RESEARCH ARTICLE

Species inventory of land Molluscs from Satpuda Mountains, India

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ABSTRACT

Diversity, Ecology and systematic of land molluscan species from Satpuda mountain area was studied during 2014-2015. Study area comprises 20 different sampling stations in about 200 sq. km zone of Satpuda Mountains in North Maharashtra, India. A total of 88 individuals belonging to 11 different species were collected from 20 collection spots in 10 localities. Eight families represent 11 species. A maximum of 03 species represented from Ariophantidae family, 02 from Cerastuidae and only 01 from Endodontidae, Vertiginidae, Pyramidulidae, Subulinidae, Camaenidae and Veronicellidae. Changes in species composition and abundance are related to natural forest site variations area (FA) and inresidential area in satpuda mountains (RA). The Shannon's diversity index shows maximum diversity index with 11 numbers of species is 2.13 in Forest area (FA) and 2.15 in Residential area (RA). The evenness values calculated statistically are 0.89in FA and 0.90 in RA. Need for biodiversity conservation is emphasized. These land mollusks are quite common in humified areas among Satpuda, mountain belts.

Keywords: Land molluscs, Satpuda, forest, Shannon's index.

INTRODUCTION

Study of fauna of mollusks provides crucial information on ecology of the region. In recent times the biotic fauna is greatly threatened by various human activities. Biodiversity conservation necessitates knowledge on the diversity of animals and plants with their distribution and ecological status. Satpuda mountain ranges of Maharashtra comprises forest zone close to Western Ghats. The estimated number in Indian subcontinent is around 5041 species out of the estimated species of 66, 535 species of the world. (Ramakrishna and Mitra, 2002).

Till date about 1487 species of land snails belonging to 32 families and 140 genera have been reported in India (Ramakrishna and Mitra, 2002). Indian gastropods have been studied by number of workers. Anandale (1919) and Prashad (1925) and Hora (1925 & 1926), Kulkarni (1971) Godan (1983) and Magare (2007) made some interesting observations on the hill stream molluscan fauna of various regions of Maharashtra. Mulkhedkar and Tonapi (1963) and Kulkarni (1973) published an account of landand freshwater Molluscs from Marathwada region. Raut and Ghose (1984) described various terrestrial mollusks of Nepal. Cooke et. Al, (1986) studied on mollusks. Recently Rao and Ghose (2001) have made survey of terrestrial mollusks from Nepal. Magare (2002 & 2006) studied on biodiversity of mollusksfrom tribal Zone of Nandurbar district.

Considering the paucity of information on land snails and severity of threat to them in India especially in satpuda mountain ranges, the need of the hour is to make an inventory and to study the distribution pattern of them. These results prompted me to make detailed survey and population dynamic study of land snails to fill up the lacuna of survey of landmolluscs fromForest and Residential area of Satpuda Mountains.

MATERIAL AND METHOD

For present study the survey was made from different vegetation types in and around satpuda mountain area. Grasslands, Forests, Rocky Mountains, marshy places, moist soil, agricultural lands, horticultural Zones, gardens, roadside dense vegetation, river-sides, grasslands and paddy fields were the exact locations of occurrence of shells and snails. The gardens, parks, cultivation area, vermin-culture center area and nurseries were always surveyed during different seasons of the year 2014-2015 from the foot of satpuda mountins and allied areas. The preliminary studies carried out at forest area of satpuda mountain area includes, Toranmal, Dhadgaon, Molgi, Walamba and Mandava whereas for residential area (Plane area) studies were carried out from Ranipur, Akkalkuwa, Taloda, Shahada and Nandurbar. Collection and observation from each site was made and from each site a quadrant of 1x1 meter was taken as the unit for population estimation of the snails and slugs. The snails and slugs found in these quadrants were collected manually by hand picking, using gloves to prevent infection. The snails were counted quadrant wise and species wise. The mean was calculated for each species and the number calculated for actual snail population per quadrant area. The shells were also collected and the study of the shells was made. The shape, colour and habitat of the gastropods samples from these collection sites were recorded for further morphological studies. Specimens were washed, dried and kept in plastic containers in small vials with cotton, for identification. The identification was made with the help of previously identified reports of Zoological Survey of India, Kolkata. From the survey sites the soil parameters and atmospheric temperature are recorded. The time spent in minutes per area in square Hectometers was recorded in searching the snails and slugs from 20 collection sites of 10 localities at the base of Satpuda Mountains.

RESULT AND DISCUSSION

Species diversity:

A total of 88 individuals belonging to 11 different species were collected from 20 collection spots in 10 localities distributed along Forest area (FA) and Residential area (RA) of Satpuda Mountains (Table-2). The occurrence of these species in Satpuda mountain is the first record but are recorded in other parts of India. Eight families represent 11 species. A maximum of 03 species represented from Ariophantidae family, 02 from Cerastuidae and only 01 from Endodontidae, Vertiginidae, Pyramidulidae, Subulinidae, Camaenidae and Veronicellidae. Changes in species composition and abundance are related to natural forest site variations area (FA) and in residential area in satpuda mountains (RA). The time spent was 2100 minutes in searching the snails and slugs from an area of 6400 square Hectometers distributed in 20 collection sites of Satpuda Mountain and allied plane area. (Fig 2).

Genera with maximum number of species include *Subulina* and *Cerastus.* The occurrence of these mollusks was reported from various sites, represent-ting moist land, fallen leaves of plants, humid, shady and rocky places of forests, agricultural fields and gardens. The majority of land mollusks were found in Taloda in plane area and in Toranmal in mountain area. Minimum numbers of species found in the study are *Euplecta* which are very rare. The greater density and species richness accounted in plane area. Calculations for diversity assay was done using Shannon-Weiner index (H,) formula, $H' = -\sum Pi \times In (Pi)$, Where Pi=proportion of individual species. The Shannon's index follows the same pattern as that of species richness. The Shannon's diversity index shows maximum diversity index with 11 numbers of species is 2.13 in Forest area (FA) and 2.15 in Residential area (RA). The eveness values calculated statistically by calculator software are 0.89 in FA and 0.90 in RA.

Variations in species composition and abundance:

Malacofauna and population density of species particularly of the most abundant mollusks varied in Mountain as well as in plane area. *Cerastua fairbanki* were tremendous in mountain area whereas *Cerastus jerdoni* were more in plane area, even though they are rare. *Subulina octona* are dominant in both area of satpuda studied in present work. Variation in topography and small scale elevation difference and the extent of human impacts (plane area) could contribute to this difference. (Fig.1). Area with high

organic content had more species like Taloda i.e. Riverside locations with agricultural land having dense vegetation and also in some other locations. Generally snails and slugs preferred moist alkaline soil. They were very few in acidic soil conditions and rare in an area without organic content.

Systematic account:

The second largest phylum in animal kingdom is Mollusca. Gastropos are more in Mollusca than any other classes. In Gastropoda, Stylommatophora is an order of sub-class Pulmonata. The stlommatophorans are with or without shells, with two pairs of tentacles of which the posterior pair is having an eye at its tip and usually with a common gonoore near base.

The order systellomorpha comprises slugs and shelled molluscs.

Phyllum- Mollusca
Class- Gastropoda.
Sub-class- Pulmonata.
Order-Stylommatophora.
Family- Cerastuidae.
Genus- *Cerastus*.
Species-*fairbanki*
Species*-jerdoni.*
Family- Ariophantidae.
Genus-*Cryptaustenia*.
Species- *bensoni.*
Genus- *Euplecta.*
Species- *subdecussata.*
Genus-*Macrochalmys*
Species-*Petrosa*.
Family- Endodontidae.
Genus- *Philalanka.*
Species- *quinquelirata.*
Family- Vertiginidae.
Genus- *Pupisome.*
Species- *evezardi.*
Family- Pyramidulidae.
Genus- *Pyramidula.*
Species- *humilis.*
Family- Subulinidae.
Genus- *Subulina.*
Species- *octona.*
Family- Camenidae.
Genus- *Trachia.*
Species- *fallociosa.*
Order- Systellomorpha.
Family- Veronicellidae.
Genus- *Laevicaluls.*
Species- *haroldi.*

Soil parameters:

To study the ecology of land mollusks simply an account of soil parameters from study site was made. Most of the snails prefer low temperature i.e. 25 C to 30 C and soil rich in organic carbon. In rainy season they occurred from soil surface to a depth of around 4-6 cm. They are more in numbers in moist and humus rich soil. Molluscs were few in mountain area up to an elevation of about 1000 meters from sea level and are more in orchards and in plane area. There are dissimilarities in soil parameters of study site preferred by different terrestrial gastropod mollusks. (Table 3).

In North Maharashtra Satpuda mountain is an allied zone of western Ghats, which is an important global hot spot of biodiversity in India. Nowadays overcrowding, overgrazing, overexploitation of natural resources and deforestation causes destruction of various natural habitats, particularly of invertebrates. From the present study it appeared that the abundance of molluscan species is more from the plane area which was quantified from terrestrial habitats of 10 different localities. There is a much variation observed in forest and plane area sites. The molluscan fauna of Satpuda Mountain is much but still unexplored therefore a systematic work to describe the members of mollusks from 20 sites of 10 localities was adjourned with 10 genera and 11 species, belonging to eight families and 03 orders. Hora (1925) studied on the habits of succineid mollusks from the Western Ghats and collected interesting data on hill stream mollusks of Pune, Maharashtra. Survey and ecological aspects of pulmonates from Marathwada region were studied by Kulkarni and Nagabhushanam (1973). Habitat studies, locations with their soil parameters, diversity index and mean density have been carried from land mollusks in Satpuda mountain areas of North Maharashtra is carried out in present investigation.

Kulkarni (1973) studied a detailed systematic on freshwater and land pulmonates of Marathwada region of Maharashtra and represented by six families with ten genera and fifteen species. Rao and Ghose (2001) studied on terrestrial mollusks of Nepal. Raheem et al. (2009) have made an illustrated guide to provide a brief introduction to the rich and fascinating land snail fauna of Western Ghats, India. Many of the species featured in this guide also occur in North Maharashtra. Magare (2002 & 2006) studied on terrestrial pulmonates from Nandurbar districts and provided a detailed systematic account of 24 different

Table 1: Species inventory of terrestrial molluscs in Forest Area (FA) and Residential Area (RA) sites of Satpuda Mountains.

Sr. No.	Species	Family	Number of individuals	
			FA	RA
1	*Cerastuafairbanki*	Cerastuidae	12	04
2	*Cerstusjerdoni*	Cerastuidae	04	01
3	*Cryptausteniabensoni.*	Aripophantidae	02	01
4	*Euplectasubdecussata.*	Ariophantidae	01	01
5	*Macrochlamyspetrosa*	Ariophantidae	08	04
6	*Philalankaquinquelirata.*	Endodontidae	09	06
7	*Pupisomeevezardi*	Vertiginidae	02	01
8	*Pyramidulahumilis*	Pyramidulidae	02	01
9	*Subulinaoctona*	Subulinidae	12	07
10	*Trachiafallasciosa*	Camaenidae	06	01
11	*Laevicaulisharoldi*	Veronicellidae	02	01
		Total	60	28
		Mean	5.54	2.54
		SD	3.16	1.60
		Shannon's Index	2.13	2.15
		Eveness	0.89	0.90

Table 2: Area wise different sampling stations (20) from 10 various localities from Satpuda mountain area.

Sr No	Mountain Area (Sector-I)		Plain Area (Sector-Ii)	
	Name of locality	Sampling station	Name of locality	Sampling station
1.	Toranmal	Lenghapani	Ranipur	Sultanpur
2.	Dhadgaon	Mungabari	Akkalkuwa	Khapar
3.	Molgi	Kathi	Taloda	Kothar
4.	Walamba	Dab	Shahada	Mhasawad
5.	Mandawa	Gadhwani	Nandurbar	Prakasha.

Table 3: Soil parameters from study sites.

Sr. No.	Locality	Soil Temp. (ºC)	PH	Electrical Conductivity (Ds/m)	Relative humidity	Organic C %	Total N %	Available S (PPM)
1.	Toranmal	25.0	7.06	0.71	85.0	2.05	0.32	45.1
2.	Ranipur	25.8	7.09	0.84	84.0	2.48	0.38	49.2
3.	Dhadgaon	25.5	7.04	0.65	77.0	4.46	0.07	55.1
4.	Akkalkuwa	25.2	7.05	0.68	78.0	4.18	0.47	54.4
5.	Molgi	26.2	6.64	1.23	57.3	5.50	0.49	53.1
6.	Taloda	26.0	6.48	0.89	61.3	5.92	0.23	37.3
7.	Walamba	24.5	6.50	0.60	89.0	3.63	0.07	23.5
8.	Shahada	24.4	6.45	0.25	87.0	3.69	0.25	44.5
9.	Mandawa	24.3	6.36	0.61	84.4	4.25	0.45	19.9
10.	Nandurbar	24.0	6.56	0.59	90.9	4.07	0.15	31.2
	Total	250.9	67.23	7.05	793.9	40.23	2.88	413.3
	Mean	25.09	6.72	0.70	79.39	4.02	0.28	41.33
	SD	0.7738	0.2989	0.2521	11.467	1.1826	0.1593	12.8287

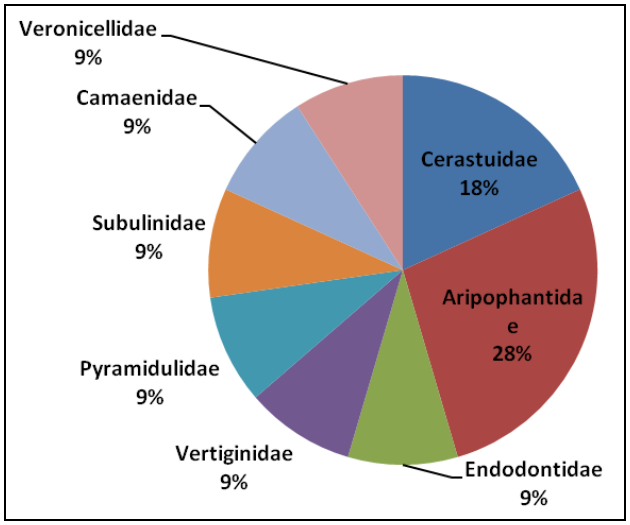

Fig. 1: Percentage of species composition of mulluscs from Satpuda mountain area

species of mollusks including 13 terrestrial species. In present work apart from published many terrestrial species of molluscs, 11 other terrestrial mollusks were studied and recorded first time from SatpoudaMountain area in India fromforested (Mountain) and residential (Plane) area.

CONCLUSION

The present work is undertaken to explore the Diversity, Ecology and systematics of land molluscan species from Satpuda mountain area. The work was undertaken during 2014-2015. The Study area consists of 20 different sampling stations in about 200 sq. km zone of Satpuda Mountains in North Maharashtra, India. A total of 88 individuals belonging to 11 different species were explored from 10 localities. The statistical data of Changes in species composition and abundance are related to natural forest site variations area (FA) and in residential area in Satpuda mountains (RA). The Shannon's diversity index 2.13 in Forest area (FA) and 2.15 in Residential area (RA). The eveness values calculated statistically are 0.89in FA and 0.90 in RA. These land mollusks are quite common in humified areas.

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