

# Biodiversity Checklist of *Senga* Dollfus, 1934 (Pseudophyllidea: Ptychobothriidae) Species from Different Piscine Hosts

Zeenat Madan<sup>1,2</sup>, Sushil Kumar Upadhyay<sup>1,\*</sup>, Manoj Singh<sup>1</sup>, Mukesh Yadav<sup>1</sup>, Deepak Yadav<sup>3</sup>

<sup>1</sup>Department of Bio-sciences and Technology, MMEC, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, Haryana, INDIA.

<sup>2</sup>Department of Zoology, Sanatan Dharma College, Ambala Cantt, Haryana, INDIA.

<sup>3</sup>Department of Zoology, Miranda House, University of Delhi, New Delhi, INDIA.

## ABSTRACT

The genus *Senga* Dollfus, 1934, belonging to the order Pseudophyllidea and family Ptychobothriidae, comprises a distinctive group of intestinal cestodes parasitizing freshwater teleost fishes. This genus was first established with the description of *Senga besnardi* from *Betta splendens* in Vincennes, France. Members of *Senga* exhibit unique morphological features, including a dorsoventrally flattened, elongated and segmented body (strobila), a specialized anterior scolex for attachment and hermaphroditic reproductive systems within each proglottid. These adaptations facilitate their survival and reproduction within the intestinal tracts of fish hosts. Over time, *Senga* species have been reported from a diverse range of fish hosts, particularly from *Mastacembelus armatus*, *Channa punctatus*, *Channa striatus*, *Channa micropeltes*, *Mystus vittatus*, *Rita rita*, *Puntis ticto* and *Labeo rohita* from India and abroad. Since the initial discovery, numerous species have been described globally, particularly across tropical Asian regions. The present review provides a comprehensive and critically evaluated checklist of 68 valid species of *Senga*, compiled from various geographic locations and fish hosts. This review paper provides the insights into immense diversity of the genus *Senga* across different hosts, locations and habitats thus provides a useful base for future studies in parasitology, taxonomy and freshwater ecology.

**Keywords:** Helminthes, Cestodes, Parasites, *Senga*, Fishes, Biodiversity.

## Correspondence:

**Dr. Sushil Kumar Upadhyay**

Department of Bio-sciences and  
Technology, MMEC, Maharishi  
Markandeshwar (Deemed to be  
University), Mullana-Ambala-133207,  
Haryana, INDIA.  
Email: upadhyay.k.sushil@gmail.com

**Received:** 11-02-2026;

**Revised:** 06-03-2026;

**Accepted:** 27-04-2026.

## INTRODUCTION

Parasitism is a highly evolved negative biological association that plays a pivotal role in ecologic and evolutionary dynamics across all ecosystems (Malhotra and Jaiswal, 2014; Upadhyay, 2020a; Upadhyay *et al.*, 2019). It is a type of antagonistic interaction between two different species in which one organism which is usually smaller, known as the parasite, derives nutritional, physiological and reproductive benefits at the expense of another organism typically larger in size and known as the host (Kashyap *et al.*, 2024; Mustafa *et al.*, 2024; Pandey and Agarwal, 2007; Upadhyay *et al.*, 2013a). Parasites have adapted to exploit a wide array of hosts and have complex life cycles and morphological specializations that ensure their survival and reproduction. These parasitic organisms cause numerous diseases in their hosts, affecting almost all major animal groups, including humans,

livestock, birds, reptiles, amphibians and aquatic species (Bannai and Jori, 2022; Upadhyay, 2017a; Upadhyay *et al.*, 2009; Upadhyay and Nanware, 2020; Upadhyay *et al.*, 2016). These parasites are primarily categorized as Protozoa, Helminthes and Arthropoda which exert deleterious effects on host health by extracting nutrients, damaging tissues, triggering immune responses and interfering with physiological functions (Babita *et al.*, 2019; Chai *et al.*, 2005; Malhotra *et al.*, 2009; Upadhyay, 2020b). Helminthes are multicellular triploblastic metazoans, dorsoventrally flattened or round, acoelomate or pseudocoelomate and predominantly exhibit parasitic behaviour. These helminthes belong to classes Trematoda and Cestoda of Phylum Platyhelminthes, Nematoda of Phylum Aschelminthes and Phylum Acanthocephala (Jaiswal *et al.*, 2013; Khalil, 1973; Rani and Upadhyay, 2019; Upadhyay, 2012; Upadhyay *et al.*, 2013b; Yamaguti, 1959). These helminthes are potent parasites and parasitize a vast group of animals having high prevalence in fish globally (Jadhav and Bhure, 2006; Jaiswal *et al.*, 2014; Menconi *et al.*, 2023; Nanware *et al.*, 2019; Upadhyay, 2017b; Upadhyay and Babita, 2021). Due to diverse behavioural patterns and ecologic niche, the fish is a suitable host for parasitic helminthes and offer conducive conditions for these parasites to thrive and complete their life cycles (Lagrué *et al.*, 2011). Among these, the cestodes commonly known as tapeworms



DOI: 10.5530/ajbls.20260112

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are of particular significance owing to their complex anatomy, unique physiological characteristics and their role as intestinal endoparasites in vertebrate hosts (Table 1) (Babita *et al.*, 2022; Dhole *et al.*, 2009; Scholz and Kuchta, 2022).

Mature cestodes are elongated, cylindrical, dorsoventrally flattened and segmented endoparasites, mainly inhabiting the intestinal tract of vertebrate hosts. Their bodies consist of a linear series of segments known as the strobila, which may range from just a few to several thousand proglottids. These parasites are hermaphroditic possessing both male and female reproductive systems within each mature proglottid. The adult forms reside within the gut whereas the larval stages often encyst in extraintestinal tissues of intermediate hosts (Bidkar, 2022; Jadhav *et al.*, 2005; Khalil *et al.*, 1994; Netane, 2022; Upadhyay and Babita, 2019). The external surface is covered by a syncytial tegument that facilitates nutrient absorption and protects against host immune defences. Anteriorly the cestodes bear a specialized scolex, which may be equipped with bothria, suckers or a rostellum for attachment to the intestinal lining. Just behind the scolex lies the neck region, which perpetually generates new immature proglottids. As these segments move posteriorly, they develop into mature proglottids having fully formed reproductive organs. The terminal proglottids are known as gravid and filled with fertilized eggs within an expanded uterus which ultimately detached and released into the host intestine via apolysis, facilitating transmission to the next host in the life cycle (Kaul and Kalse, 2018; Malhotra *et al.*, 1981; Upadhyay *et al.*, 2020). Thus, cestodes are a taxonomically rich and biologically significant group of parasitic flatworms having medical, veterinary and ecologic relevance. However, significant gaps persist in the complete understanding of the species diversity, host specificity, life cycles and geographical distribution of a number of cestodes.

Within the class Cestoda, the order Pseudophyllidea comprises several genera of ecologic, parasitological and aquacultural importance. Among these, the genus *Senga* (Dollfus, 1934) classified under the family Ptychobothriidae holds particular significance due to its parasitism in freshwater teleost fishes (Bhure *et al.*, 2010a; Geetanjali *et al.*, 2007). Despite being reported from a number of tropical freshwater ecosystems, especially across the Asian continent, the biodiversity and taxonomy of *Senga* species remain incompletely understood and poorly documented, as most available literature focus either on isolated species descriptions or specific host-parasite records. A little effort has been made to integrate these findings into a broader, cohesive taxonomic or ecologic framework. Keeping in view these challenges, there is an urgent need to systematically compile all available records of *Senga* species reported from freshwater fish hosts. To address this, the present review tried to assemble a consolidated and critically evaluated checklist of valid *Senga* species.

## Taxonomic Status

**Phylum:** Platyhelminthes.

**Class:** Cestoda Southwell (1930).

**Subclass:** Eucestoda Yamaguti (1934).

**Order:** Pseudophyllidea Carus and Gerstaecker (1863).

**Family:** Ptychobothriidae Luhe, 1902.

**Genus:** *Senga* Dollfus, 1934.

## Biodiversity of *Senga*

The genus *Senga* was established by Dollfus (1934) with the type species *S. besnardi* recovered from *Betta splendens* at Vincennes in France. After that *S. ophiocephalina* (syn. *Anchisrocephalus o.*) had been described from *Ophiocephalus argus* by Tseng (1933) at Tsian and Pieping, China while Woodland (1924) later on added *S. pycnomera* (syn. *Bothriocephalus* sp. W.) found in *Ophicephalus marulius* at Allahabad, India. Subsequently, multiple taxonomic studies have led to the description of several new species of *Senga*, reflecting its high prevalence and taxonomic richness among freshwater fishes.

Johri (1956) described *S. lucknowensis* collected from *Mastacembelus armatus* from Lucknow, India. Fernando and Furtado (1964) contributed three species namely *S. malayana* from *Channa striatus*; *S. parva* and *S. filiformis* both from *Channa micropeltes* at Malacca. Ramadevi and Rao (1966) identified a *Senga* species in the plerocercoid stage from *Panchax panchax* in Visakhapatnam. *S. pahangensis* from *C. micropeltes* at Tesak Bera, Malayasia was described by Furtado and Chau-Lan (1971). *S. besnardi* was redescribed from *O. gachua* in India by Shinde (1972). Ramadevi and Rao (1973) described one more species *S. vishakhapatnamensis* from *O. punctatus*. A new species *S. taunsaensis* from *C. gachua* in Pakistan was reported by Zaidi and Khan (1976).

In the series of the discovery of new species of genus *Senga*, Gupta and Sinha (1980) reported two species namely *S. punctati* from *O. punctatus* and *S. mastacembali* from *M. armatus* in Lucknow, India. Jadhav and Shinde (1980) described *S. aurangabadensis* while Shinde and Jadhav (1980) described and *Senga godavarii* collected from *M. armatus* at Aurangabad and Nanded districts of Maharashtra, India respectively. *S. khami* from *O. marulius* at Aurangabad, Maharashtra, India was described by Shinde and Deshmukh (1980). *S. paithanensis* from *M. armatus* was recovered in Paithan, Maharashtra, India by Kadam *et al.*, (1981).

Majid and Shinde (1984) contributed *S. raoii* and *S. jagannathe* from *Channa punctatus* in Orissa, India. *Senga indica* was described by Gupta and Parmar (1985) from *M. armatus* in Lucknow. Gariola and Malhotra reported two novel species as *S. gangesii* (Gairola and Malhotra, 1986a) and *S. yamunica* (Gairola and Malhotra, 1986b) followed by *S. vittati* (Gairola

**Table 1: Checklist of pseudophyllidean parasite *Senga* Dollfus, 1934 from different piscine hosts.**

Sl. No.	Parasites sp.	Host	Place	References
1	<i>Senga besnardi</i>	<i>Betta splendens</i>	France	Dollfus (1934) and Shinde (1972)
2	<i>S. ophiocephalina</i>	<i>Ophiocephalus argus</i>	China	Tseng (1933)
3	<i>S. pycnomera</i>	<i>Ophiocephalus marulius</i>	India	Woodland (1924)
4	<i>S. lucknowensis</i>	<i>Mastacembelus armatus</i>	India	Johri (1956)
5	<i>S. malayana</i>	<i>Channa striatus</i>	Malacca	Fernando and Furtado (1964)
6	<i>S. parva</i>	<i>Channa micropeltes</i>	Malacca	Fernando and Furtado (1964)
7	<i>S. filiformis</i>	<i>Channa micropeltes</i>	Malacca	Fernando and Furtado (1964)
8	<i>Senga</i> sp. (plerocercoid)	<i>panchax panchax</i>	India	Ramadevi and Rao (1966)
9	<i>S. pahangensis</i>	<i>Channa micropeltes</i>	Malyasia	Furtado and Chau-Lan (1971)
10	<i>S. vishakapatnamensis</i>	<i>Ophiocephalus punctatus</i>	India	Ramadevi (1973)
11	<i>S. taunsaensis</i>	<i>Channa gachua</i>	Pakistan	Zaidi and Khan (1976)
12	<i>S. punctati</i>	<i>Ophiocephalus punctatus</i>	India	Gupta and Sinha (1980)
13	<i>S. mastacembali</i>	<i>Mastacembelus armatus</i>	India	Gupta and Sinha (1980)
14	<i>S. aurangabadensis</i>	<i>Mastacembelus armatus</i>	India	Jadhav and Shinde (1980)
15	<i>S. godavarii</i>	<i>Mastacembelus armatus</i>	India	Shinde and Jadhav (1980)
16	<i>S. khami</i>	<i>Ophiocephalus marulius</i>	India	Shinde and Deshmukh (1980)
17	<i>S. paithanensis</i>	<i>Mastacembelus armatus</i>	India	Bidkar (2022) and Kadam <i>et al.</i> , (1981)
18	<i>S. raoii</i>	<i>Channa punctatus</i>	India	Majid and Shinde (1984)
19	<i>S. jagannathe</i>	<i>Channa punctatus</i>	India	Majid and Shinde (1984)
20	<i>S. indica</i>	<i>Mastacembelus armatus</i>	India	Gupta and Parmar (1985)
21	<i>S. gangesii</i>	<i>Mystus vittatus</i>	India	Gairola and Malhotra (1986a)
22	<i>S. yamunica</i>	<i>Mystus vittatus</i>	India	Gairola and Malhotra (1986b)
23	<i>S. vittati</i>	<i>Mystus vittatus</i>	India	Gairola and Malhotra (1987)
24	<i>S. nayari</i>	<i>Mastacembelus armatus</i>	India	Malhotra (1988)
25	<i>S. pathankotensis</i>	<i>Labeo rohita</i>	India	Duggal (1989)
26	<i>S. teleostei</i>	<i>Ophiocephalus marulius</i>	India	Banerjee <i>et al.</i> , (1990)

Sl. No.	Parasites sp.	Host	Place	References
27	<i>S. gachuae</i>	<i>Channa gachua</i>	India	Jadhav (1991)
28	<i>S. maharashtrii</i>	<i>Mastacembelus armatus</i>	India	Jadhav et al. (1991) and Sawarkar (2012)
29	<i>S. chauhani</i>	<i>Channa punctatus</i>	India	Hasnain (1992)
30	<i>S. jhansiensis</i>	<i>Mastacembelus armatus</i>	India	Mathur et al. (1994)
31	<i>S. mohekarae</i>	<i>Mastacembelus armatus</i>	India	Tat and Jadhav (1997)
32	<i>S. Chiangmaiensis</i>	<i>Mastacembelus armatus</i>	Thailand	Wongsawad et al. (1998)
33	<i>S. armatusae</i>	<i>Mastacembelus armatus</i>	India	Hiware (1999)
34	<i>S. tappi</i>	<i>Mastacembelus armatus</i>	India	Patil and Jadhav (2003)
35	<i>S. sharpiloi</i>	<i>Channa micropeltes</i>	Singapore	Polyakova and Kirin (2005)
36	<i>S. ayodhensis</i>	<i>Amphinoous cuchia</i>	India	Pande et al. (2006)
37	<i>S. baughui</i>	<i>Rita rita</i>	India	Pande et al. (2006)
38	<i>S. jadhavae</i>	<i>Mastacembelus armatus</i>	India	Bhure et al. (2007)
39	<i>S. chandikapurensis</i>	<i>Mastacembelus armatus</i>	India	Khadap et al. (2007)
40	<i>S. ticto</i>	<i>Puntius ticto</i>	India	Srivastav et al. (1934)
41	<i>S. nathsagarensis</i>	<i>Mastacembelus armatus</i>	India	Kankale (2008)
42	<i>S. panzaraensis</i>	<i>Mastacembelus armatus</i>	India	Mangale and Kalse (2009)
43	<i>S. kaigaonensis</i>	<i>Mastacembelus armatus</i>	India	Wankhede and Reddy (2009)
44	<i>S. madhavae</i>	<i>Mastacembelus armatus</i>	India	Bhure et al. (2010b)
45	<i>S. satarensis</i>	<i>Mastacembelus armatus</i>	India	Bhure and Nanware (2011a)
46	<i>S. mangalbaiae</i>	<i>Mastacembelus armatus</i>	India	Bhure and Nanware (2011b)
47	<i>S. rostellarae</i>	<i>Mastacembelus armatus</i>	India	Dhole et al. (2011)
48	<i>S. Chandrashekhari</i>	<i>Mastacembelus armatus</i>	India	Dhole et al. (2011)
49	<i>S. rupchandensis</i>	<i>Channa striatus</i>	India	Pardeshi and Hiware (2011)
50	<i>S. govindii</i>	<i>Mastacembelus armatus</i>	India	Jadhav et al. (2012)
51	<i>S. silcharensis</i>	<i>Channa punctatus</i>	India	Puniyabati et al. (2013)
52	<i>S. microstellata</i>	<i>Mastacembelus armatus</i>	India	Bhure et al. (2014)
53	<i>S. nandedensis</i>	<i>Mastacembelus armatus</i>	India	Fartade and Fartade (2014)
54	<i>S. jadhavii</i>	<i>Mastacembelus armatus</i>	India	Fartade and Fartade (2015)
55	<i>S. madhukarii</i>	<i>Mastacembelus armatus</i>	India	Fartade et al. (2015)
56	<i>S. shindei</i>	<i>Mastacembelus armatus</i>	India	Mote et al. (2015)

Sl. No.	Parasites sp.	Host	Place	References
57	<i>S. sukhanensis</i>	<i>Mastacembelus armatus</i>	India	Nimbalkar and Deolalikar (2015)
58	<i>S. triangulata</i>	<i>Mastacembelus armatus</i>	India	Nanware et al. (2016)
59	<i>S. rostellata</i>	<i>Mastacembelus armatus</i>	India	Deshmukh (2015)
60	<i>S. maruliusensis</i>	<i>Ophiocephalus marulius</i>	India	Deolalikar (2016)
61	<i>S. bothriolata</i>	<i>Mastacembelus armatus</i>	India	Khade and Dabhade (2017)
62	<i>S. mohkhedensis</i>	<i>Mastacembelus armatus</i>	India	Lakhe (2017)
63	<i>S. banshelkinesis</i>	<i>Mystus seenghala</i>	India	Bele (2019)
64	<i>S. mastacembalae</i>	<i>Mastacembelus armatus</i>	India	Kalse and Patil (2019)
65	<i>S. killedharurensis</i>	<i>Mastacembelus armatus</i>	India	Lakhe (2021)
66	<i>S. wakadii</i>	<i>Mastacembelus armatus</i>	India	Pradhan and Dandawate (2021)
67	<i>S. follicularae</i>	<i>Mastacembelus armatus</i>	India	Barshe et al., (2023)
68	<i>S. ashwiniae</i>	<i>Mastacembelus armatus</i>	India	Hasekar and Thakare (2025)

and Malhotra, 1987) in *Mystus vittatus* from Allahabad, Uttar Pradesh, India. Malhotra (1988) described *S. nayari* from *M. armatus* near Pauri in Uttarakhand, India. Duggal and Bedi (1989) recovered *S. pathankotensis* from *Labeo rohita* in Pathankot, Punjab. *S. teleostei* was recovered from *C. punctatus* in Garhwal Himalayas by Banerjee et al., (1990).

Jadhav (1991) described *S. gachuae* from *Channa gachua* whereas Jadhav et al., (1991) reported *S. maharashtrii* from *M. armatus* both from Maharashtra, India. Hasnain (1992) reported *Senga chauhani* from *C. punctatus* in Jamshedpur, Bihar, India. *S. jhansiensis* from *M. armatus* in Jhansi was reported by Mathur, et al., (1994). Tat and Jadhav (1997) added one more species of *Senga* as *S. mohekarae* recovered from *M. armatus* at Parli, Dist. Beed, M. S. India. *S. chiangmaiensis* in *M. armatus* was reported from Thailand by Wongsawad et al., (1998) while Hiware (1999) described *S. armatusae* from the same fish species in Pune, Maharashtra, India.

Patil and Jadhav (2003) reported *S. tappi* from Shirpur, Dhule, India. Polyakova and Kirin (2005) contributed *S. sharpiloi* from *C. micropeltes* from Vylov Lennogo Coast, Singapore. Pande et al., (2006) described *S. ayodhensis* from *Amphinothus cuchia* and *S. baughui* from *Rita rita* of Ayodhya and Basti respectively in Uttar Pradesh, India. Bhure et al. described *S. jadhavae* (Bhure et al., 2007) in Aurangabad and later added *S. madhavae* (Bhure et al., 2010b) and *S. microstellata* (Bhure et al., 2014) from *M. armatus* at various places of Maharashtra.

Khadap et al., (2007) described *S. chandikapurensis* from Chandikapur, Bihar, India. *S. ticto* from *Puntius ticto* from Jhansi, Uttar Pradesh, India was reported by Srivastav et al., (1934) Kankale (2008) described *S. nathsagarensis* from *M. armatus* from Nathsagar Dam, Paithan while Mangale and Kalse (2009) reported *S. panzaraensis* from Panzara River, Dhule, India. *S. kaigaonensis* from *M. armatus* from Kaigaon Toka at Maharashtra, India was recovered by Wankhede and Reddy (2009).

Bhure and Nanware recovered *S. satarensis* (Bhure and Nanware, 2011a) and *S. mangalbaiiae* (Bhure and Nanware, 2011b) while Dhole et al., (2011) described *S. rostellariae* and *S. chandrashekhari* from *M. armatus* at Maharashtra, India. Pardeshi and Hiware described *S. rupchandensis* from *Channa striatus* in Jalana, Maharashtra, India (Pardeshi and Hiware, 2011). Jadhav et al., (2012) reported *S. govindii* from Kolegaon Dam, Osmanabad while Sawarkar (2012) described *S. maharashtrii* from *M. armatus* from Chandrabhanga river, Daryapur, Maharashtra, India. Puinyabati et al., reported *S. silcharensis* from *Channa punctatus* at Silchar, Assam, India.

Fartade and Fartade described *S. nandedensis* (Fartade and Fartade, 2014) and later recovered *S. jadhavii* (Fartade and Fartade, 2015) while Fartade et al. (2015) described *S. madhukarii* all from *M. armatus* of Godavari Basin, Maharashtra, India. Mote et al., (2015) described *S. shindei* in *M. armatus* from Godavari Basin, Paithan while Nimbalkar and Deolalikar (2015) reported *S. sukhanensis* from Sukhaa Dam, Aurangabad, Maharashtra, India. Deshmukh (2015) introduced *S. rostellata* from *M. armatus* at Nanded, Maharashtra, India. Deolalikar (2016)

described *S. maruliusensis* and Nanware et al., (2016) described *S. triangulate* and from *Ophiocephalus marulius* from Jaikwadi Dam at Aurangabad District, India.

*S. bothrialata* from *M. armatus* was reported by Khade and Dabhade (2017). Lakhe (2017) reported *S. mohkhedensis* from *M. armatus* from Mohked Dam, Beed, Maharashtra, India. Bele (2019) described *S. banshelkinesis* in *Mystus seenghala* from Banshelki Dam, Latur. Kalse and Patil (2019) introduced *S. mastacembae* and Lakhe (2021) described *S. killedharurensis*, both from *M. armatus* in Jalgaon and Kille Dharur respectively in Maharashtra, India. *S. wakadii* from Wakadi Dam, Osmanabad was reported by Pradhan and Dandawate (2021). *S. follicularae* recovered from *M. armatus* at Ahmedpur, India was described by Barshe et al., (2023). Recently, Hasekar and Thakare (2025) reported a new species *S. ashwiniae* from *M. armatus* of Niwati dam, Parbhani, Maharashtra, India.

## CONCLUSION

Parasitism is a highly specialized antagonistic association between two organisms. It constitutes a highly specialized evolutionary strategy, with helminths exhibiting a wide array of morphological and physiological adaptations to exploit diverse host species. Within this group of parasites, cestodes have demonstrated significant diversification in aquatic ecosystems, where they commonly inhabit the intestinal tracts of fishes. The genus *Senga* Dollfus, classified under the order Pseudophyllidea, exemplifies such specialization and ecologic adaptability. Total 68 species of genus *Senga* Dollfus (Pseudophyllidea: Ptychobothriidae) reported in this review paper from various fish hosts, out of which 62 species have been described from India, reflecting the country's dominant contribution to the known diversity of the genus. The remaining six species, documented from France, China, Malaysia, Pakistan, Thailand and Singapore, further indicate a widerglobal distribution. Hence, this compilation of genus *Senga* with diverse host range and geographic locations offers a foundational reference for future taxonomic and ecologic studies, positioning the genus as a valuable model for parasitological research and a promising framework for advancing knowledge in cestode systematics and freshwater parasite ecology.

## ACKNOWLEDGEMENT

The authors are deeply grateful to the Head, Department of Bio-Sciences and Technology, Maharishi Markandeshwar (Deemed to be University), MMEC, Mullana–Ambala (Haryana), India for constant support and encouragement extended during the course of this research work.

## ABBREVIATIONS

**M.S:** Maharashtra State; **Dist:** District; **sp. nov:** Species novum (new species); **n. sp:** New species; **syn:** Synonym; **MS:** Maharashtra State; **U.P:** Uttar Pradesh.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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**Cite this article:** Madan Z, Upadhyay SK, Singh M, Yadav M, Yadav D. Biodiversity Checklist of *Senga* Dollfus, 1934 (Pseudophyllidea: Ptychobothriidae) Species from Different Piscine Hosts. *Asian J Biol Life Sci.* 2026;15(1):15-22.