# FAUNA OF INDIA CHECKLIST

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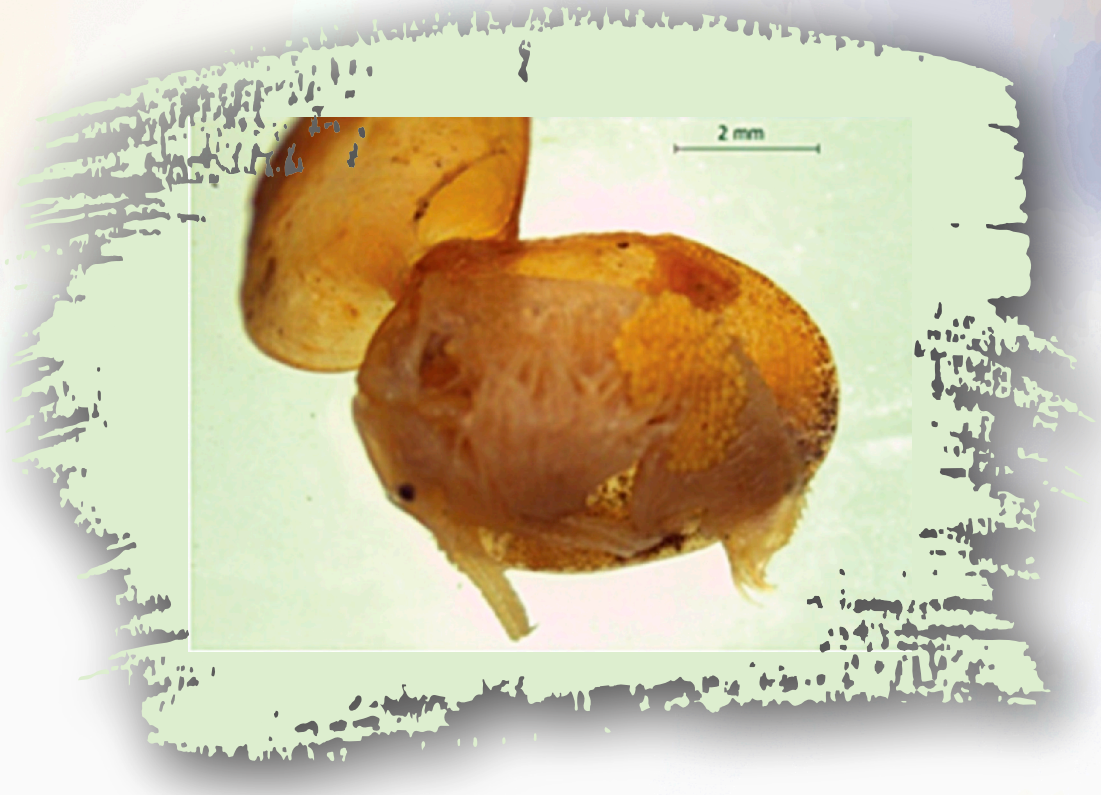


# ARTHROPODA: CRUSTACEA: BRANCHIOPODA

## (Anostraca, Notostraca, Cyclestherida Laevicaudata and Spinicaudata)

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**ZOOLOGICAL SURVEY OF INDIA**
**Ministry of Environment, Forest & Climate Change**

# CRUSTACEA: BRANCHIOPODA

## (Anostraca, Notostraca, Cyclestherida Laevicaudata and Spinicaudata)

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**Introduction:** The Branchiopods are a primordial and diverse class of the Crustacea characterized by having flattened and foliaceous thoracic appendages (thoracopods); these structures have respiratory (as well as other) function and hence the name branchio- (breathing) poda (legs) (Greaves, 2012). It is a reasonably small taxon of primarily freshwater crustaceans with numerous primeval members like fairy shrimps,tadpole shrimps and encompasses highly modified associates of Cladocerans (Martin, 1992, Olesen, 2009). Nearly half of the known branchiopod species are cladocerans. The non-cladocerans (Anostraca=fairy shrimps, Notostraca=tadpole shrimps, Laevicaudata=smooth clam shrimps and Spinicaudata = Spiny clam Shrimps) are generally named as 'large branchiopods', despite the group being clearly paraphyletic, nevertheless, they share a number of common characteristics like serially similar phyllopodous trunk limbs, their preference for temporary wetlands or salt lakes (Olesen, 2009). In India many of the major groups of non-cladoceran or large branchiopods are well represented in various temporary and semi permanent water bodies, occasionally in some permanent water bodies. The anostracans, inhabiting temporary rain pools and permanent saltwater worldwide, are branchiopods lacking a carapace and with 19-27 postcephalic segments of which 9-19 carry a pair of similar, foliaceous limbs (Weekers *et al.,* 2002). Most of them are about 10-30 mm long (extreme range 5-150 mm), and consist of a long cylindrical body divided into a head, a thorax with many pairs of foliaceous limbs, the genitalia, and an abdomen and interestingly the fairy shrimps swim upside down (Timms, 2015).

Baird (1860) initiated the awareness of Phyllopod crustaceans of the Indian Empire by describing *Streptocephalus dichotomus* from a single male specimen swimming in a bucket of milk (Bond, 1934). Since then there are many workers who contributed to the knowledge of the non cladoceran branchiopods (Sars, 1887; Alcock, 1898; Gurney, 1906, 1921,1924,1925,1930; Kemp, 1911a,b; Bond, 1934; Mahabate, 1939; Gopinath, 1944; Chako, 1950). Tiwari (1951, 1958,1962,1965, 1966,1971,1972,1996) made a significant contribution to the large branchipod crustaceans of India. The contribution made by other workers (Raj, 1951; Kulkarni, 1953; Iyengar and Basavaiah, 1956; Mathur and Sidhu, 1957; Baid, 1958,1968,1975; Raji,1951; Karande and Inamdar, 1959, 1961a,b; Nayar, 1965; Shull, 1967; Raj, 1971; Nayar and Nair, 1968, Shanbag and Inamdar, 1968; Issac, 1970; Malhotra and Duda, 1970; Royan *et al*., 1970; Das, 1971; Das and Akhtar, 1971; Royan and Alfred, 1971; Royan and Sumitra, 1973; Radhakrishna and Durga Prasad, 1974,1976; Bhargava and Alam, 1980; Munuswamy, 1982a,b; Battish, 1981, 1983; Joseph *et al.,* 1992; Belk and Esparza, 1995; Ghate and Patil, 1995; Belk and Brendonck, 1997; Ghate and Shetty, 1997; Manca and Mura, 1997) is also noteworthy.

Presently numerous remarkable investigations were carried out by Ghate, *et al*. (2003), Balaraman and Nayar (2004), Durga Prasad and Simhachalam (2004, 2009) Velu, and Munuswamy (2003, 2005,2006,2007), Babu and Nandan, (2010), Padhye *et al*. (2011a,b,c), Simhachalam and

Timms (2012), Vikas *et al* (2012) and Padhye *et al*. (2015), Kulkarni *et al*.(2015), Padhye and Dahanukar (2015) and Padhye and Ghate, 2016). Rogers and Padhye (2015) reviewed the large branchiopod crustaceans of Indian subcontinent and Padhye *et al*. (2016) studied the diversity and zoogeography of the fairy shrimps of Indian subcontinent. Recently Sanoamuang et al., (2020) added *Eulimnadia cryptus* from Telengana.

**Global Diversity:** The large branchiopod crustaceans comprise about 500 species found in aquatic, inland, saline and/or temporary wetland habitats from all continents, including Antarctica (Brendonck *et al*., 2008; Rogers and Padhye, 2015).

**Diversity in India:** In general, the Asian large branchiopod fauna has been poorly studied and with many areas not surveyed and much confusion in the taxonomic literature (Rogers, 2013; Rogers and Padhye, 2014, 2015). Rogers and Padhye (2015) made a detailed review of large branchiopod crustaceans of Indian subcontinent (Bangladesh, India, Nepal, Pakistan, and Sri Lanka). Out of 86 species of large branchiopods known earlier from the Indian subcontinent they have recognized only 42 species: 16 anostracans, 2 notostracans, 3 laevicaudatans, 21 spinicaudatans (with reservations), and a single species of cyclestherid, while the rest were synonymized. Valarmathi (2017) in her inventory on the large branchiopod diversity in Indian Freshwater ecosystem has has mentioned the availability 40 species of large branchiopods under 14 genera, 11 families and 4 orders are known to occur in India. The present checklist provides a list of 46 species of large Branchiopods belonging to 13 genera and 12 families.

**Diversity in States:**

| Sl.No. | State/Union Territory | No. Species | No. Endemic Species |
|---|---|---|---|
| 1. | Andhra Pradesh | 10 | |
| 2. | Arunachal Pradesh | 0 | |
| 3. | Assam | 0 | |
| 4. | Bihar | 2 | |
| 5. | Chhattisgarh | 0 | |
| 6. | Gujarat | 5 | |
| 7. | Goa | 1 | |
| 8. | Haryana | 0 | |
| 9. | Himachal Pradesh | 4 | |
| 10. | Jharkhand | 0 | |
| 11. | Karnataka | 3 | |
| 12. | Kerala | 5 | |
| 13. | Madhaya Pradesh | 4 | |
| 14. | Maharashtra | 11 | |
| 15. | Manipur | 0 | |
| 16. | Meghalaya | 0 | |
| 17. | Mizoram | 0 | |
| 18. | Nagaland | 0 | |
| 19. | Odisha | 1 | |
| 20. | Punjab | 10 | |

| Sl.No. | State/Union Territory | No. Species | No. Endemic Species |
|---|---|---|---|
| 21. | Rajasthan | 12 | |
| 22. | Sikkim | 1 | |
| 23. | Tamil Nadu | 25 | |
| 24. | Telangana | 6 | |
| 25. | Tripura | 0 | |
| 26. | Uttarpradesh | 4 | |
| 27. | Uttarakhand | 3 | |
| 28. | West Bengal | 3 | |
| 29. | Andaman & Nicobar | 0 | |
| 30. | Chandigarh | 0 | |
| 31. | Delhi | 0 | |
| 32. | Dadra Nagar Haveli, Daman & Diu | 0 | |
| 33. | Jammu & Kashmir | 4 | |
| 34. | Ladakh | 0 | |
| 35. | Lakshadweep | 0 | |
| 36. | Puducherry | 0 | |

**Endemism:** Of the nearly 500 described species of large branchiopods, more than one-fourth are known only from their type localities, and several species have only been collected once or twice (Rogers, 2009). In India also many species are known only from their type locality and nearby areas and few species are reported from very limited areas.

**Habitat:** The anostracans inhabit almost exclusively temporary standing freshwaters like clay pans, gnammas on rock outcrops, vegetated pools, newly filled freshwater lakes, salt lakes, ephemeral farm dams, roadside ditches, disconnected creek pools, actually anywhere where water is ponded for more than few days (Timms, 2015). The tadpole shrimp *Triops* occurs in rice fields, rain pools, fishery ponds and other temporary freshwater water bodies (Zierold *et al.,* 2009, Hora *et al.,* 1955, Padhye and Ghate, 2016). The clam shrimps are also noticed in temporary and semi- permanent inland water bodies. We could observe the cyclotheriids even in permanent water bodies like ponds along with cladocerans among the marginal vegetation (Personnel observation).

**Ecological Significance:** The play a significant role in food chain as they become prey for many larger aquatic vertebrates and invertebrates.

**Human Significance:** Many species of fairy shrimps are considered as a live feed in aquaculture industries and they are used effectively as 'living pills' to provide antibiotics, medications, or vitamins to the aquacultural livestock (Amitha *et al.,* 2007; Basil and Pandian, 1991; Rogers, 2009). *Triops cancriformis* has been reported as a rice pest in Kashmir, India (Hora *et al,* 1955, Zaka-ur-Eab, 1984, Padhye and Ghate, 2016). On the contrary the *Triops* species are used in biological control in Japan. In pet industries *Artemia* is frequently sold as 'Sea Monkeys' and the tadpole shrimp *Triops* is sold as a 'living fossil' (Rogers, 2009). Any kind of anthropogenic activities that affects the temporary water

bodies will directly or indirectly affect the diversity of large branchiopod crustaceans so if we protect the habitat we can conserve the large branchiopod crustaceans.

Threatened species as per IUCN : Of the nearly 500 described species of large branchiopods, more than one fourth are known only from their type localities, and several species have only been collected once or twice (Rogers, 2009). About 31 large branchiopod species are included in the IUCN red list and no Indian species is noticed among them (IUCN, 2016).

Protected Species as per WPA (2022) (Number of species in different schedules): Nil

Species under CITES (Number of species): Nil

Invasive alien species (Number of species) Nil

**Gap areas** : The works on large branchiopod crustaceans are very scattered and except the recent literature based review by Rogers and Padhye (2015) no concrete information is available in this group. Attention should be given to make a detailed taxonomic study based on the materials already collected and available in the museums and fresh faunal surveys to various parts of the country is also essential. The taxonomic ambiguity of various species of the non cladoceran branchiopods should be solved by a detailed study of the already known species and especially by examining more samples from different localities. Apart from that there are many unexplored area of this group and the youngsters should develop expertise in this group to have a better knowledge on these poorly known organisms

## List of Species Known from India

**Class Branchiopoda**

**Subclass Sarsostraca**

**Order Anostraca Sars, 1867**

**Family Artemiidae Grochowski, 1896**

1. *Artemia salina* (Linneaus, 1758)
2. *Artemia franciscana* Kellogg, 1906

**Family Streptocephalidae Daday, 1910**

3. *Streptocephalus dichotomus* Baird, 1860
4. *Streptocephalus echinus* Bond, 1934
5. *Streptocephalus longimanus* Bond, 1934
6. *Streptocephalus simplex* Gurney, 1906
7. *Streptocephalus spinifer* Gurney, 1906.
8. *Streptocephalus sahyadriensis* Rogers and Padhye, 2014

**Family Branchipodidae Simon, 1886**

9. *Branchipodopsis affinis* Sars, 1901

**Family Thamnocephalidae Packard, 1883**

10. *Branchinella hardingi* (Qadri & Baqai, 1956)

11. *Branchinella maduraiensis* (Raj, 1951)
12. *Carinophallus ornata* (Daday, 1910)

**Family Chirocephalidae Daday, 1910**

13. *Chirocephalus priscus* (Daday, 1910)

**Super Order Calmanostraca**

**Order Notostraca, Sars, 1867**

**Family** Triopsidae Keilhack, 1909

14. *Triops cancriformis* (Bosc, 1801)
15. *Triops granarius* (Lucas, 1864)

**Order Cyclestherida**

**Family Cyclestheriidae**

16. *Cyclestheria hislopi* (Baird, 1859)

**Subclass Phyllopoda**

**Super Order Diplostraca**

**Order Laevicaudata**

**Family: Lynceidae Baird, 1845**

17. *Lynceus brachyurus* Müller, 1776
18. *Lynceus denticulatus* (Gurney, 1930) complex
19. *Lynceus indicus* Daday, 1913

**Order Spinicaudata**

**Family : Cyzicidae**

20. *Cyzicus ludhianatus* (Battish, 1981)
21. *Cyzicus politus* (Baird, 1849)
22. *Ozestheria annandalei* Daday, 1913
23. *Ozestheria indica* (Gurney, 1906)

**Family Eocyzicidae**

24. *Eocyzicus bouvieri* Daday, 1913b
25. *Eocyzicus hutchinsoni* Bond, 1934 (Species complex)
26. *Eocyzicus plumosus* Royan & Sumitra, 1973
27. *Eocyzicus sahlbergi* (Simon, 1886)

**Family Leptestheriidae**

28. *Leptestheria dumonti* Subash Babu and Bijoy Nandan, 2010
29. *Leptestheria gurneyi* Padhye & Ghate, 2016
30. *Leptestheria jaisalmarensis* Tiwari, 1962
31. *Leptestheria nobilis* Sars, 1900
32. *Leptestheria sarsi* (Daday, 1923)
33. *Leptestheria sambharensis* (Tiwari, 1966)
34. *Leptestheria simhadrii* (Simhachalam and Timms, 2012)

**Family Limnadiidae**

35. *Eulimnadia azisi* Subash Babu and Bijoy Nandan, 2010

36. *Eulimnadia bondi* Padhye, Rabet, Kulkarni and Pagni, 2018
37. *Eulimnadia chaperi* (Simon, 1886) (fide Padhye & Rabet 2017)
38. *Eulimnadia cryptus Sanoamuang,* Padhye, and Rogers, 2020
39. *Eulimnadia compressa* (Baird, 1860)
40. *Eulimnadia gibba* Sars, 1900
41. *Eulimnadia gunturensis* Radhakrishna and Durga Prasad, 1976
42. *Eulimnadia indocylindrova* Durga-Prasad and Simhachalam, 2004
43. *Eulimnadia similis* Sars, 1900
44. *Eulimnadia margaretae* Bond, 1934
45. *Eulimnadia michaeli* Nayar and Nair, 1968
46. *Eulimnadia ovata* Nayar, 1965

## References


Alcock, A. 1898. Description of a new species of *Branchipus* from Calcutta. *Journal of the Asiatic Society, Bengal,* **65**: 538-539.

Babu, K.K.S., and S.B. Nandan. 2010. Two new clam shrimp species (Crustacea: Branchiopoda: Spinicaudata) from Kerala, India. *Zootaxa,* **2713**: 55-64.

Baid, I.C. 1958. Occurrence of *Artemia salina* in Sambhar Lake, Rajasthan. *Current Science,* **27**: 58-59.

Baid, I.C.. 1968. The arthropod fauna of Sambhar Salt Lake, Rajasthan, India. *Oikos,* **19**: 292-303.

Baid, I.C. 1975. Description of a new species of *Branchinella* Sayce from Sambhar Lake, India (Crustacea-Branchiopoda-Anostraca). *Journal of the Bombay Natural History Society,* **72**: 786-790.

Baird, W. 1860. Description of two new species of entomostracous crustaceans from India. *Proceedings of the Zoological Society of London,* **28**: 445-446.

Balaraman, U., and C.K.G. Nayar. 2004. A new species of the clam shrimp genus *Lynceus* (Branchiopoda, Conchostraca, Laevicaudata) from Kerala, India. *Crustaceana,* **77**: 407- 416.

Basil, J.A., and G.T. Pandian. 1991. Culturing *Artemia* (Tuticorn strain) in organic and agricultural wastes at different salinities. *Hydrobiologia,* **212**: 11-17.

Battish, S.K. 1981. On some conchostracans from Punjab with the description of three new species and a new subspecies. *Crustaceana,* **40**:178-196.

Battish, S.K. 1983. On the occurrence of three species of fairy shrimps (Anostraca: Crustacea) in Punjab, with a check-list of Indian anostracans. Researches on Crustacea, **12**: 77-84.

Belk, D. 1989. Identification of species in the conchostracan genus *Eulimnadia* by egg shell morphology. *Journal of Crustacean Biology,* **9**: 115-125.

Belk, D and J. Brtek. 1995. Checklist of the Anostraca. *Hydrobiologia,* **298**: 315-354.

Belk, D and C.E. Esparza. 1995. Anostraca of the Indian subcontinent. *Hydrobiologia,* **298**: 287- 293.

Belk, D and L. Brendonck. 1997. *Branchinella maduraiensis* Raj (Crustacea, Branchiopoda, Anostraca) shown by new evidence to be a validspecies. *Hydrobiologia,* **359**: 93-99.Crustacea: Branchiopoda (Anostraca, Notostraca, Laevicaudata, Diplostraca)

Bhargava, S.C., and M. Alam. 1980. Occurrence of *Artemia salina* (Crustacea: Phylopoda) in Didwana Lake, Rajasthan. *Journal of the Bombay Natural History Society,* **77**: 158-159.

Bhusnale R., Marathe A., Kulkarni M.R., Padhye S.M., and Pai, K. 2016. Observations on the atching dynamics and phenology of co-occurring large branchiopods from a small temporary pool in western India using ex situ sediment rehydration. *Ann. Limnol. -Int. J. Lim.,* **52** (2016): 327-333. DOI:10.1051/limn/2016020.

Bond, R.M., 1934. Report of phyllopod Crustacea (Anostraca, Notostraca and Conchostraca) including a revision of the Anostraca of the Indian Empire. *Memoirs of the Connecticut Academy of Arts and Sciences,* **10**: 29-62.

Brantner, J.S., Ott, D.W., Duff, R.J and, Orridge, J.I., Waldman, J.R., and Weeks, S.C. 2013. Evidence of selfing hermaphroditism in the Clam Shrimp *Cyzicus gynecia* (Branchiopoda: Spinicaudata). *Journal of Crustacean Biology*, **33**(2), 184-190.

Brendonck L., Rogers, D.C., Olesen, J., Weeks, S. and Hoeh, W.R., 2008. Global diversity of large branchiopods (Crustacea: Branchiopoda) in freshwater. *Hydrobiologia*, **595**: 167- 176.

Chako, P.I. 1950. Occurrence of the fairy shrimp (sic) *Apus*, in a temple tank in Tirunelveli District, Madras. *Journal of the Bombay Natural History Society,* **49**: 571.

Das, S.M. 1971. On a new species of *Apus* (Crustacea: Notostraca) from Kashmir. Proceedings of the Indian Scientific Congress (Abstracts) **58**: 555-556.

Das, S.M and S. Akhtar. 1971. On a new species of *Eocyzicus*: *Eocyzicus wulari* n.sp. (Conchostraca, Cyzicidae, Crustacea). *Kashmir Science,* **8**: 111-114.

Dumont, H.J. & S.V. Negrea, 2002. Branchiopoda. Guides to the Identification of the Microinvertebrates of the Continental Waters of the World. Ed H.J.F. Dumont. Backhuys Publishers, Leiden. 398 pp.

Durga Prasad and G. Simhachalam. 2004. *Eulimnadia indocylindrova* sp. nov. (Branchiopoda: Spinicaudata) from South India with a review of thegenus *Eulimnadia* in Indomalayan region, pp. 74-81. In, Proceedings of the International Conference on Great Himalayas: Climate, Health,Ecology Management and Conservation. KU/AEHMS/HIRI Publishers, Kathmandu University, Kathmandu.

Durga Prasad and G. Simhachalam. 2009. Distribution of Indian clam shrimps (Branchiopoda: Crustacea). *Current Science,* **96**: 71-73.

Fryer, G., 1987. A new classification of the branchipod Crustacea.*Zoological Journal of the Linnean Society*, **91**: 357-383.

Fryer G. 1988. Studies on the functional morphology and biology of the Notostraca (Crustacea: Branchiopoda). *Philosophical Transactions of the Royal Society of London B. Biological Sciences,* **321**: 27-124.

Ghate, H.V., and S.G. Patil. 1995. New record of a conchostracan (Crustacea: Branchiopoda) from Maharashtra State. *Journal of the Bombay Natural History Society,* **92**: 128.

Ghate, H.V. and N. Shetty. 1997. Records of *Triops* (Crustacea: Branchiopoda: Notostraca) from Pune, Maharashtra. *Journal of the Bombay Natural History Society,* **94**: 588-589.

Ghate, H.V.N. Rane, and S.G. Patil. 2003. New record of conchostraca (Crustacea) from Pune, Maharashtra. *Zoos Print Journal,* **18**: 1046.

Gopinath, K. 1944. On the occurrence of *Streptocephalus dichotomus* Baird in Travancore. *Current Science,* **13**: 81.

Greaves, P.M. 2012. An introduction to the branchiopod crustaceans. *Quekett Journal of Microscopy*, **41**: 679-694.

Gurney, R. 1906. On freshwater Entomostraca in the collection of the Indian Museum, Calcutta. *Journal of the Asiatic Society, Bengal,* **2**: 273-281.

Gurney, R. 1921. Freshwater Crustacea collected by Dr. P.A. Buxtom in Mesopotamia and Persia. *Journal of the Bombay Natural History Society,* **27**: 836-843.

Gurney, R. 1924. Some notes on the genus *Apus*. *Annales Magazine of Natural History London*, **9**: 559-568.

Gurney, R. 1925. Some Asiatic species of *Apus*. *Records of the Indian Museum,* **27**: 439-442.

Gurney, R. 1930. A new species of branchiopod from southern India. *Records of the Indian Museum,* **32**: 63-64.

Hora, Sunder Lal, G.M. Mulik, and H. Khajuria. 1955. Some interesting features of the aquatic fauna of the Kashmir Valley. *Journal of the Bombay Natural History Society,* **53**: 140-143.

Issac, M.P.L. 1970. Occurrence of *Triops longicaudatus granarius*. *Journal of Madurai Kamaraj University,* **3**: 41-50.

Iyengar, H.D.R., and N. Basavaiah. 1956. Occurrence of the fairy shrimp *Streptocephalus dichotomus* (Baird, 1860) in Mysore State. Journal of the Bombay Natural History Society, **53**: 738.

Joseph, A.N.T., Ramakrishna, and S.G. Patil. 1992. On a new record of Conchostraca (Crustacea) from Andhra Pradesh. *Records of the Zoological Survey of India,* **90**: 305-306.

Karande, A.A., and N.B. Inamdar. 1959. Observations on the taxonomic characters of *Triops orientalis* (Tiwari), with a note on its biology. Journal of the Bombay Natural History Society, **56**: 215-225.

Karande, A.A., and N.B. Inamdar.. 1961a. Some observations on the biology of the conchostracan Branchiopod [Crustacea], *Leptestheriella gigas* Karande &

Inamdar, 1960. *Journal of the Bombay Natural History Society,* **58**: 92-99.

Karande, A.A., and N.B. Inamdar.. 1961b. 1965. On *Eocyzicus* sp. (Conchostraca: Branchiopoda) at Panchgani, W. India. *Journal of Bombay Natural History Society,* **62**: 167-168.

Crustacea: Branchiopoda (Anostraca, Notostraca, Laevicaudata, Diplostraca) Kemp, S. 1911a. Notes on Asiatic species of Crustacea Anostraca in the Indian Museum. *Records of the Indian Museum,* **6**: 219-223.

Kemp, S.. 1911b. Notes on the occurrence of *Apus* in Central Asia. *Records of the Indian Museum,* **6**: 353-357.

Kulkarni, C.V. 1953. Occurrence of the brine shrimp *Artemia salina* in Bombay. *Journal of the Bombay Natural History Society,* **51**: 951-952.

Kulkarni M.R., Padhye S., Vanjare A.I., Jakhalekar S.S., Shinde Y.S., Paripatyadar S.V., Sheth S.D., Kulkarni S., Phuge S.K., Bhakare K., Kulkarni A.S., Pai K. and Ghate H.V., 2015. Documenting the fauna of a small temporary pond from Pune, Maharashtra, India. *Journal of Threatened Taxa*, **7**: 7196-7210

Longhurst, A.R. 1955. A review of the Notostraca. *Bulletin of the British Museum (Natural History) Zoology,* **3**: 1-57.

Mahabate, T.S. 1939. On the occurrence of *Apus* in Gujarat, India. *Current Science,* **8**: 471.

Malhotra, Y.R., and P.L.A. Duda. 1970. New fairy shrimp, *Branchinecta acanthopenes* n. sp. (Anostraca, Branchinectidae), from India. *Crustaceana,* **18**: 173-176.

Manca, M. & G. Mura, 1997. On Branchinecta orientalis Sars (Anostraca) in the Himalayas. *Hydrobiologia,* **356**: 111-116.

Mantovani B. Cesari M. & Scanabissi F. (2004). Molecular taxonomy and phylogeny of the 'living fossil' lineages *Triops* and *Lepidurus* (Branchiopoda: Notostraca). *Zoologica Scripta,* **33**: 367-374.

Mathur, S.N., and N. Sidhu. 1957. Occurrence of *Apus* (Crustacea: Notostraca) in Pilani, Rajasthan. *Journal of Bombay Natural History Society,* **54**: 961-962.

Martin, J.W. & G.E. Davis, 2001. *An Updated Classifi cation of the Recent Crustacea. Natural History Museum of Los Angeles County,* Science Series, **39**: 124 pp.

Martin, J.W., and S.L. Boyce. 2004. Crustacea: Non-cladoceran Branchiopoda. Pp. 284-297 In: Yule, C.M., and H.S. Yong (editors), *Freshwater Invertebrates of the Malaysian Region*. Academy of Science Malaysia and Monash University,

Kuala Lumpur, Malaysia. 861 pp.

Munuswamy, N. 1982a. Electrophoregram studies of three problematic *Streptocephalus* species (Anostraca). *Crustaceana,* **43**: 261-264.

Munuswamy, N. 1982b. On the occurrence of a fairy shrimp *Streptocephalus simplex echinus* in the freshwater ponds of Chingleput District, TamilNadu. *Journal of the Bombay Natural History Society,* **79**: 439-440.

Nayar, C.K.G. 1965. Three new species of Conchostraca (Crustacea: Branchiopoda) from Rajasthan. *Bulletin of Systematic Zoology*, **1**: 19-24.

Nayar, C.K.G. and K.K.N. Nair. 1968. On a collection of Conchostraca (Crustacea: Branchiopoda) from south India, with the description of two new species. Hydrobiologia, **32**: 219-224.

Olesen, J. 2009. Phylogeny of Branchiopoda (Crustacea) – Character Evolution and Contribution of Uniquely Preserved Fossils. *Arthropod Systematics Phylogeny,* **367**(1): 3-39.

Padhye S.M. and Dahanukar N., 2015. Distribution and assemblages of large branchiopods (Crustacea: Branchiopoda) of northern Western Ghats, India. *J. Limnol*., **74**: 371-380.

Padhye S.M. and Ghate H.V. 2016a. A new species of *Leptestheria* (Crustacea: Branchiopoda: Spinicaudata) from Western Maharashtra, India. *Zootaxa,* **4127**(2): 345-354.

Padhye, S. and Ghate, H.V. 2016b. Morphological Reassessment of *Triops cancriformis* Bosc (Crustacea: Branchiopoda: Notostraca) population from Kashmir, India with comments on the distribution of the species in India. *Proceedings of the Zoological Society,* **69**(1): 146-152.

Padhye, S., Ghate, H.V. and K. Pai. 2011a. New locality records and additional information on habitats of three species of clam shrimps (Crustacea: Branchiopoda) from a region in northern part of WesternGhats (Sahyadris), India. *Journal of Threatened Taxa,* **3**: 1756- 1763.

Padhye, S., Ghate, H.V. and K. Pai. 2011b. New locality record and additional information on the habitat of *Cyclestheria hislopi* (Baird, 1859) (Crustacea: Branchiopoda: Cyclestherida) in India. *Journal of Threatened Taxa*, **3**: 1445-1448.

Padhye S.M., Ghate H.V. and Pai K. 2011c. New locality records and additional information on habitats of three species of clam shrimps (Crustacea: Branchiopoda) from a region in northern part of Western Ghats (Sahyadris), India. Journal of Threatened Taxa, **3**: 1756- 1763.

Padhye, S.M. Rabet, and H. Ghate. 2015. First faunal inventory of largebranchiopods (Crustacea: Branchiopoda) of Western Maharashtra, Indiawith taxonomical and distributional comments. Zootaxa, **3904**: 208-222.

Padhye S.M., Kulkarni, M.R. and Dumont, H.J. 2016. Diversity and zoogeography of the fairy shrimps (Branchiopoda: Anostraca) on the Indian subcontinent. *Hydrobiologia* DOI 10.1007/s10750-017-3122-6.

Radhakrishna, Y., and M.K. Durga Prasad. 1974. Occurrence of *Streptocephalus spinifer* urney, 1906 (Crustacea: Branchiopoda) from Andhra Pradesh. *Current Science*, **44**: 471.

Radhakrishna, Y., and M.K. Durga Prasad. 1976. Anostraca (Crustacea: Branchiopoda) from Guntur district and its environs. *Memoirs of the Society of Zoology of Guntur,* **1**: 79-87.

Raj, P. J. S. 1951. The first record of the genus *Branchinella* Sayce in India and a new variety of *Branchinella kugenumaensis* (Ishikawa), var.*madurai*. *Current Science,* **20**: 334.

Raj, P.J.S. 1971. *Triops granarius* (Lucas) (Crustacea: Branchiopoda) from Tamil Nadu, and a review of the species from India. *Journal of the Bombay Natural History Society,* **68**: 161-168.

Rogers, D.C. 2009. Branchiopoda (Anostraca, Notostraca, Laevicaudata, Spinicaudata Cyclestherida), pp. 242-249. In, G.F. Likens (ed.), Encyclopedia of Inland Waters. Vol. **2**. Elsevier Science, Oxford.

Rogers, D.C., 2013. Anostraca catalogus (Crustacea: Branchiopoda). The Raffles Bulletin of Zoology, **61**: 525-546.

Rogers, D.C., & Padhye, S.M. 2014. A new species of Streptocephalus (Crustacea: Anostraca: Streptocephalidae) from the Western Ghats, India, with a key to the Asian species. *Zootaxa,* **3802**: 75-84.

Rogers, D.C. & S. Padhye, 2015. Review of the large branchiopod crustacean fauna of the Indian subcontinent (Anostraca, Notostraca, Laevicaudata, Spinicaudata, Cyclestherida). *Journal of Crustacean Biology,* **35**: 392-406.

Royan, J.P., and J.R.B. Alfred. 1971. *Lynceus serratus* sp. nov. (Conchostraca, Lynceidae) from southern India. *Crustaceana,* **21**: 37-40.

Royan, J.P., Navaneethakrishna, P and A.M. Selvaraj. 1970. Occurrence of *Artemia salina* in southern India. *Current Science*, **39**: 14.

Royan, J.P. and V. Sumitra. 1973. On the occurrence of *Eocyzicus plumosus* n. sp. (Branchiopoda, Conchostraca) in Tuticorin, south India. *Crustaceana,* **24**: 1-4.

Sanoamuang L, Padhye SM, Rogers DC. 2020. Review of the *Eulimnadia* (Branchiopoda: Spinicaudata: Limnadiidae) of tropical Asia, with the description of a new species. Zool Stud 59:41. doi:10.6620/ZS.2020.59-41.

Sars, G.O. 1887. On *Cyclestheria hislopi* (Baird), a new generic type of bivalve Phyllopoda; raised from dried Australian mud. Forhandlinger i Videnskabs- Selskabeti Kristiania, **1**: 1-65.

Sassaman, C., 1995. Sex determination and evolution of unisexuality in the Conchostraca. *Hydrobiologia*, **298**: 45-65.

Sassaman, C., Simovich, M.A., Fugate, M. 1997. Reproductive isolation and genetic differentiation in North American speciesof *Triops* (Crustacea: Branchiopoda: Notostraca). *Hydrobiologia,* **359**: 125-147.

Shanbag, S.V., and N.B. Inamdar. 1968. On the occurrence of *Triops mavliensis* (Tiwari), Notostraca (Crustacea), in the Okhammandal Region of Saurashtra (India). *Journal of the Bombay Natural History Society,* **65**: 408-417.

Shull, E.M. 1967. First record of the fairy shrimp *Branchinella kugenumaensis* Ishikawa in Gujarat State, North India. *Journal of the Bombay Natural History Society,* **63**: 769-770.

Simhachalam, G., and B.V. Timms. 2012. Two new species of Spinicaudata (Crustacea: Branchiopoda) in south India with a key to *Leptestheriella* and *Eocyzicus*. *Zootaxa*, **3161**: 20-36.

Timms, B.V., 2012. An appraisal of the diversity and distribution of large Branchiopods (Branchiopoda: Anostraca, Laevicaudata, Spinicaudata,Cyclestheria, Notostraca) in Australia. *Journal of Crustacean Biology,* **32**: 615-623.

Timms, B.V. 2015. A revised identification guide to the fairy shrimps (Crustacea: Anostraca: Anostracina) of Australia. *Museum Victoria Science Reports,* **19**: 1-44.

Tiwari, K.K., 1951. Indian species of the genus *Apus* (Crustacea: Branchiopoda) with description of two new species. *Records of the Indian Museum,* **XLIX**: 197-205.

Tiwari, K.K., 1954. Sex ratio and variability of apodous segments in *Apus* (Phyllopoda: Crustacea). *Journal of the Bombay Natural History Society,* **52**: 641-644.

Tiwari, K.K., 1956. Reproduction of the Notostraca. *Journal of the Bombay Natural History Society,* **53**: 491-492.

Tiwari, K.K., 1962. New species of Conchostraca (Crustacea: Phyllopoda) from Rajastan. *Proceedings of the All-India Congress of Zoology,* **1**: 180-190.

Tiwari, K.K., 1966. A new genus and species of clam-shrimp [Crustacea, Branchiopoda: Conchostraca] from the Sambhar Lake, Rajasthan. *Proceedings of the Zoological Society*, Calcutta, **19**: 67-76.

Tiwari, K.K., 1971. Occurrence of *Branchinella*? *hardingi* Qadri and Baqai, 1956 (Crustacea, Phyllopoda: Anostraca) in Madhya Pradesh. *Journal of Zoological Society of India,* **23**: 89-94.

Tiwari, K.K., 1972. Taxonomic status of two recently described Branchiopoda from Kashmir, India. *Crustaceana,* **23**: 311-

314.

Tiwari, K.K., 1996. Chapter 13: Branchiopod Crustacea of the Rajasthan Desert, pp. 113-129. In, A.K. Ghosh, Q.H. Baquri, and I. Prakash (eds.), *Faunal Diversity in the Thar Desert: Gaps in Research. Scientific Publishers, Jodhpur*.

Tiwari, K.K., 1958. Diagnosis of a new species of the genus Branchinella Sayce (Crustacea:Branchiopoda: Anostraca) from Sambhar Lake, Rajasthan. *Journal of the Bombay Natural History Society,* **55**: 585-588.

Tiwari, K.K., 1965. *Branchinella kugenumaensis* (Ishikawa, 1894) (Phylopoda, Anostraca) in Rajasthan, Western India. *Crustaceana,* **9**: 220-222.

Valarmathi 2017. Crustacea: Branchiopoda (Anostraca, Notostraca, Laevicaudata, Diplostraca). 225-242. Kailash Chandra, Gopi, K.C., Rao, D.V., Valarmathi, K. and Alfred, J.R.B., 2017. Current Status of Freshwater Faunal Diversity in India: 1-624 (Published by the Director, *Zool. Surv. India*, Kolkata)

Velu, C.S., and N. Munuswamy. 2003. Occurrence of *Triops granaries* (Lucas), Crustacea: Notostraca, from Madurai, Tamil Nadu. *Journal of the Bombay Natural History Society,* **100**: 154-156.

Velu, C.S., and N. Munuswamy. 2005. Updated diagnoses for the Indian species of *Streptocephalus* (Crustacea: Branchiopoda: Anostraca). *Zootaxa,* **1049**: 33-48.

Velu, C.S., and N. Munuswamy. 2006. Scanning electron microscope study of the development of mandibular structure and the molar surface morphology of *Branchinella maduraiensis* and *Streptocephalus dichotomus* (Crustacea, Anostraca). *Canadian Journal of Zoology,* **84**: 1248-1262.

Velu, C.S., and N. Munuswamy. 2007. A new fairy shrimp, *Branchinellites nallurensis* from south India. *Journal of the Bombay Natural History Society,* **104**: 334-338.

Vikas, P.A., N.K. Sajeshkumar, P.C. Thomas, K. Chakraborty, and K.K. Vijayan. 2012. Aquaculture related invasion of the exotic *Artemia franciscana* and displacement of the autochthonous *Artemia* populations from the hypersaline habitats of India. *Hydrobiologia,* **684**: 129-142.

Weekers, P.H.H., Murugan, G., Vanfleteren, J.R., Belk, D., and Dumonta, H.J. 2002. Phylogenetic analysis of anostracans (Branchiopoda: Anostraca) inferred from nuclear 18S ribosomal DNA(18S rDNA) sequences. *Molecular Phylogenetics and Evolution,* **25**: 535–544

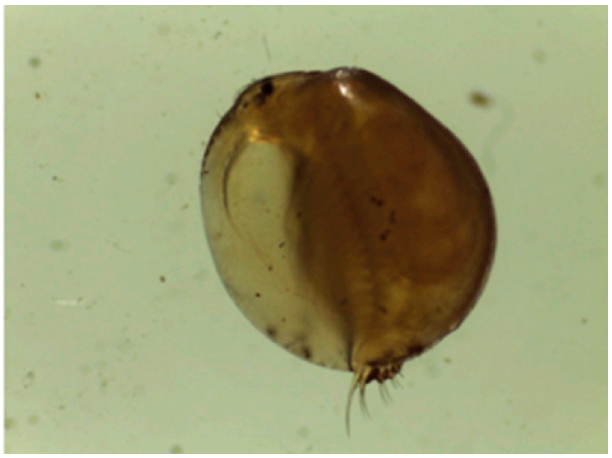
Weeks, S.C., E.G. Chapman, D.C. Rogers, D.M. Senyo, and W.R. Hoeh. 2009. Evolutionary transitions among dioecy, androdioecy and hermaphroditism in limnadiid clam shrimp (Branchiopoda: Spinicaudata). *Journal of Evolutionary Biology*, **22**: 1781-1799.

Zak-ur-Eab, M. 1984. The European tadpole shrimp, *Triops cancriformis* (Bosc) (Crustacea: Notostraca: Triopsidae) as a pest of rice plantations in Kashmir (India). *Journal of Entomological Research,* **8**: 103-105.

Zierold, T., Pau, J.M., Hä Nfling, B., and Mez, A.G. 2009. Sex Ratio, Reproductive Mode And Genetic Diversityin *Triops cancriformis*. *Freshwater Biology,* (2009). Doi:10.1111/J.1365- 2427.2009.02191.X_2009.

*Triops granarius* (Lucas, 1864)

*Streptocephalus echinus* Bond, 1934



*Cyclestheria hislopi* (Baird, 1859)


*Ozestheria annandalei* Daday, 1913