



# Diversity and Population Density of Freshwater Snails in Darbari and Kodamdesar Village Pond in Bikaner District, Rajasthan

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

The study on freshwater snails at Darbari and Kodamdesar pond was carried out for an annual cycle encompassing the years 2022-2023. The study involved diversity of snail species found in above mentioned ponds. In this study, the major focus was on the diversity of freshwater snails, i.e., different species of prosobranch and pulmonate snails found in Darbari and Kodamdesar ponds of Bikaner district. The following species *Bellamya bengalensis*, *Digoniostoma pulchella*, *Indoplanorbis exustus*, *Lymnea acuminata* were found in Darbari and Kodamdesar ponds. Among these, *Bellamya bengalensis*, *Digoniostoma pulchella* are prosobranch, while *Indoplanorbis exustus*, *Lymnaea acuminata* are pulmonate snails. Aspect of population density total prosobranch represent 50.49 no./m<sup>2</sup> and pulmonate 31.83 no./m<sup>2</sup>. Season wise *Bellamya bengalensis* represent

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61.48% in monsoon at Darbari pond. At Kodamdesar *Indoplanorbis exustus* shows 50.02% in summer season. Prosobranch have gills for water respiration and pulmonate have lungs for aerial respiration.

**Keywords:** Diversity; freshwater snails; prosobranch; pulmonate snails.

## 1. INTRODUCTION

Fresh water snails form an important part of aquatic ecosystem, helping in controlling algal growth and serving as a food source for various aquatic animals, such as fish, turtles and some birds. The diversity of freshwater snails in Darbari and Kodamdesar pond of Bikaner varies, based on specific location and ecosystem. It is influenced by factors such as water quality, habitat availability and climate. Fresh water ecosystems are known to be the most endangered ecosystems in the world. In terms of biodiversity, freshwater ecosystems have far greater diversity than in most terrestrial ecosystems [1]. Ray and Mukharjee [2] gave a faunal volume of Mollusca of Rajasthan, which included 21 species of gastropods and one of bivalve from the state. Choubisa [3] reported 22 species of molluscs from various freshwater habitats of southern Rajasthan. Increased water temperature and decomposed organic matters have been reported by Bath et al., [4]. Singh [5] recorded 4 species of mollusk fauna in desert region. In Darbari and Kodamdesar ponds of Bikaner, some of these species are present. Saxena [6], reported gastropod fauna, population, thermal tolerance and drought evasion in Indian desert wetlands. Gumus B.A, etal. [7]. described the diversity of freshwater gastropods in relation to environmental factors in the konya closed basin, Turkiye. Khanam Y and Singh. Y [8] were also studied dispersal of land snails *Zootecus insularis* in north west region of Rajasthan.

### 1.1 The Study Site

India is situated in the continent of Asia. It lies completely in the northern hemisphere and eastern hemisphere between latitudes 84°N and 37°6'N and longitudes 68°7'E and 97°25'E. Rajasthan is situated in the north-western part of India. Rajasthan lies between latitudes 23°3' and 30°12', north and longitudes 69°30' and 78°17' east and Bikaner is one of desert districts situated in the north – west of Rajasthan. The latitude of Bikaner is 28.0229°N and longitude is 73.3119°E. In Bikaner, the Kodamdesar pond is situated at a distance of 26 km from Bikaner, while Darbari pond is situated on Bikaner-Jaisalmer highway 33 km away from Bikaner.

The depth of the Kodamdesar pond is approximately 3.2 meters and Darbari pond is approximately 3.13 meters.

## 2. MATERIALS AND METHODS

The sample collection of freshwater snails was from four sampling areas of Darbari and Kodamdesar pond of Bikaner. Snails were selected based on their active appearance such as movable on leaves and attached to bricks, stones and bottles. After collection snails were brought to the laboratory, cleaned carefully with water and identified. Collected snails were kept in appropriate containers with proper labels on each sample with date, location and habitat details. Monthly study involved snail diversity and population density. Mud samples from pond were collected and filtered through a sieve of 2 mm mesh size for small sized species. Identification was done under stereoscopic binocular microscope or bull lens, following Subba Rao [9]. The mud samples from ponds were collected with the help of a quadrat of known dimension (i.e. 500 cm<sup>2</sup>). The mud from this quadrat was taken out with the help of a shovel and transferred to plastic bucket and some water was added to prepare a suspension. This was filtered to an enamel tray and molluscan forms were picked up mechanically and counted. Snail species population was measured by quadrat method. Population per m<sup>2</sup> were calculated by using formula described by Saxena [10]:

$$\text{Gastropods No./m}^2 = N/A \times 10^4$$

N= Number of gastropods per sample  
A= Area of sampler (cm<sup>2</sup>)

## 3. RESULTS AND DISCUSSION

The gastropods of both the ponds were represented by the two subclasses namely prosobranchia and pulmonata. Snail diversity was comprised of four snail species namely *Bellamya bengalensis* (Lamarck), *Digoniostoma pulchella* (Benson), *Indoplanorbis exustus* (Deshayes) and *Lymnaea acuminata* (Lamarck) Fig. 2. In first two prosobranch belongs to family Viviparidae and Bithyniidae other two pulmonates belongs to family Lymnaeidae and Planorbidae.

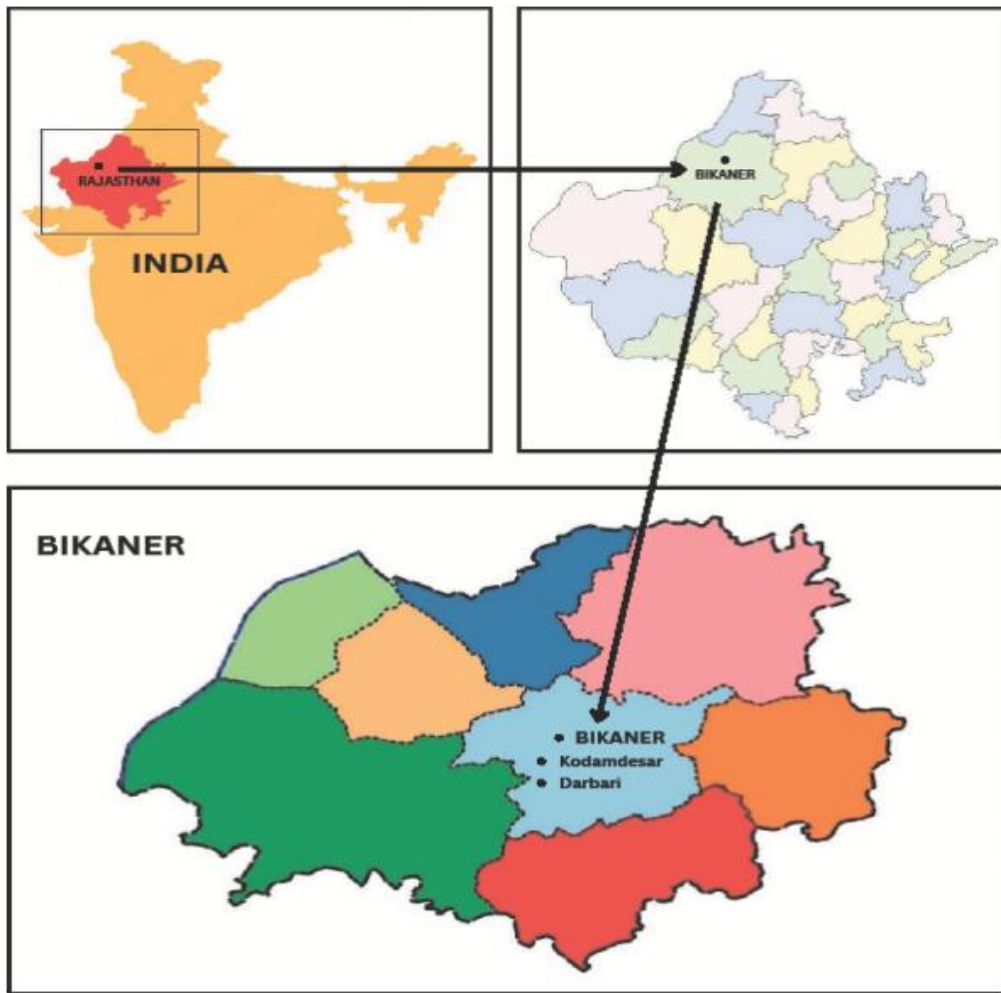


Fig. 1. Location of the study area

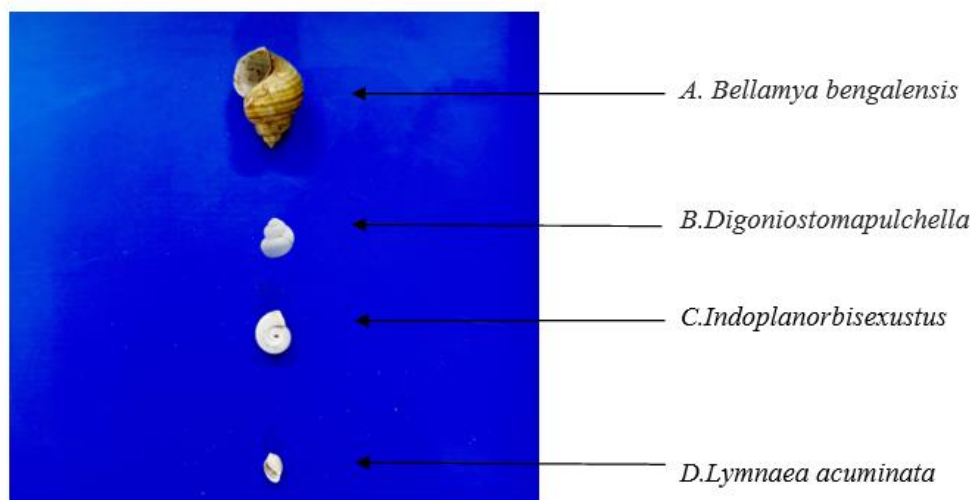
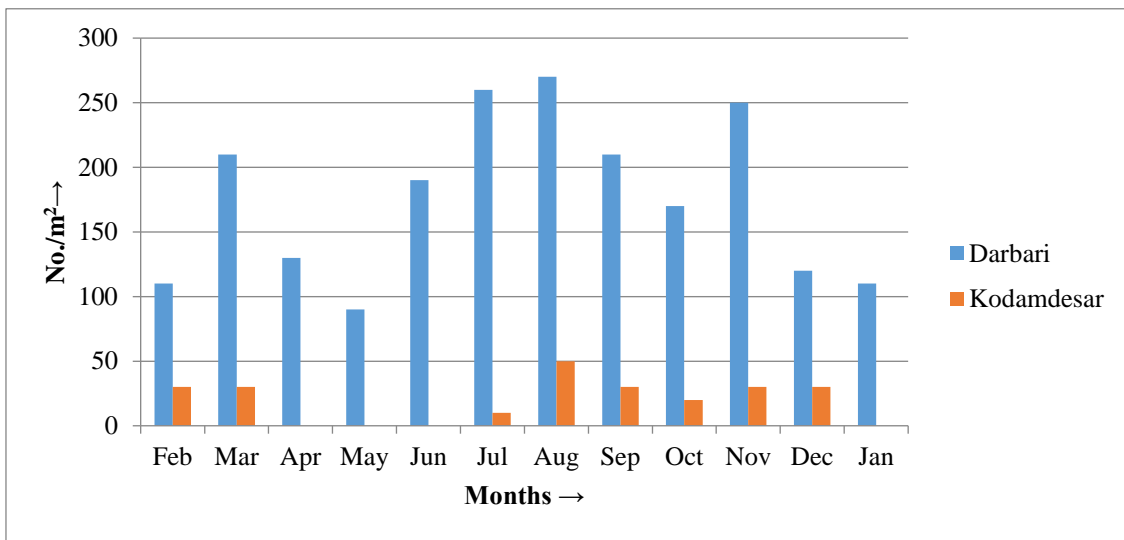
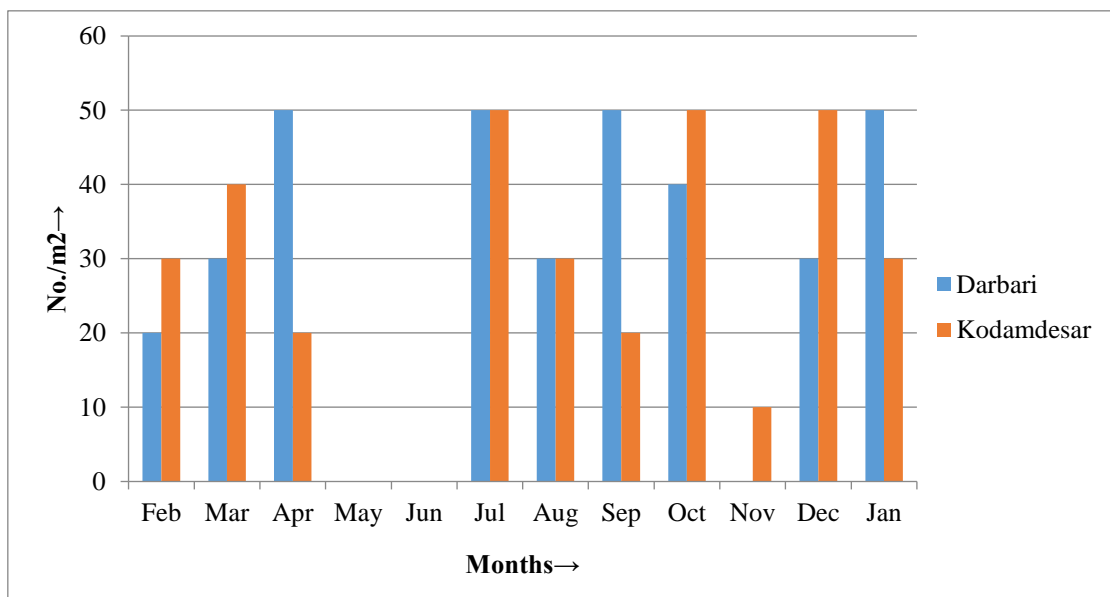


Fig. 2. Diversity of snail species i.e. *Bellamya bengalensis*, *Digoniostoma pulchella*, *Indoplanorbis exustus*, *Lymnaea acuminata*



***Bellamya bengalensis***



***Digoniostoma pulchella***

**Fig. 3. Population density of prosobranch at Darbari and Kodamdesar (*B. bengalensis*, *D. pulchella*)**

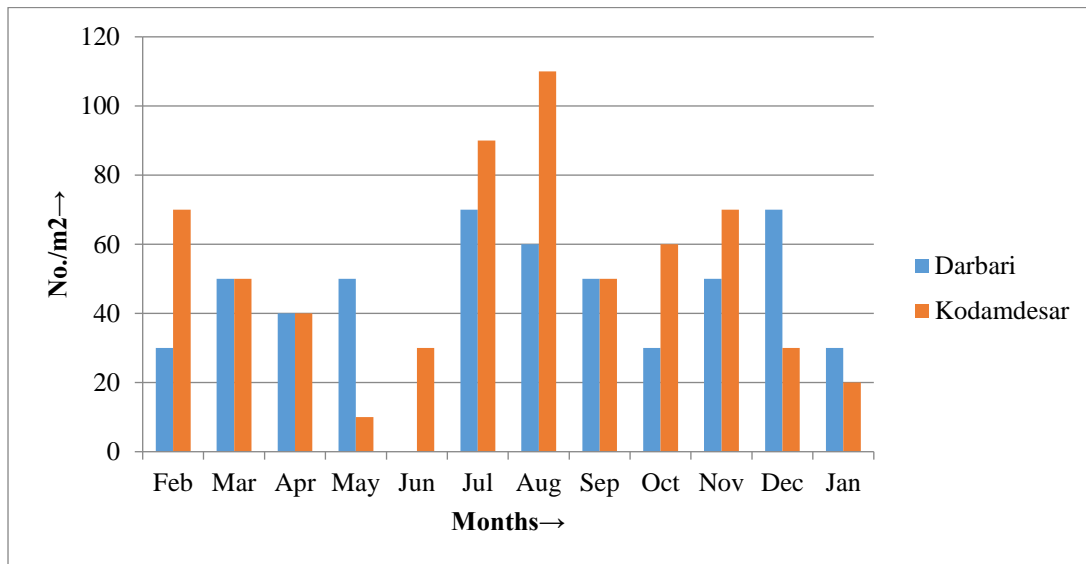
The population densities of different gastropods species at both wetland ponds over an annual cycle are presented in Fig. 3 and Fig. 4. It is evident that the population of prosobranch was far greater than that of pulmonates. Both the prosobranch (*Bellamya bengalensis* and *Digoniostoma pulchella*) showed an almost similar trend of population fluctuations being rich in monsoon and lowest during summer. The peaks of population densities of both (*B. bengalensis* 270 no./m<sup>2</sup> and *L. acuminata* 90 no./m<sup>2</sup> at Darbari in August month; *I. exustus* 110

no./m<sup>2</sup> in August month and *L. acuminata* 60 no./m<sup>2</sup> in July month at Kodamdesar pond. Although the population was in general, richer at deeper stations, rest no definite spatial pattern of distribution was evident.

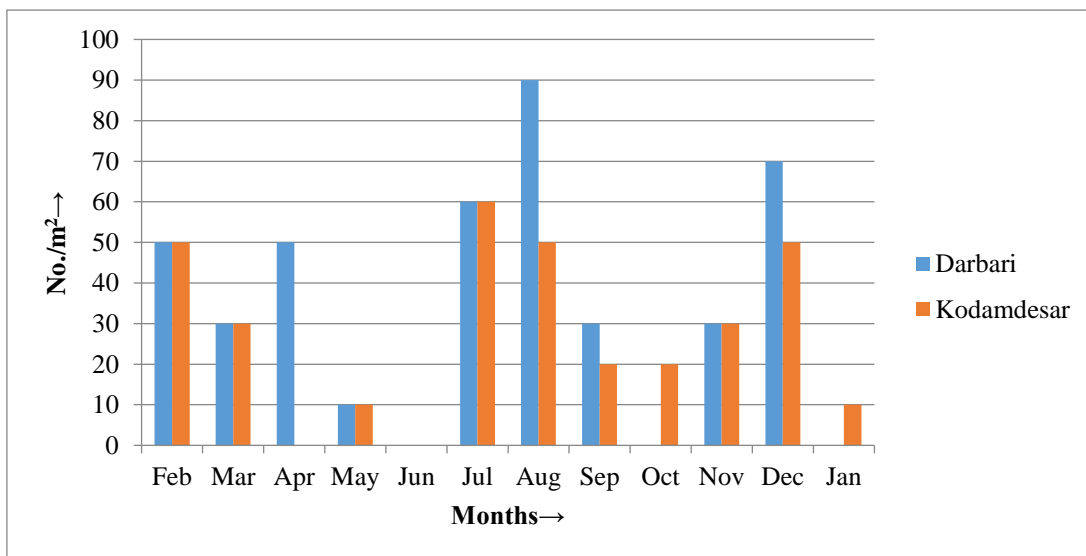
Khanam and Singh [11] studied of density of prosobranch snails in a pond near Bikaner Raj. Karwasara [12] in a nearby pond recorded four gastropod species out of which two *Gabbia orcula* and *Lymnea pseudosuccinea* were widely distributed and others two *Digoniostoma*

*pulchella* and *Indoplanorbis exustus* were noted less in numbers in the same region. Singh [5], reported two prosobranch species *Gabbia orcula* and *Digoniostoma pulchella* in his malacological study in the Indian desert region. He also noted that the population density of *Digoniostoma pulchella* and *Gabbia orcula* was found to be greater (over 90%) than that of pulmonate snails *Indoplanorbis exustus* and *Gyrulus rotula*. Rathore [13] studied the bioecological observation on banded snail *Bellamyia bengalensis* in some desert water region. Singh

et.al., [14] reported gastropod and its population ecology in desert region. Khanam [15] reported densities of *Gabbia orcula* 660 no./m<sup>2</sup> at Gajner pond, 108 no./m<sup>2</sup> at Kodamdesar pond but during present study in Kodamdesar pond, it was observed to be absent. Gumus, B.A. et.al. [7] were identified a total of 21 fresh water gastropod species (two neritimorpha, four caenogastropoda, and 15 hetrobranchia) of lotic and lentic sites as the some of three sampling seasons at Konya closed basin Turkiye.

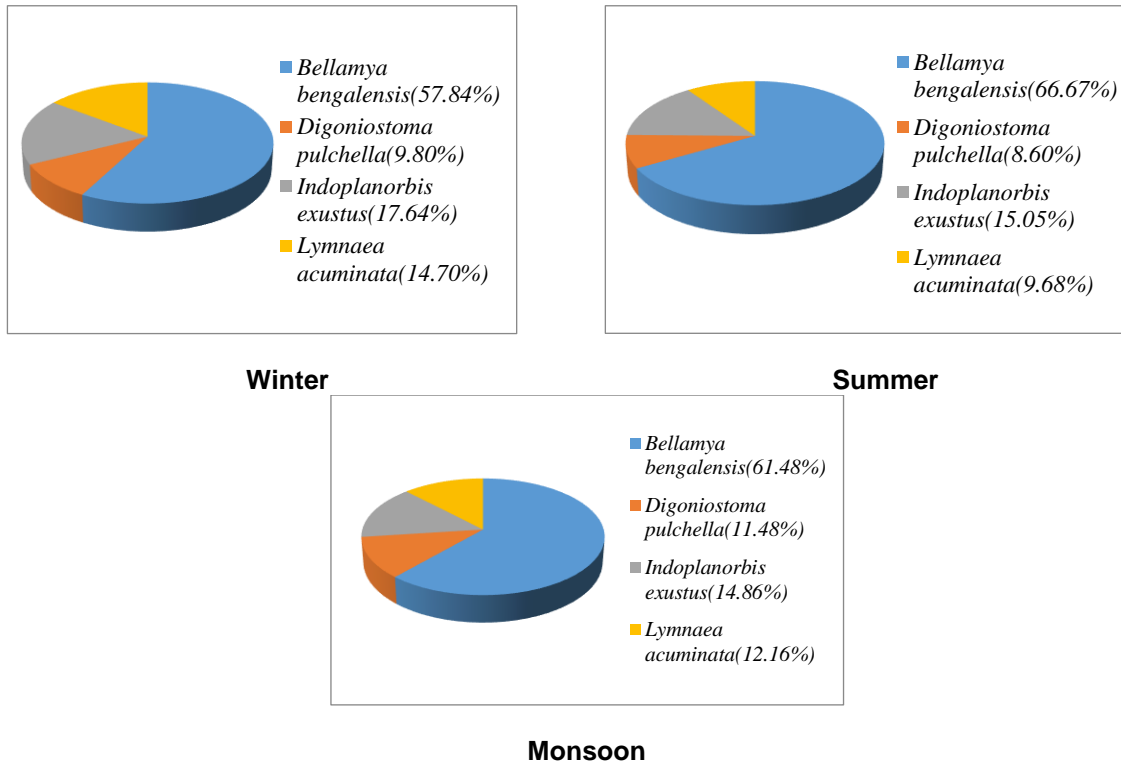


*Indoplanorbis exustus*

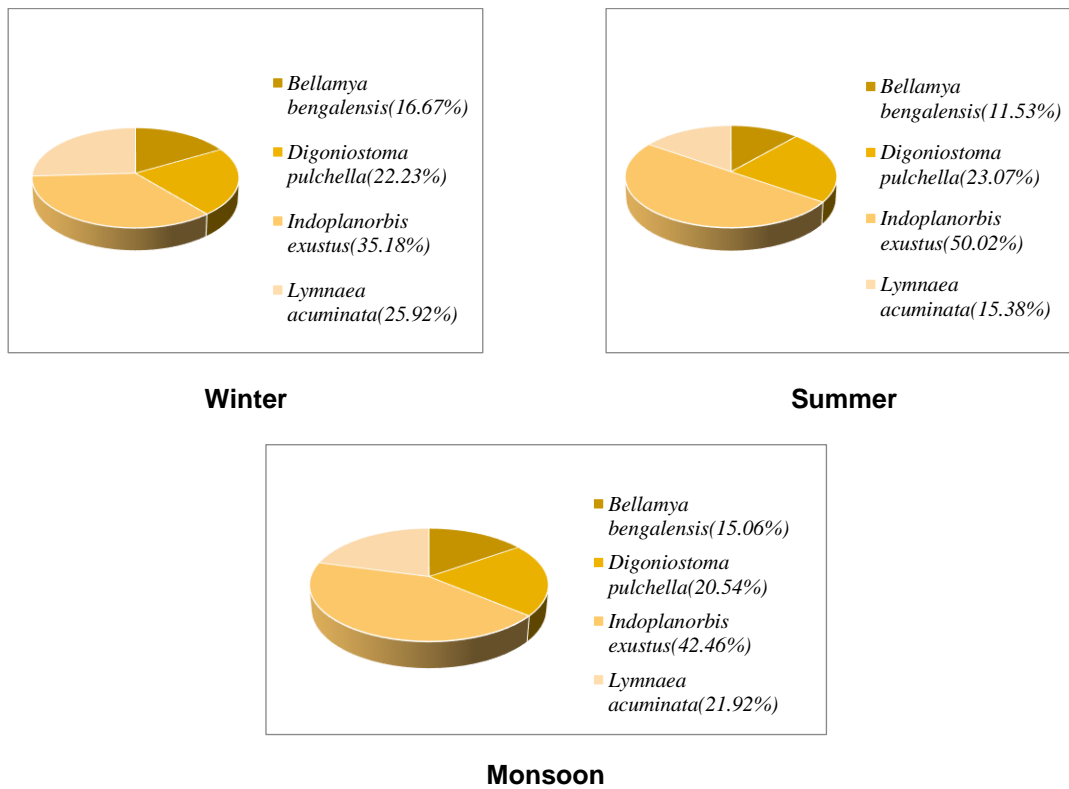


*Lymnaea acuminata*

Fig. 4. Population density of Pulmonate at Darbari and Kodamdesar (*I. exustus*, *L. acuminata*)



**Fig. 5. Seasonal population share of Prosobranch (*B. bengalensis*, *D. pulchella*) and Pulmonate (*I. exustus*, *L. acuminata*) at Darbari pond**



**Fig. 6. Seasonal population share of Prosobranch (*B. bengalensis*, *D. pulchella*) and Pulmonate (*I. exustus*, *L. acuminata*) at Kodamdesar pond**

The percentage share of different gastropods in the gross population density over three seasons is depicted in Figs .5,6. It is evident that prosobranch *B. bengalensis* dominated the scene throughout the year being over 57.84% and pulmonate *I. exustus* dominated the scene throughout the year being over 14.86% at Darbari pond. At Kodamdesar pond numerically, *I.exustus* dominated over all the three season being over 35.18% of the total population. It was followed by *Lymnaea acuminata* (15.38% to 25.92%), *Digoniostoma pulchella* (20.54% to 23.07%), and *Bellamyia bengalensis* (11.53% to 16.67%), constituted almost equal share over all the three season. During the study period, the population of snails have not any evident of increasing or decreasing in their numbers. Singh and Panwar [16] noted the highest population of *I. exustus* over rainy and autumn season. Bugalia [17] in her macrobenthic survey of some eight bodies of water in the same region recorded *Bellamyia bengalensis* as the most dominant gastropod followed by *Indoplanorbis exustus*.

**Ecological Notes:** Near Darbari and Kodamdesar ponds, the vegetation is typical of the arid and semi-arid regions of Rajasthan. The vegetation mainly consists of thorny shrubs and bushes, grasses, trees, and some aquatic plants. The flora is adapted to the harsh climatic conditions with minimal water availability.

#### 4. CONCLUSION

The semi-arid region of both village ponds consists best aquatic ecosystems for fresh water snails in all three winter, summer and monsoon season during study period. We determine the microhabitats of gastropods and their responses to seasonal changes. The result of the study will be useful for comparison with future studies.

In the study presented here, basic purpose was to investigate the species richness, diversity and population size of the gastropods living at each sampling sites, including seasonal effects.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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