.mehdii* Bhagwan et. al., 2002, *T.alibagensis* Bhagwan and Mohekar, 2003, *T.gajananae* Wankhede and Jadhav, 2003, *T.babulalae* Pawar and Jadhav, 2005, *T.shindei* Pawar and Jadhav, 2005, *Tylocephalum damodarae* Pathan and Bhure, 2013. Data regarding the morphology of all species, their hosts and distribution in Maharashtra is also provided.

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## Introduction

Parasitism is a natural way of life, among the large number of organism, parasitic diseases are the major public health problem, which results into morbidity and mortality in tropical countries, particularly in the socioeconomically under developed societies in the world. Food, water and soil-borne infections are estimated to be affecting almost half of the world's population. Zoonoses (i.e. diseases that are transmittable between animals and men) of parasitic origin contribute to this statistics by affecting human health and causing heavy losses directly or indirectly to economy. The infection of cestode parasites are found in plenty of marine fishes which reduces the food value of fishes and decreases in their production and result in mortality so the study of cestode parasites is necessary today. The human beings consume the fishes as one of the nutritious food. If the fishes are not properly cooked, the cestode parasites cause dangerous diseases to human beings.

The taxonomy of the genus *Tylocephalum* has been studied in detail by Linton, 1890 with its type species. *T. yorkei* from *Aetobatis narinari* by Southwell, 1925. *T.minimum* & *T.elongatum* from *Rhynchobatus djeddensis* by Subhadrpradha, 1955, Chincholikar and Shinde, 1980 added *T. madhukari* from *Trygon sephen*. *T.singhii* is added by Jadhav and Shinde, 1981 from *Trygon zugei*. In 1983 *T.bombayensis* is erected by Jadhav from *Trygon sephen*. Jadhav et.al., 1987 added *T.aurangabadensis* from *Aetobatis narinari*. Later on *T.hanumanthraoae* is added from *Trygon sephen* by Shinde et.al., 1989. *T.mehdii* is erected from *Trygon zugei* by Bhagwan et.al., 2002. Bhagwan and Mohekar 2003 added *T.alibagensis* from *Trygon zugei*. *T.gajananae* is described by Wankhede and Jadhav 2003 from *Trygon sephen*. Pawar and Jadhav 2005 added two new species to this genus i.e. *T.babulalae* from *Trygon zugei* and *T.shindei* from *Trygon sephen*. Recently *Tylocephalum damodarae* is added by Pathan and Bhure, 2013 from *Dasyatis walga*.

## Material and methods

The authors made a deep survey for collection of parasites from all marine localities of Maharashtra State. The major collection was done by Author from West Cost of Maharashtra at places like Ratnagiri, Sindhudurg, Raigad and Thane. Freshly collected intestinal fish cestodes were fixed in hot 4% formalin (almost boiling fixative). All the specimens stained with Harris Alum Haematoxylin or Borax carmine. Drawings are made with the aid of Camera Lucida and all the measurements are in millimeters.

## Result and discussions

### Species Identification:

Fourteen species of cestodes i.e. *Tylocephalum yorkei*, *T. minimum*, *T. elongatum*, *T. madhukari*, *T. singhii*, *T.bombayensis*, *T.aurangabadensis*, *T.hanumanthraoae*, *T.mehdii*, *T.alibagensis*, *T.gajananae*, *T. babulalae*, *T.shindei*, *T. damodarae* have been identified.

### *Tylocephalum yorkei* (Southwell, 1925)

(Fig. II-A)

**Host:** *Aetobatis narinari*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

### Comments:

Scolex is cushion shaped, neck present, testes 30-36 in number, ovary small and bilobed, vitellaria are follicular and arranged in one row and specimen is collected from host *Aetobatis narinari*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differs from *T.minimum* in having scolex ( cushion shaped vs. small anterior region than posterior) and neck (present vs absent), from *T.elongatum* having scolex ( cushion shaped vs. anterior region larger than posterior), neck (present vs absent), number of testes ( 30-36 vs. 40), ovary ( small and bilobed vs.

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bilobed with number of small acini) and vitellaria (follicular in one row vs. follicular in band, from *T.madhukari* in having scolex (cushion shaped vs. sub-globular), neck (present vs absent), number of testes ( 30-36 vs. 16), ovary (small and bilobed vs. compact granular and bean shaped) and vitellaria (follicular vs. granular); from *T.singhii* in having scolex (cushion shaped vs. globular), number of testes (30-36 vs. 76-80) and ovary (small bilobed vs. 'U'shaped); from *T.bombayensis* in having scolex ( cushion shaped vs. rounded) number of testes ( 30-36 vs. 34-38), ovary (small bilobed vs. cylindrical) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex (cushion shaped vs. quadrangular), number of testes (30-36 vs. 16) and ovary (small bilobed vs. 'U'shaped); from *T. hanumantraoe* in having scolex (small bilobed vs. quadrangular neck (present vs. absent) and vitellaria (follicular vs. granular); from *T. mehdii* scolex (cushion shaped vs. globular), number of testes (30-36 vs. 43-47), ovary (small bilobed vs. 'U'shaped) and vitellaria (follicular vs. granular); from *T. alibagensis* in having scolex (cushion shaped vs. squarish), neck (present vs. absent), number of testes (30-36 vs. 64), ovary (small bilobed vs. 'U' shaped) and vitellaria (follicular vs. granular); from *T.gajananae* in having scolex (cushion shaped vs. quadrangular), neck (present vs. absent), number of testes (30-36 vs. 55-60) and ovary (small bilobed vs. bilobed with elongated acini); from *T.babulalae* in having scolex (cushion shaped vs. globular), number of testes (30-36 vs. 11-12) and ovary (small bilobed vs. U-shaped); from *T. shindei* in having scolex (cushion shaped vs. globular), number of testes (30-36 vs. 26-27) and ovary (small bilobed vs. 'U'shaped); It differs from *Tylocephalum damodarae* in having scolex (cushion shaped vs. globular), testes (30-34 vs. 60 -70), ovary( bilobed vs. 'U' shaped) and vitellaria(follicular vs. granular).

***Tylocephalum minimum* (Subhpradha, 1955.)**

**(Fig. II-B)**

**Host:** *Rhynchobatus djeddensis*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex divided into two regions, anterior region is much smaller than posterior one, neck is absent, testes are 33 in number, vitellaria follicular and arranged in one row, collected from host *Rhynchobatus djeddensis*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differ from *T.yorkei* in having scolex ( anterior region smaller than posterior vs. cushion shaped) and neck (absent vs. present); from *T.elongatum* in having scolex (anterior region smaller than posterior vs. anterior region larger than posterior) and number of testes(33 vs. 40); from *T.madhukari* in having scolex ( anterior region smaller than posterior vs. sub globular), number of testes (33 vs 16 )and vitellaria (follicular vs. granular); from *T.singhii* in having scolex ( anterior region smaller than posterior vs. globular), neck (absent vs present) and number of testes (33 vs. 76-80 ); from *T.bombayensis*, in having scolex ( anterior region smaller than posterior vs. rounded), neck (absent vs present), number of testes (33 vs 34-38 ) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex ( anterior region smaller than posterior vs. quadrangular), neck (absent vs present) and number of testes (33 vs 16); from *T.hanumantraoe* in having scolex ( anterior region smaller than posterior vs. quadrangular) and vitellaria (follicular vs. granular); from *T.mehdii* scolex ( anterior region smaller than

posterior vs. globular), neck(absent vs. present), number of testes (33 vs 43-47 ) and vitellaria (follicular vs. granular); from *T.alibagensis* in having scolex (anterior region smaller than posterior vs. squarish), number of testes(33 vs. 64) and vitellaria (follicular vs. granular); from *T.gajanani* in having scolex (anterior region smaller than posterior vs. quadrangular), number of testes(33 vs. 55-60) and vitellaria (follicular vs. granular); from *T.babulalae* in having scolex (anterior region smaller than posterior vs. globular), neck (absent vs. present) and number of testes (33 vs. 11-12); from *T.shindei* in having scolex (anterior region smaller than posterior vs. rounded), neck (absent vs. present) and number of testes(33 vs. 26-27); It differs from *Tylocephalum damodarae* in having scolex (anterior region smaller than posterior one vs. globular), neck (absent vs. present), testes (33 vs. 60 -70) and vitellaria(follicular vs. granular).

***Tylocephalum elongatum* (Subhpradha, 1955)**

**(Fig. II-C)**

**Host:** *Rhynchobatus djeddensis*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex having the anterior region almost as large as posterior region, neck is absent, testes are forty in number, ovary bilobed with number of small acini, vitellaria found in the form of band and collected from the host *Rhynchobatus djeddensis*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differs from *T. yorkei* in having scolex (anterior region larger than posterior Vs cushion shaped), neck (absent Vs present), number of testes ( 40 vs 30-36), ovary (bilobed with number of small acini vs small bilobed ) and vitellaria (follicular in band vs follicular in row); from *T. minimum* in having scolex (anterior region larger than posterior Vs anterior region smaller than posterior) and number of testes ( 40 vs 33); from *T.madhukari* in having scolex (anterior region larger than posterior Vs sub globular), number of testes ( 40 vs 16), ovary (bilobed with number of small acini vs compact granular and bean shaped) and vitellaria (follicular in band vs granular); from *T.singhii* in having scolex (anterior region larger than posterior vs globular), neck (absent vs present), number of testes ( 40 vs 76-80) and ovary (bilobed with number of small acini vs 'U'shaped) ; from *T.bombayensis* in having scolex (anterior region larger than posterior vs rounded), neck (absent vs present), number of testes ( 40 vs 34-38), ovary (bilobed with number of small acini vs cylindrical) and vitellaria (follicular vs granular); from *T.aurangabadensis* in having scolex (anterior region larger than posterior vs quadrangular), neck (absent vs present), number of testes ( 40 vs 16) and ovary (bilobed with number of small acini vs 'U'shaped ); from *T.hanumantraoe* in having scolex (anterior region larger than posterior vs quadrangular), number of testes ( 40 vs 30-35) and vitellaria (follicular vs granular); from *T.mehdii* in having scolex (anterior region larger than posterior vs globular), neck (absent vs present), number of testes ( 40 vs 43-47), ovary (bilobed with number of small acini vs 'U'shaped) and vitellaria (follicular vs granular); from *T.alibagensis* in having scolex (anterior region larger than posterior vs squarish), number of testes ( 40 vs 40-64), ovary (bilobed with number of small acini vs 'U' shaped) and vitellaria (follicular vs granular); from *T.gajananae* in having scolex (anterior region larger than posterior vs quadrangular), number of testes ( 40 vs 55-60) and vitellaria (follicular vs granular); from *T.babulalae* in having scolex (anterior region larger than posterior vs globular), neck

(absent vs. present), number of testes (40 vs 11-12) and ovary (bilobed with number of small acini vs 'U' shaped); from *T.shindei* in having scolex (anterior region larger than posterior vs globular), neck (absent vs. present), number of testes (40 vs 26-27) and ovary (bilobed with number of acini vs. 'U' shaped); It differs from *Tylocephalum damodarae* in having scolex (anterior region larger than posterior vs. globular), testes (40 vs. 60 -70), ovary (bilobed vs. 'U' shaped) and vitellaria (follicular vs. granular).

***Tylocephalum madhukari* (Chincholikar, 1976)**

**(Fig. II-D)**

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex is divided in two regions, sub globular, neck is absent, testes are 16 in number ovary compact, granular and bean shaped, vitellaria granular and collected from host *Trygon* species.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differ from *T.yorkei* in having scolex (subglobular vs. cushion shaped), neck (absent vs. present), number of testes (16 vs. 30-36), ovary (compact granular bean shaped vs. small bilobed) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (subglobular vs. anterior region smaller than posterior), number of testes (16 vs. 33) and vitellaria (granular vs. follicular); from *T.elongatum* in having scolex (subglobular vs. anterior region larger than posterior), number of testes (16 vs. 40), ovary (compact granular bean shaped vs. bilobed with number of small acini) and vitellaria (granular vs. follicular); from *T.singhii* in having scolex (subglobular vs. globular), neck (absent vs. present), number of testes (16 vs. 76-80), ovary (compact granular bean shaped vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T.bombayensis* in having scolex (subglobular vs. rounded), neck (absent vs. present), number of testes (16 vs. 34-38) and ovary (compact granular bean shaped vs. cylindrical); from *T.aurangabadensis* in having scolex (subglobular vs. quadrangular), neck (absent vs. present), ovary (compact granular bean shaped vs. U-shaped) and vitellaria (granular vs. follicular); from *T.hanumantraoe* in having scolex (subglobular vs. quadrangular), number of testes (16 vs. 30-35), ovary (compact, bean shaped vs. bilobed 'H' shaped); from *T.mehdii* in having scolex (subglobular vs. globular), neck (absent vs. present), number of testes (16 vs. 43-47) and ovary (compact, bean shaped vs. 'U' shaped); from *T.alibagensis* in having scolex (subglobular vs. squarish), number of testes (16 vs. 64) and ovary (compact, bean shaped vs. 'U' shaped); from *T.gajananae* in having scolex (subglobular vs. quadrangular), number of testes (16 vs. 55-60) and ovary (compact granular bean shaped vs. bilobed with elongated acini); from *T.babulalae* in having scolex (subglobular vs. globular), neck (absent vs. present), number of testes (16 vs. 11-12), ovary (compact granular bean shaped vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T.shindei* in having scolex (subglobular vs. rounded), neck (absent vs. present), number of testes (16 vs. 26-27), ovary (compact, bean shaped vs. 'U' shaped) and vitellaria (granular vs. follicular); It differs from *Tylocephalum damodarae* in having scolex (subglobular vs. globular), testes (16 vs. 60 -70), ovary (compact, bean shaped vs. 'U' shaped).

***Tylocephalum singhii* (Jadhav and Shinde, 1981)**

**(Fig. II-E)**

**Host:** *Trygon zugei*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex globular, neck present, number of testes 76-80, genital pores sub marginal, regularly alternate, vagina posterior and ventral to cirrus sac, ovary bilobed U-shaped, vitellaria follicular and collected from host *Trygon zugei*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differ from *T.yorkei* in having scolex (globular vs. cushion shaped) and number of testes 76-80 vs. 30-36); from *T.minimum* in having scolex (globular vs. anterior region smaller than posterior), neck (present vs. absent) and number of testes (76-80 vs. 33); from *T.elongatum* in having scolex (globular vs. anterior region larger than posterior), neck (present vs. absent), number of testes (76-80 vs. 40) and ovary (bilobed, 'U' shaped vs. bilobed with number of small acini); from *T.madhukari* in having scolex (globular vs. sub globular), neck (present vs. absent), number of testes (76-80 vs. 16), ovary ('U' shaped vs. compact granular and bean shaped) and vitellaria (follicular vs. granular); from *T.bombayensis* in having scolex (globular vs. rounded), number of testes (76-80 vs. 34-38), ovary ('U' shaped vs. cylindrical) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex (globular vs. quadrangular) and number of testes (76-80 vs. 16); from *T.hanumantraoe* in having scolex (globular vs. quadrangular), neck (present vs. absent), number of testes (76-80 vs. 30-35), ovary ('U' shaped vs. 'H' shaped) and vitellaria (follicular vs. granular); from *T.mehdii* in having number of testes (76-80 vs. 43-47) and vitellaria (follicular vs. granular); from *T.alibagensis* in having scolex (globular vs. squarish), neck (present vs. absent), number of testes (76-80 vs. 64) and vitellaria (follicular vs. granular); from *T.gajananae* in having scolex (globular vs. quadrangular), neck (present vs. absent), number of testes (76-80 vs. 55-60) and vitellaria (follicular vs. granular); from *T.babulalae* in having number of testes (76-80 vs. 11-12); from *T.shindei* in having number of testes (76-80 vs. 26-27); It differs from *Tylocephalum damodarae* in having testes (76-80 vs. 60 -70), and vitellaria (follicular vs. granular).

***Tylocephalum bombayensis* (Jadhav, 1983)**

**(Fig. II-F)**

**Host:** *Trygon sephen*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex rounded, neck present, testes are 34-38, ovary cylindrical vitellaria granular and collected from host *Trygon sephen*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differ from *T.yorkei* in having scolex (rounded vs. cushion shaped), number of testes (34-38 vs 30-36), ovary (cylindrical vs. small bilobed) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (rounded vs. anterior region smaller than posterior), neck (present vs. absent), number of testes (34-38 vs 33) and vitellaria (granular vs. follicular); from *T.elongatum* in having scolex (rounded vs. anterior region larger than posterior), neck (present vs. absent), number of testes (34-38 vs 40), ovary (cylindrical vs. bilobed with number of small acini) and vitellaria (granular vs. follicular); from *T. madhukari* in having scolex (rounded vs. sub globular), neck (present vs. absent), number of testes (34-38 vs 16) and ovary (cylindrical vs. compact granular and bean shaped); from *T. singhii* in

having scolex (rounded vs. globular), number of testes (34-38 vs 76-80), ovary (cylindrical vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T. aurangabadensis* in having scolex (rounded vs. quadrangular), number of testes (34-38 vs 16), ovary (cylindrical vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T. hanumantrae* in having scolex (rounded vs. quadrangular), neck (present vs. absent) and ovary (cylindrical vs. bilobed 'H' shaped); from *T. mehdii* in having scolex (rounded vs. globular), number of testes (34-38 vs 43-47) and ovary (cylindrical vs. 'U' shaped); from *T. alibagensis* in having scolex (rounded vs. squarish), neck (present vs. absent), number of testes (34-38 vs 64) and ovary (cylindrical vs. 'U' shaped); from *T. gajananae* in having scolex (rounded vs. quadrangular), neck (present vs. absent) and ovary (cylindrical vs. 'U' shaped); from *T. babulalae* in having scolex (rounded vs. globular), number of testes (34-38 vs 11-12), ovary (cylindrical vs. 'U' shaped with 10-12 acini) and vitellaria (granular vs. follicular); from *T. shindei* in having scolex (rounded vs. globular), number of testes (34-38 vs 26-27), ovary (cylindrical vs. 'U' shaped with many acini) and vitellaria granular vs. follicular; It differs from *Tylocephalum damodarae* in having scolex (rounded vs. globular), testes (34-38 vs. 60 -70), ovary (Cylindrical vs. 'U' shaped).

***Tylocephalum aurangabadensis* (Jadhav et.al., 1987)**

**(Fig. II-G)**

**Host :** *Aetobatis narinari*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex quadrangular, neck present, testes are 16 in number, genital pore sub marginal, vagina posterior to cirrus pouch, ovary U-shaped, vitellaria follicular and collected from host *Aetobatis narinari*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differ from *T. yorkei* in having scolex (quadrangular vs cushion shaped), number of testes (16 vs. 30-36) and ovary ('U' shaped vs. small bilobed); from *T. minimum* in having scolex (quadrangular vs anterior region smaller than posterior), neck (present vs. absent) and number of testes (16 vs. 33); from *T. elongatum* in having scolex (quadrangular vs anterior region larger than posterior), neck (present vs. absent), number of testes (16 vs. 40), ovary ('U' shaped vs. bilobed with number of small acini); from *T. madhukari* in having scolex (quadrangular vs sub globular), neck (present vs. absent), ovary ('U' shaped vs. compact granular and bean shaped) and vitellaria (follicular vs. granular); from *T. singhii* in having scolex (quadrangular vs globular) and number of testes (16 vs. 76-80); from *T. bombayensis* in having scolex (quadrangular vs rounded), number of testes (16 vs. 31-38) and vitellaria (follicular vs. granular); from *T. hanumantrae* in having neck (present vs. absent), number of testes (16 vs. 30-35) ovary ('U' shaped vs. 'H' shaped) and vitellaria (follicular vs. granular); from *T. mehdii* in having scolex (quadrangular vs globular), number of testes (16 vs. 43-47) and vitellaria (follicular vs. granular); from *T. alibagensis* in having scolex (quadrangular vs squarish), neck (present vs. absent), number of testes (16 vs. 64), vitellaria (follicular vs. granular); from *T. gajananae* in having neck (present vs. absent), number of testes (16 vs. 55-60) and vitellaria (follicular vs. granular); from *T. babulalae* in having scolex (quadrangular vs globular) and number of testes (16 vs. 11-12); from *T. shindei* in having scolex (quadrangular vs globular), number of testes (16 vs. 26-27); It

differs from *Tylocephalum damodarae* in having scolex (quadrangular vs. globular), testes (16 vs. 60 -70) and vitellaria (follicular vs. granular).

***Tylocephalum hanumanthrae* (Shinde et.al., 1989)**

**(Fig. II-H)**

**Host :** *Trygon sephen*

**Habitat :** Intestine

**Locality :** West Coast of Maharashtra

**Period of collection :** June, 2009 to December, 2013

**Comments :**

Scolex quadrangular, neck is absent, number of testes 30-35, ovary bilobed H-shaped, vitellaria follicular and collected from host *Trygon sephen*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differs from *T. yorkei* in having scolex (quadrangular vs. cushion shaped), neck (absent vs. present) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (quadrangular vs. anterior region smaller than posterior) and vitellaria (granular vs. follicular); from *T. elongatum* in having scolex (quadrangular vs. anterior region larger than posterior), number of testes (30-35 vs. 40) and vitellaria (granular vs. follicular); from *T. madhukari* in having scolex (quadrangular vs. sub globular), number of testes (30-35 vs. 16) and ovary (bilobed 'H' shaped vs. compact granular bean shaped); from *T. singhii* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (30-35 vs. 76-80) and vitellaria (granular vs. follicular); from *T. bombayensis* in having scolex (quadrangular vs. rounded) and neck (absent vs. present); from *T. aurangabadensis* in having neck (absent vs. present), number of testes (30-35 vs. 16) and vitellaria (granular vs. follicular); from *T. mehdii* in having scolex (quadrangular vs. globular), neck (present vs. present) and number of testes (30-35 vs. 43-47); from *T. alibagensis* in having scolex (quadrangular vs. squarish), number of testes (30-35 vs. 64) and ovary (bilobed 'H' shaped vs. 'U' shaped); from *T. gajananae* in having number of testes (30-35 vs. 55-60); from *T. babulalae* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (30-35 vs. 11-12), ovary (bilobed 'H' shaped vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T. shindei* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (30-35 vs. 26-27), ovary (bilobed 'H' shaped vs. 'U' shaped with many acini), vitellaria (granular vs. follicular); It differs from *Tylocephalum damodarae* in having scolex (quadrangular vs. globular), testes (30-35 vs. 60 -70), ovary ('H' shaped vs. 'U' shaped).

***Tylocephalum mehdii* (Bhagvan and Mohekar, 2003)**

**(Fig. II-I)**

**Host:** *Trygon zougei*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex globular, neck is present, number of testes 43-47, vagina anterior to cirrus pouch, ovary 'U' shaped, vitellaria granular and collected from host *Trygon zougei*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890 but differs from *T. yorkei* in having scolex (globular vs. cushion shaped), number of testes (43-47 vs. 30-36), ovary ('U' shaped vs. small bilobed) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (globular vs. anterior region smaller than posterior), neck (present vs. absent), number of testes (43-47 vs. 33) and vitellaria (granular vs. follicular); from *T.*

*elongatum* in having scolex (globular vs. anterior region larger than posterior), neck (present vs. absent), number of testes (43-47 vs. 40) and vitellaria (granular vs. follicular); from *T. madhukari* in having scolex (globular vs. sub globular), neck (present vs. absent), number of testes (43-47 vs. 16) and ovary ('U' shaped vs. compact granular and bean shaped); from *T. singhii* in having number of testes (43-47 vs. 76-80) and vitellaria (granular vs. follicular); from *T. bombayensis* in having number of testes (43-47 vs. 34-38), ovary (U-shaped vs. cylindrical); from *T. aurangabadensis* in having scolex (globular vs. quadrangular), number of testes (43-47 vs. 16) and vitellaria (granular vs. follicular); from *T. hanumantrae* in having scolex (globular vs. quadrangular), neck (present vs. absent) and number of testes (43-47 vs. 30-35); from *T. alibagensis* in having scolex (globular vs. squarish), neck (present vs. absent) and number of testes (43-47 vs. 64); from *T. gajananae* in having scolex (globular vs. quadrangular), neck (present vs. absent) and number of testes (43-47 vs. 55-60); from *T. babulalae* in having number of testes (43-47 vs. 11-12) and vitellaria (granular vs. follicular); from *T. shindei* in having number of testes (43-47 vs. 26-27), vitellaria (granular vs. follicular); It differs from *Tylocephalum damodarae* in having testes (43-47 vs. 60-70).

***Tylocephalum alibagensis* (Bhagvan and Mohekar, 2003) (Fig. II-J)**

**Host:** *Trygon zugei*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex squarish, neck absent, number of testes 64 ovary U-shaped vitellaria granular and collected from host *Trygon zugei*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890, but differs from *T. yorkei* in having scolex (squarish vs. cushion shaped), neck (absent vs. present), number of testes (64 vs. 30-36), ovary ('U' shaped vs. small and bilobed) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (squarish vs. anterior region smaller than posterior), number of testes (64 vs. 33) and vitellaria (granular vs. follicular); from *T. elongatum* in having scolex (squarish vs. anterior region larger than posterior), number of testes (64 vs. 40), ovary ('U' shaped vs. bilobed with small acini) and vitellaria (granular vs. follicular); from *T. madhukari* in having scolex (squarish vs. sub globular), number of testes (64 vs. 16) and ovary ('U' shaped vs. compact granular bean shaped); from *T. singhii* in having scolex (squarish vs. globular), neck (absent vs. present), number of testes (64 vs. 76-80) and vitellaria (granular vs. follicular); from *T. bombayensis* in having scolex (squarish vs. rounded), neck (absent vs. present), number of testes (64 vs. 34-38) and ovary ('U' shaped vs. cylindrical); from *T. aurangabadensis* in having scolex (squarish vs. quadrangular), neck (absent vs. present), number of testes (64 vs. 16) and vitellaria (granular vs. follicular); from *T. hanumanthrae* in having scolex (squarish vs. quadrangular), number of testes (64 vs. 30-35), ovary ('U' shaped vs. bilobed 'H' shaped) and vitellaria (granular vs. follicular); from *T. mehdii* in having scolex (squarish vs. globular), neck (absent vs. present) and number of testes (64 vs. 43-47); from *T. gajananae* in having scolex (squarish vs. quadrangular) and number of testes (64 vs. 55-60); from *T. babulalae* in having scolex (squarish vs. globular), neck (absent vs. present), number of testes (64 vs. 11-12) and vitellaria (granular vs. follicular); from *T. shindei* in having scolex (squarish vs. globular), neck (absent vs. present), number of

testes (64 vs. 26-27), vitellaria (granular vs. follicular); It differs from *Tylocephalum damodarae* in having scolex (squarish vs. globular), neck (absent vs. present), testes (64 vs. 60-70).

***Tylocephalum gajananae* (Wankhede and Jadhav, 2003) (Fig. II-K)**

**Host:** *Trygon sephen*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex quadrangular, neck is absent, number of testes 30-35, ovary bilobed H-shaped, vitellaria follicular and collected from host *Trygon sephen*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890. But differs from *T. yorkei* in having scolex (quadrangular vs. cushion shaped), neck (absent vs. present), number of testes (55-60 vs. 30-36) and vitellaria (granular vs. follicular); from *T. minimum* in having scolex (quadrangular vs. anterior region smaller than posterior), number of testes (55-60 vs. 33) and vitellaria (granular vs. follicular); from *T. elongatum* in having scolex (quadrangular vs. anterior region larger than posterior), number of testes (55-60 vs. 40) and vitellaria (granular vs. follicular); from *T. madhukari* in having scolex (quadrangular vs. sub-globular), number of testes (55-60 vs. 16) and ovary (bilobed with elongated acini vs. compact granular and bean shaped); from *T. singhii* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (55-60 vs. 76-80) and ovary (bilobed with elongated acini vs. U-shaped); from *T. bombayensis* in having scolex (quadrangular vs. rounded), neck (absent vs. present), number of testes (55-60 vs. 34-38) and ovary (bilobed with elongated acini vs. cylindrical); from *T. aurangabadensis* in having neck (absent vs. present), number of testes (55-60 vs. 16), ovary (bilobed with elongated acini vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T. hanumanthrae* in having number of testes (55-60 vs. 30-35); from *T. mehdii* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (55-60 vs. 43-47) and ovary (bilobed with elongated acini vs. 'U' shaped); from *T. alibagensis* in having scolex (quadrangular vs. squarish), number of testes (55-60 vs. 64) and ovary (bilobed with elongated acini vs. U-shaped); from *T. babulalae* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (55-60 vs. 11-12), ovary (bilobed with elongated acini vs. 'U' shaped) and vitellaria (granular vs. follicular); from *T. shindei* in having scolex (quadrangular vs. globular), neck (absent vs. present), number of testes (55-60 vs. 24-27), ovary (bilobed with elongated acini vs. 'U' shaped) and vitellaria (granular vs. follicular); It differs from *Tylocephalum damodarae* in having scolex (quadrangular vs. globular), testes (50-60 vs. 60-70) and ovary (bilobed vs. 'U' shaped).

***Tylocephalum babulalae* (Pawar and Jadhav, 2005) (Fig. II-L)**

**Host:** *Trygon zugei*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex divided into two region, suckers placed at four corners of posterior region, testes 11-12 in number, cirrus pouch anteriorly directed and placed marginally, ovary U-shaped vitellaria follicular and collected from host *Trygon zugei*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton, 1890.



### Map Showing the Location of West Coast of Maharashtra State



● Study Area

Fig. I- Study Area



A) *Tylocephalum yorkei* (Southwell, 1925)

B) *Tylocephalum minimum* (Subhapradha, 1955)

C) *Tylocephalum elongatum* (Subhapradha, 1955)



D) *Tylocephalum madhukari* (Chinchoškar, 1976)

E) *Tylocephalum singhi* (Jadhav and Shinde, 1981)

F) *Tylocephalum bombayensis* (Jadhav, 1983)



G) *Tylocephalum aurangabadensis* (Jadhav et al., 1987)

H) *Tylocephalum hanumanthrao* (Shinde et al., 1989)

I) *Tylocephalum mehdii* (Bhagvan & Mohakar, 2003)



J) *Tylocephalum albogentis* (Bhagvan & Mohakar, 2003)

K) *Tylocephalum galanrao* (Warikhe & Jadhav, 2005)

L) *Tylocephalum babulao* (Pawar & Jadhav, 2005)



M) *Tylocephalum shindei* (Pawar and Jadhav, 2005)

N) *Tylocephalum damodarae* (Pathan and Bhure, 2013)

0.125 mm

Figure II. Camera Lucida diagram of Cestode parasites of Marine Fishes from West Coast Of Maharashtra State, India.

But differs from *T. yorkei* in having scolex (globular vs. cushion shaped), number of testes (11-12 vs. 30-36) and ovary ('U'shaped vs. small and bilobed); from *T. minimum* in having scolex (globular vs. anterior region smaller than posterior), neck (present vs. absent) and number of testes (11-12 vs.33); from *T.elongatum* in having scolex (globular vs. anterior region larger than posterior), number of testes (11-12 vs.40) and ovary ('U'shaped vs.bilobed with small acini); from *T. madhukari* in having scolex (globular vs.sub globular), neck (present vs. absent), number of testes (11-12 vs.16), ovary ('U'shaped vs small and compact granular bean shaped) and vitellaria (follicular vs. granular); from *T.singhii* in having number of testes (11-12 vs. 76-80); from *T.bombayensis* in having scolex (globular vs. rounded), number of testes (11-12 vs. 34-38), ovary (U-shaped vs. small and cylindrical) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex (globular vs. quadrangular) and number of testes (11-12 vs.16); from *T.hanumanthrae* in having scolex (globular vs. quadrangular), neck (present vs. absent), number of testes (11-12 vs.30-35), ovary ('U'shaped vs. bilobed 'H'shaped) and vitellaria (follicular vs. granular); from *T.alibagensis* in having scolex (globular vs. squarish), neck ( present vs. absent), number of testes (11-12 vs.64) and vitellaria (follicular vs. granular); from *T.gajananae* in having scolex (globular vs. quadrangular), neck (present vs. absent), number of testes (11-12 vs.55-60) and vitellaria (follicular vs. granular); from *T.shindei* in having number of testes (11-12 vs.26-27); It differs from *Tylocephalum damodarae* in having testes (11-12 vs. 60 -70), genital pore (marginal vs submarginal), vagina (posterior to cirrus pouch vs anterior to cirrus pouch) and vitellaria(follicular vs. granular).

***Tylocephalum shindei* (Pawar and Jahav, 2005)**

**Fig. II-M)**

**Host:** *Trygon sephen*

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** June, 2009 to December, 2013

**Comments:**

Scolex globular divided in to two region, testes 26-27 in number, ovary U-shaped, vitellaria follicular and collected from host *Trygon sephen*.

The present species having close resemblance to all the known species of the genus *Tylocephalum* Linton,1890. But differs from *T. yorkei* in having scolex (globular vs. cushion shaped), number of testes (26-27 vs. 30-36) and ovary ('U'shaped vs. small bilobed); from *T. minimum* in having scolex (globular vs.anterior region smaller than posterior), neck (present vs. absent) and number of testes (26-27 vs.33).; from *T.elongatum* in having scolex (globular vs. anterior region larger than posterior), neck (present vs. absent),number of testes (26-27 vs. 40) and ovary ('U'shaped vs. bilobed with number of small acini); from *T.madhukari* in having scolex (globular vs.sub globular), neck (present vs. absent),number of testes (26-27 vs.16), ovary ('U'shaped vs. compact granular bean shaped) and vitellaria (follicular vs. granular); from *T.singhii* in having number of testes (26-27 vs.76-80); from *T.bombayensis* in having number of testes (26-27 vs.34-38), ovary ('U'shaped vs.cylindrical) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex (globular vs. quadrangular) and number of testes (26-27 vs.16); from *T.hanumanthrae* in having scolex (globular vs. quadrangular), neck (present vs. absent),number of testes (26-27 vs. 30-35), ovary ('U'shaped vs. bilobed 'H'shaped) and vitellaria (follicular vs. granular); from *T.mehdii* in having number of testes (26-27 vs. 43-47) and vitellaria (follicular vs. granular); from *T.alibagensis* in having scolex (globular vs.squarish), neck (present vs. absent),number

of testes (26-27 vs.64) and vitellaria (follicular vs. granular); from *T.gajananae* in having scolex (globular vs. quadrangular), neck (present vs. absent),number of testes (26-27 vs.55-60) and vitellaria (follicular vs. granular); from *T.babulalae* in having number of testes (26-27 vs.11-12); It differs from *Tylocephalum damodarae* in having testes (26-27 vs. 60 -70).

***Tylocephalum damodarae* (Pathan and Bhure, 2013)**

**(Fig. II-N)**

**Host:** *Dasyatis walga* Muller and Henle, 1841

**Habitat:** Intestine

**Locality:** West Coast of Maharashtra

**Period of collection:** December, 2013

**Comments:**

Scolex globular anteriorly and quadrangular posteriorly, presence of short neck, mature proglottids three to four times longer than broad, testes 60 to 70 in numbers and pre-ovarian, cirrus pouch oval, elongated placed below the middle of the proglottids, cirrus straight, vas deferens long coiled, genital pores are large, sub-marginal, irregularly alternate, vagina anterior to cirrus pouch, ovary 'U' shaped and vitellaria are granular in shape.

The present worm comes closer to all the known species of the genus *Tylocephalum* in general topography of organ. But differs from *T. yorkei* in having scolex (globular vs. cushion shaped), number of testes (60-70 vs. 30-36) and ovary ('U'shaped vs. bilobed); from *T. minimum* in having scolex (globular vs. anterior region smaller than posterior), neck (present vs. absent) and number of testes (60-70 vs.33); from *T.elongatum* in having scolex (globular vs. anterior region larger than posterior), neck (present vs. absent), number of testes (60-70 vs. 40) and ovary ('U'shaped vs. bilobed); from *T.madhukari* in having scolex (globular vs.sub globular), neck (present vs. absent),number of testes (60-70 vs.16), ovary ('U'shaped vs. compact, bean shaped) and vitellaria (follicular vs. granular); from *T.singhii* in having number of testes (60-70 vs.76-80); from *T.bombayensis* in having number of testes (60-70 vs.34-38), ovary ('U'shaped vs.cylindrical) and vitellaria (follicular vs. granular); from *T.aurangabadensis* in having scolex (globular vs. quadrangular) and number of testes (60-70 vs.16); from *T.hanumanthrae* in having scolex (globular vs. quadrangular), neck (present vs. absent), number of testes (60-70 vs. 30-35), ovary ('U'shaped vs. bilobed 'H'shaped) and vitellaria (follicular vs. granular); from *T.mehdii* in having number of testes (60-70 vs. 43-47) and vitellaria (follicular vs. granular); from *T.alibagensis* in having scolex (globular vs.squarish), neck (present vs. absent), number of testes (60-70 vs.64) and vitellaria (follicular vs. granular); from *T.gajananae* in having scolex (globular vs. quadrangular), neck (present vs. absent),number of testes (60-70 vs.55-60) and vitellaria (follicular vs. granular); from *T.babulalae* in having number of testes (60-70 vs.11-12), genital pore (sub marginal vs marginal), vagina (anterior to cirrus pouch vs posterior to cirrus pouch) and vitellaria( granular vs follicular); from *T.shindei* in having number of testes (60-70 vs.26-27).

**Discussion**

From West Coast of Maharashtra, India a total 14 species of the genus *Tylocephalum*, (Linton,1890) have been reported from marine fishes and these species are *Tylocephalum yorkei* Southwell, 1925, *T.minimum*Subhadrpradha,1955, *T.elongatum* Subhadrpradha,1955, *T.madhukari* Chincholikar and Shinde 1980,*T.singhii* Jadhav and Shinde 1981,*T.bombayensis* Jadhav 1983,*T.aurangabadensis* Jadhav et al 1987, *T.hanumanthrae* Shinde et al 1989, *T.mehdii* Bhagwan et al 2002,*T.alibagensis* Bhagwan and Mohekar 2003, *T.gajananae* Wankhede and Jadhav 2003, *T. babulalae* Pawar and Jadhav 2005,*T.shindei*

Pawar and Jadhav 2005, *Tylocephalum damodarae* Pathan and Bhure, 2013.

Most of the species of *Tylocephalum* have been reported from host *Trygon sephen* rather than other marine fishes. The present investigation deals with the diversity of tapeworms, their host specificity and taxonomy of *Tylocephalum* from marine fishes of West Coast of Maharashtra State, India. This study will add more to our knowledge about the piscian tapeworms from West Coast of Maharashtra.

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