

Diversity of Molluscan communities in Kondakarla Freshwater Lake, Visakhapatnam, Andhra Pradesh

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ABSTRACT

Background: Kondakarla Lake is the second largest natural fresh water lake in Andhra Pradesh, India located at a distance of 42 km from Visakhapatnam. The molluscan faunal diversity was investigated during the study period from July 2012 to June 2014. The study aimed to keep records mainly on the taxonomy, distribution, status, and conservation need of the different species.

Methods: Samples were collected with the help of local people by using Peterson's grab sampler, Surber and D-Frame. The collected samples were washed and preserved in plastic screw cap bottles and preserved in 70–80% ethyl alcohol and in 5% formalin solution.

Results: Altogether 14 species of these 28.57% of class Bivalvia and 71.429% of Gastropoda were recorded at four selected stations. Order Mesogastropoda dominant with 2 families which contributed to 50% of the total population followed by Trigoïnoida and Bsommatophora each contributed to 25%. The number and Percentage composition of Population Status were recorded during the study period. The recorded range of various diversity indexes were noted at different seasons.

Conclusion: Kondakarla freshwater lake consisting of 28.571% of class Bivalvia and 71.429% of gastropoda was recorded at four stations during the study period. The Population Status was 07.143% abundant, 57.143% species were common, 21.429% species were moderate and 14.286% species were rare in the total catch.

Key-words: Bivalvia, Diversity Index, Gastropoda, Population Status, Mollusca

INTRODUCTION

The Indian freshwater community is a rich diversity of molluscs, representing 212 species belonging to 21 families, 164 species were recorded from rivers and streams ^[1]. Approximately 5,000 species of freshwater snails were inhabitant lakes, ponds, and streams worldwide ^[2]. Freshwater mussels are soft-bodied animals that are usually producing an external skeleton is composed of a limy material or calcium carbonate, which

serves both protective and supportive purposes. Freshwater molluscs grouped into two main classes i.e. Bivalves, and Gastropods. These are found in a wide range of freshwater habitats and have varied life history strategies, with lifespan that vary from species to species three months i.e. pea clams, 120 years for pearl mussels. They find their highest levels of endemism and diversity in ancient lakes, large river basins, and artesian basins and all of these habitats can be found within the Eastern Mediterranean region ^[3]. The freshwater snails are bioindicators and play a crucial role in the natural ecosystem. They are saprophytic animals and purify water bodies as they consume algae, zooplankton, diatoms, and organic waste. They provide food for many kinds of animals such as fish, birds and also for human beings and they are part of food webs ^[4,5].

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Being mollusks are significant to humans throughout history food source, tools, jewelry, and even pets [6]. The present study aimed to keep records mainly on the

taxonomy, distribution, status, and conservation need of the different species found at Kondakarla freshwater lake.

MATERIALS AND METHODS

Study area- Kondakarla Lake is the second largest natural fresh water lake in Andhra Pradesh located at a distance of 42 km from Visakhapatnam and 7 km from Anakapalle. It is located north-east of Kondakarla village, lies between latitudes 17°35'30" and 17°36'02" N, and longitudes 82°59' 27" and 83°1' 0" E. Samplings were done between 6.30 am and 11.30 am on every

bimonthly and analyzed in department of Environmental sciences laboratory, Andhra University. Four stations were selected for the present study to the collection of Molluscans during the period June 2012 to may 2014. They are (Station I- Kakarapalli (E), Station II- Kondakarla Bird sanctuary (W), Station III- Vadrappalli (N), Station IV- Avasomavaram (S) (Fig. 1).

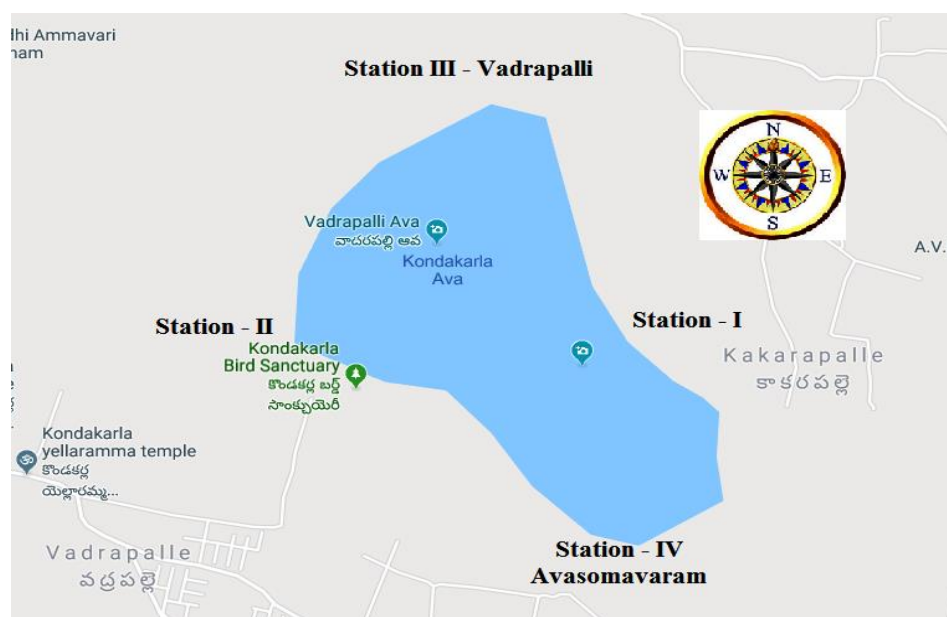


Fig. 1: Kondakarla Ava Freshwater lake study area

Collection, Preservation, and Identification- Molluscans were collected from each sampling site with the help of local people by using the boat, nylon scoop net, gloves, Peterson's grab sampler, Surber and D-Frame. The Specimens were assembled to use hand-picking and scoop method, and collected samples were washed and preserved in plastic screw cap bottles and preserved in 70–80% ethyl alcohol and in 5% formalin solution [7]. Diversity was estimated by counting the total number of species per square meter for each sample. The specimens were categorized and identified on the basis of characteristics of the shell such as shape, size, color, and ornamentation of coiled shell [8-12]. Other characteristics included whorls as rounded, angular, keel over including shape, length and number of the spire, aperture as sinistral/dextral, opercula (trap door) absence/presence and their shape.

Few minute characteristics such as the size and shape of apex, suture deepness, low, the shape, position, size of umbilicus and columellar, Imperforated and perforated, the outer covering (periostracum), pigment, patterning (ribbed and striated), eye and tentacle position were also studied this course of work [13,14]. The mathematical expression of Shannon- Wiener Index (H), Simpson Index, Menhinick Index, Buzas and Gibson's Index, and evenness was calculated by using online calculator [15].

RESULTS

The present study revealed, the occurrence of fourteen species belonged to two classes, three orders, four families and ten genera. List of molluscan fauna including their Class, order, family, genus, species and IUCN status were recorded in the present investigation was given in Table 1.

Total 28.57% of class Bivalvia and 71.42% of gastropoda was recorded at four stations during the study period. The listed species are *Lamellidens corrianus*, *Lamellidens marginalis*, *Parreysia favidens*, *Parreysia corrugata*, *Bellamya bengalensis*, *Bellamya dissimilis*, *Thiara*

(*Melanooides*) *tuberculata*, *Tarebia granifera*, *Tarebia granifera*, *Bithynia pulchella*, *Pila globosa*, *Lymnaea acuminata*, *Gyraulus convexiusculus* and *Indoplanorbis exustus*.

Table 1: List of molluscans and their class, order, family, genus, species, population status and IUCN status at Kondakarla Lake

	Taxa	Population Status	IUCN 2018-1
Class: Bivalvia			
Order: Trigoinoida			
Family– Unionidae	<i>Lamellidens corrianus</i>	C	LC
	<i>Lamellidens marginalis</i>	C	LC
	<i>Parreysia favidens</i>	M	LC
	<i>Parreysia corrugata</i>	C	LC
Class: Gastropoda			
Order: Mesogastropoda			
Family– Viviparidae	<i>Bellamya bengalensis</i>	M	LC
	<i>Bellamya dissimilis</i>	M	LC
Family- Thiaridae	<i>Thiara rudis</i>	R	LC
	<i>Thiara (Melanooides) tuberculata</i>	C	LC
	<i>Tarebia granifera</i>	R	LC
	<i>Bithynia pulchella</i>	C	LC
	<i>Pila globosa</i>	C	LC
Order: Bsommatophora			
Family– Planorbidae	<i>Lymnaea acuminata</i>	C	LC
	<i>Gyraulus convexiusculus</i>	C	LC
	<i>Indoplanorbis exustus</i>	A	LC

LC- Least concern; A= Abundant (76-100%); C = Common (51-75%); M = Moderate (26-50%); R = Rare (1-25%) of the total catch

In the present investigation, the number and percentage composition of families, genera, and species under different orders are shown in Table 2 and Fig. 2 to Fig. 4. Order Mesogastropoda dominant with 2 families which contributed to 50% of the total population followed by Trigoinoida and Bsommatophora each with one, which contributed to 25%. Recorded orders Mesogastropoda dominant with 5 genera which contributed to 50% of the total population followed by

Bsommatophora with 3 contributed to 30% and Trigoinoida with 2 contributed to 20%. Order Mesogastropoda dominant with 7 species, which contributed to 50% of the total population followed by Trigoinoida with 4, which contributed to 28.57% and Bsommatophora with 3 contributed to 21.43%.

Table 2: The number and percent composition of families, genera and species of Molluscans under various orders

S. No.	Order	Families (%) in an order	Genera (%) in an order	Species (%) in an order
1	Trigoinoida	25	20	28.57
2	Mesogastropoda	50	50	50
3	Bsommatophora	25	30	21.43

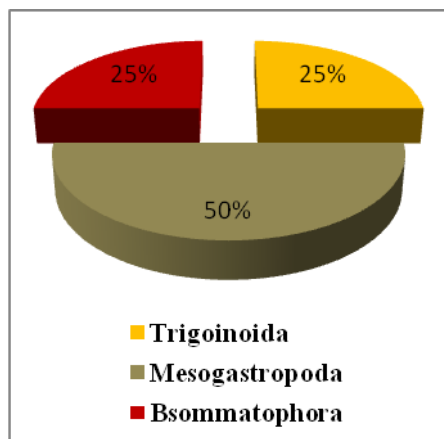


Fig. 2: Percentage of families in an order

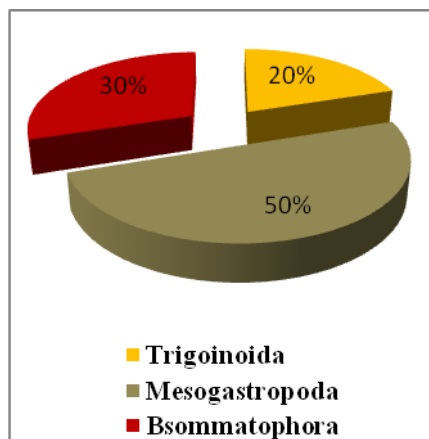


Fig. 3: Percentage of genera in an order

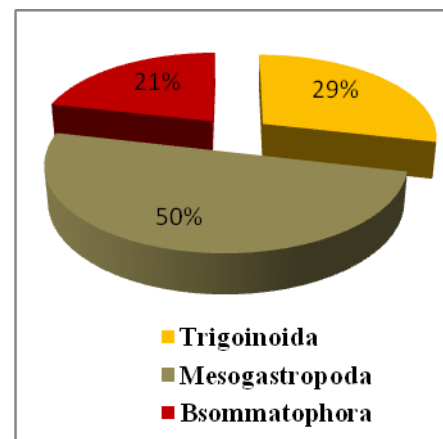


Fig. 4: Percentage of species in an order

In the present study, the number and percent composition of genera and species under various families were represented in Table 3 and Fig. 5 & Fig. 6. The generic composition of Molluscans belonged to different families were shown that ten genera were recognized.

The highest genera under Thiaridae contributed to 4, which contributed to 40% followed by Planorbidae with 3 contributed to 30%, Unionidae with 2 contributed to 20% and Viviparidae with one, which contributed to 10%.

Table 3: Number and percent composition of genera and species under various families

S. No.	Families	Genera in a family (%)	Species in a family (%)
1	Unionidae	20	28.57
2	Viviparidae	10	14.29
3	Thiaridae	40	35.71
4	Planorbidae	30	21.43

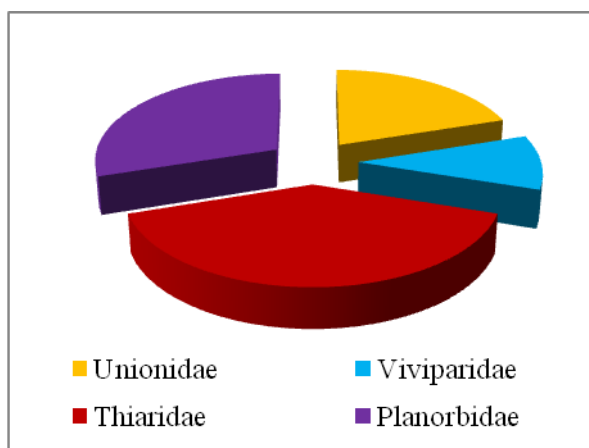


Fig. 5: Percentage of genera under families

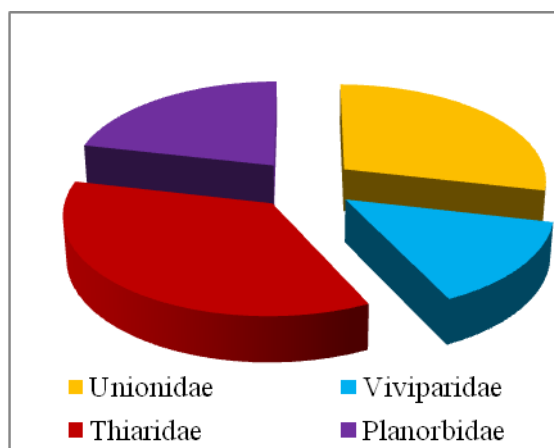


Fig. 6: Percentage of species under families

The number and percentage composition of population status was one species was abundant, which contributed to 7.14%, 08 species were common, which contributed to 57.14%, three species moderate which contributed to 21.43% and two species rare, which contributed to 14.29% in the total population (Table 4, Fig. 7). According to IUCN ^[24] all 14 species of both classes were Least Concern (LC) Table 1. On an average of various diversities, indexes were analyzed during the study

period from July 2012 to June 2014. The recorded range of Shannon's Index (H), Simpson Index, Menhinick Index, Buzas, and Gibson's Index of class Bivalvia was 1.30 – 0.18 and gastropoda is 2.21–0.11. The calculate range in various orders i.e. Trigoinoida was 1.36 – 0.18, Mesogastropoda was 01.83–0.16, Bsommatophora was 1.09 - 0.32. Evenness is nearly similar in all classes and orders Table 5, Fig. 8 & Fig. 9.

Table 4: Number and percentage composition of Population Status in the total population

Population Status	A (76 - 100%)	C (51 - 75%)	M (26 - 50%)	R (1 - 25%)
Number of species	01	08	03	02
Composition (%)	7.14	57.14	21.43	14.29

A=Abundant, C= Common, M= Moderate, R= Rare

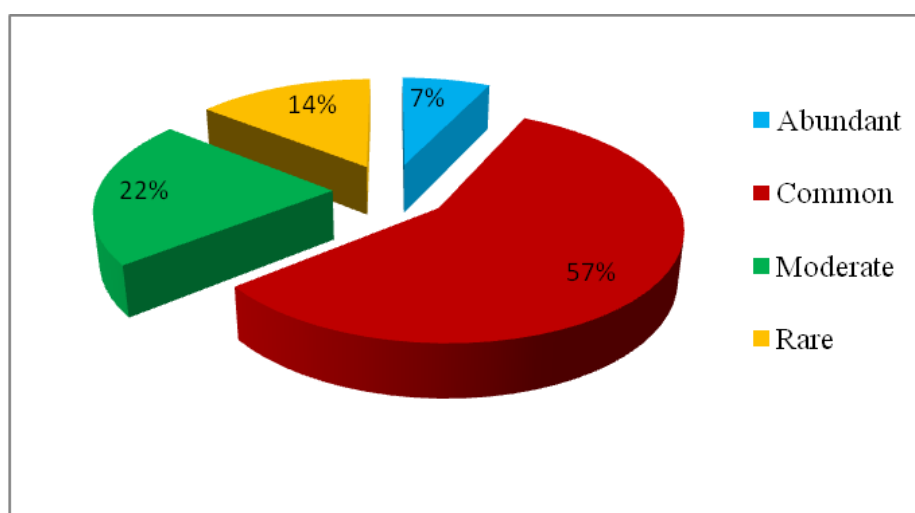


Fig. 7: Number and percentage composition of Population Status

Table 5: Average diversity indexes from July 2012 to June 2014 in Kondakarla Ava Lake

Diversity Index	Class			Orders	
	Bivalvia	Gastropoda	Trigoinoida	Mesogastropoda	Bsommatophora
Shannon's Index (H)	1.36	2.21	1.36	1.83	1.09
Evenness E=H/Hmax	0.98	0.96	0.98	0.94	0.99
Simpson Index	0.18	0.11	0.18	0.16	0.32
Menhinick Index	1.27	1.10	1.27	0.99	0.52
Maralef Richness Index	1.30	2.04	1.30	1.53	0.57
Buzas and Gibson's Index	0.98	0.91	0.98	0.89	0.99

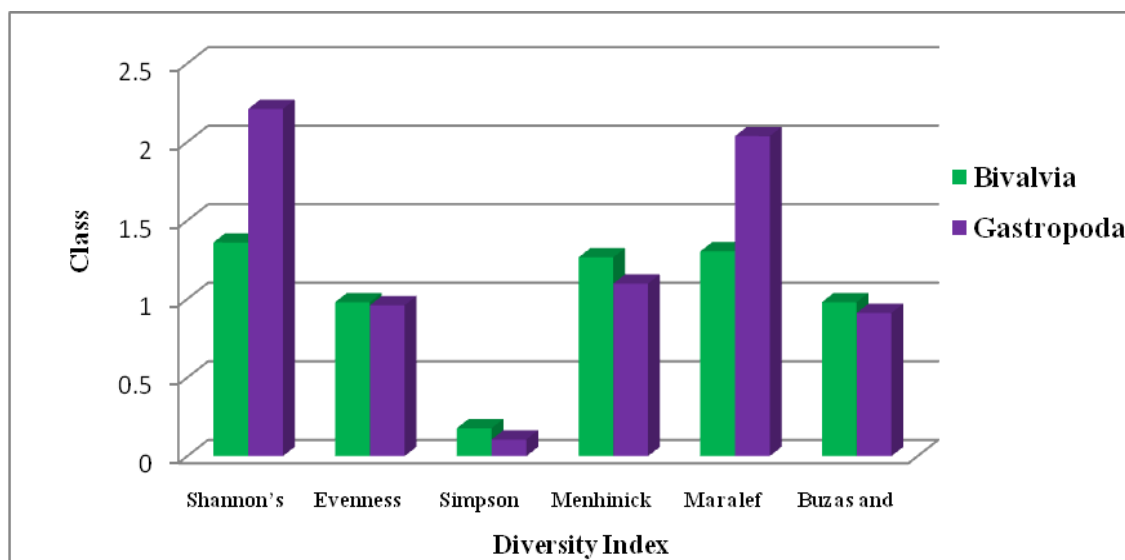


Fig. 8: Diversity Index in different classes

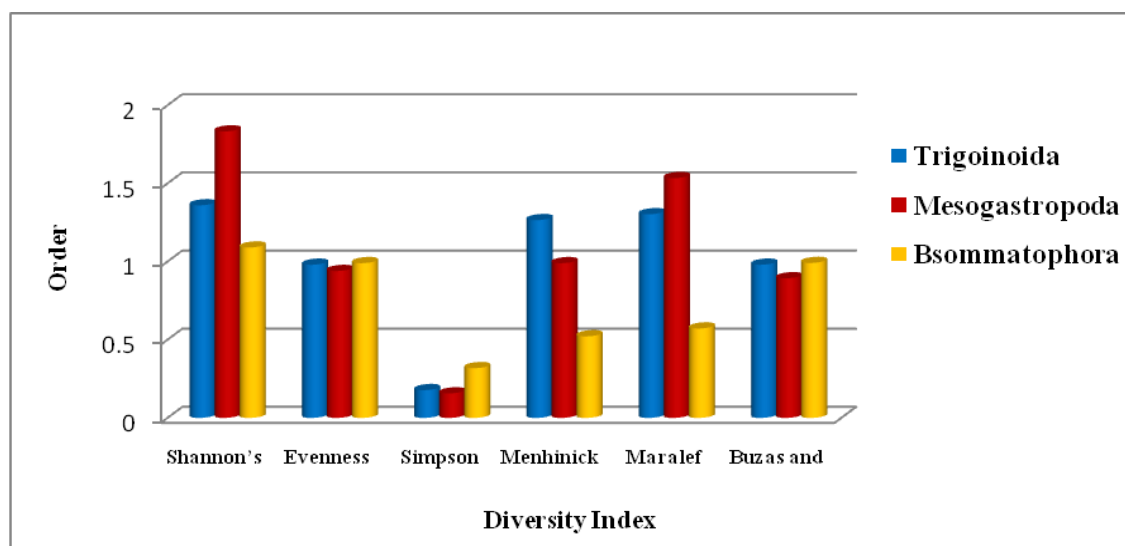


Fig. 9: Diversity Index in different orders

DISCUSSION

The similar observations were made reported by Subba [16] was identified ten freshwater molluscs, nine species belonging to six families viz. Planorbidae, Viviparidae, Pilidae, Lymnaeidae and Thiaridae of class Gastropoda and one species is of family Amblemididae of the class Bivalvia. Seba Roy and Gupta [17] reported a total of 16 molluscan taxa belonging to 2 classes, viz., Gastropoda, and Bivalvia, 4 orders, 5 families and 9 genus were recorded from 12 different sites, of the 16 species, 5 gastropods and 2 bivalves were recorded in a few sites only and appeared to be sensitive to anthropogenic disturbances. Raina *et al.* [18] recorded 17 species and identified from nine families in Sip River is a tributary of River Narmada. The documentation of bivalve as a whole during the period of study was less dominant as compared to Gastropoda. Similar reports were observed by Khade and Mane [19] studied the diversity of bivalve and gastropod Molluscs from mangrove habitat, rocky substrata, sandy beach, and muddy habitat was studied. The 22% bivalves while 78% gastropods were recorded. Ercan *et al.* [20] reported the freshwater mussel fauna of Turkey has hitherto received little attention. Five native mussel species belonging to 3 genera were encountered in surveys: *Anodonta cygnea*, *A. anatina*, *Unio pictorum*, *U. crassus*, and *Dreissena polymorpha*. In addition, an invasive species from Asia, *A. woodiana*, was recorded in the region for the first time. Pir *et al.* [21] investigated on the distribution of molluscans in Narmada River, where as Biju *et al.* [22] recorded on molluscs collected from the Bharathapuzha River, Kerala [23] noted on a collection of freshwater Molluscs from Lahore. In this present study, the number and percentage composition of families, genera, and species under different orders similarities were identified by various investigators. Burdi *et al.* [25] noted a total of four genera including seven species of pelecypods were identified where *Parreysia (Radiatula) wynegungansis* was found most dominant. Pelecypod populations were fairly good and more or less same numbers of individuals were recorded. Negi and Mangain [26] were reported to assess the benthic macro-invertebrates from the Tons river, is to be inversely correlated with the maximum diversity of benthos at the upstream site ('H' 0.204) during the winter season while it was recorded minimum during the rainy season at all the sites. Maximum diversity is reported during the winter season

at all the sites. Kakar *et al.* [27] reported species diversity indices of freshwater in different sites of Balochistan province, Kumar and Vyas [28] investigated on diversity index of molluscan communities in Narmada River.

CONCLUSIONS

Kondakarla freshwater lake consisting of 28.57% of class Bivalvia and 71.42% of Gastropoda was recorded at four stations during the study period. The Population Status is 07.14% abundant, 57.14% species were common, 21.42% species were moderate and 14.28% species were rare in the total catch. This study concluded that the presence of diversified Molluscan community indicated that the lake is a good potential bioindicator.

Further investigations on habitat wise preferences with life cycles of mollusc fauna could provide insights into their conservation and an important food resource to migratory birds of the Kondakaral Lake.

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CONTRIBUTION OF AUTHORS

Research concept- First Report of Molluscans from Kondakarla Lake

Research design- Amaravathi D

Supervision- Prof. PS Raja Sekhar and Dr. K. Rama Rao

Materials- Prof. PS Raja Sekhar

Data collection- Kondakarla Lake

Data analysis- Online software and scientific calculator

Literature search- Andhra University central Library and Biological Abstracts

Writing article- Amaravathi D

Critical review- Not Sufficient Literature

Article editing- Dr. K. Rama Rao

Final approval- Dr. K. Rama Rao, Dr. Amaravathi D

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