J. Adv. Zool. 2021: 42(1) : 128-134 **ISSN-0253-7214**

COMPARATIVE STUDY ON ECOLOGY AND BREEDING BEHAVIOUR OF TWO ANURAN SPECIES OF RANID *(EUPHLYCTIS HEXADACTYLUS)* AND RHACOPHORID *(POLYPEDATES MACULA TUS) IN* NORTH ODISHA

Bhagyashree Panda* and Sibaprasad Parida**
Department of Zoology, School of Applied Sciences,
Centurion University of Technology and Management, Bhubaneswar Campus, Odisha, India.
*1ucky.panda 79@gmai1.com
**sibaprasad.parida@cutm.ac.in

ABSTRACT: Ranids are restricted to permanent ponds rich with hydrophytes or thick vegetation. *Polypedates maculatus* is arboreal in nature and frequently hided near human habitation. *Euphlyctis hexadactylus* is restricted to permanent ponds rich with hydrophytes which are the major source of food for the species. Ranid amplecting pairs move and eggs are laid in scattered manner and adhered to aquatic plants. Foam nest in rhacophorid is adhered to twigs above the water level. Smallest female of *Euphlyctis hexadactylus* have more number of eggs than some larger female. There is lack of correlation between body size and clutch size. The snout vent lenght (SVL) is not a key determining factor for clutch size in case of Ranid species but in case of rhacophorid the number of eggs in a clutch increases with increase size of the female. Variation in pigmentation or characteristic colouration are observed in tadpoles of ranid and rhacophorid.

KEYWORDS: Arboreal, Foam nest, Amplecting pairs, SVL, Clutch size

INTRODUCTION

Out of 210 species of amphibians in India, ranids have 90 species and rhacophorids have 54 species. Liem II classified three families: Ranidae, Rhacophoridae and Hyperoliidae. Inger demonstrated the close relationship of the families Within ecological communities, environmental resources are partitioned on the basis of dimensional differences in comparative sizes of the organisms[2l]. Two species of the genus *Polypedates,* five species of the genus *Rhacophurus* and six species of the genus *Philautus* from Northeast India have been reported[22]. Within ecological communities, environmental resources are partitioned on the basis of dimensional differences in comparative sizes of the organisms[23]. Brockelman[1] and Brouce[2] observed that both ranids and rhacophorids are wetland species . Literature is reviewed on habitat and breeding aspects of one ranid, *Euphlyctis hexadactylus* and one Rhacophorid *Polypedates maculatus* to provide a comparative analysis of these groups. The present study is aimed at differences in developmental characterstics in allied families in more or less similar habitat. Difference in habitat utilization and developmental pattern are studied.

Ranids are found in restricted pockets where permanent source of stagnant water is observed. *Polypedates* live in trees and tree holes or among grass and weeds near

water[11,24]. This species lives near perennial water and in house where water is at hand and can be seen all the year round[13]. The size analysis of *H.crassus*, a detailed account on the morphometric analysis of *Limnochans* was reported[6,15]. Rath[20] studied on *Polypedates maculatus* and Das3 reported on *Tomopterna rolandae.* Mohanty-Hejmadi and Dutta[16] reported the size correlation of the Indian Bull frog, *Hoplobatrachus tigennus*. Shaffer[23] published the data on the size and scaling in the Indian frogs *Nyctibatrachus* and *Nannobatrachus* (Ranidae). The expected positive correlations between both body size (SVL) as well as body mass (WT) and number of LAGs has been demonstrated[18]. Anurans found in Odisha are seasonal breeders and observed in areas with temperature and rainfall fluctuation. Anurans depend on acoustic communication to attract mates and advertise territory ownership[26].

The term clutch stands for full complement of eggs of single female, irrespective of whether she lays them all at once or over longer period of time[27]. Publication on clutch size of anurans has been made on *L. limnocharis* and *P. maculatus* to report no of eggs per clutch[15,20].

The tadpoles are radiated into a variety of microhabitat and modes of life have been accompanied by modification of their ovoidal body form. Poikilothermic nature of amphibian has made then group seasonal breeder. Occasional breeding habit is observed. Reproduction capabilities are different in similar habitat. Both ranids and rhacophorids of amphibian are poikilothermic in nature so they are coming under seasonal breeders. Different morphological structures of tadpoles mark the differentiation between species[4,19].

MATERIALS AND METHODS

Study area

The field study and sampling of two anurans of ranid and rhacophorid were conducted during 2018-2019, from 2 different places in North Odisha**.** The localities are under Mayurbhanj districts of North Odisha located between 21.933 degree N and 733 degree E. Thirty specimens of ranid and rhacophorid were collected at Bankati HSS campus and Mrugabadi. Out of thirty, fourteen specimens were *Euphlyctis hexadactylus* and sixteen specimens were *Polypedates maculatus.*

Fig. 1. Map showing sampling area of North Odisha presented by arrow mark.

Distribution of species of both families was ascertained by visiting perennial water bodies at North Odisha during (June-Aug) during the years 2018-2019 and their snout vent lenght (SVL) were measured by a digital caliper. The adult frogs were sexed on the basis of secondary sexual character. Foam nest was collected from natural environment from the vicinity of Bankati HSS campus to study the clutch sizes. Amplecting pairs were collected during night time and day time availability and their SVL were measured. Clutches were transferred in a rearing tray with conditioned water. Hydrilla plants were introduced in to the rearing tray of ranids[17]. Tadpoles were collected from natural environment for their characterisation.

RESULTS AND DISCUSSION

Morphology and size

Euphlyctis hexadactylus is large sized frog bright green or mid brown coloured, rudimentary webbed with snout vent length (SVL) 35-95 mm in male and 45-200 mm in female. A broad dark blotch is present along the middle of the back with elongated dark patches on either side. They frequently change colour from green to brown to protect from predator. *Polypedates maculatus* is a medium sized frog with two cream dorso lateral lines. SVL of male was 40-75mm and 44-80 mm in female. Head is longer than broad with bluntly pointed snout. Dorsal side is brownish, yellowish white or greenish with or without irregular dark brown patches. There is a large brown marking on the head, from behind the eyes, extending to the dursum. They change colour to grey chocolate brown as to protect themselves.

Habitat

Euphlyctis hexadactylus is restricted to permanent ponds rich with hydrophytes which are the major source of food for the species. *Polypedates maculatus* like other rhacophorids is arboreal in nature and frequently encountered near human habitation. These rhacophorids are found in open fields during breeding season. This species is hidden in resting areas during day time.

Clutch size

Smallest female (SVL- 45 mm) of *Euphlyctis hexadactylus* had more (4850) number of eggs than some larger female (SVL-110mm, SVL-120 mm, SVL-130mm, SVL-136mm) which indicted that there is no relationship between body size and clutch size. The clutch size ranged from 2010-9200. Ranid female with more weight had less number of eggs in a clutch than number of eggs produced by female with less weight. Ranid species was also associated with multiple clutches. Number of eggs in clutch varies between 141-650 with an average of 395.5 in case of *Polypedates maculatus*. The number of eggs in a clutch increases with size of the female Rhacophorid species.

Fig.2 *Polypedates maculatus* encountered near human habitation.

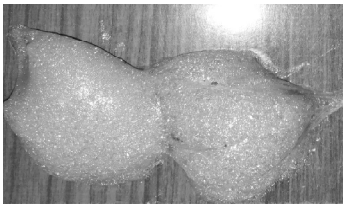


Fig.3 Foam nest of *Polypedates maculatus.*

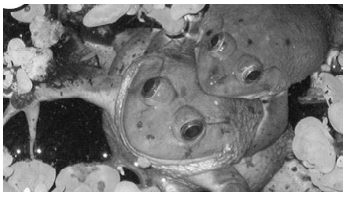


Fig.4 Amplecting pairs of *Euphlyctis hexadactylus.*

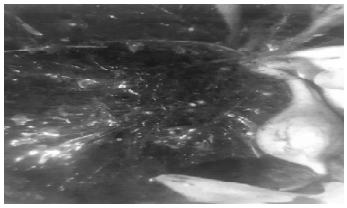


Fig.5 Clutches of *E. hexadactylus.*

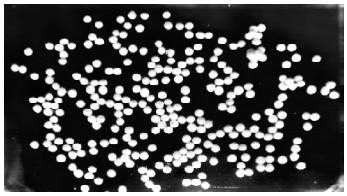


Fig.6 fertilized egg removed from jelly foam nest.

Table 1. Mean, Standard deviation (SD), and Correlation between SVL and Clutch size of *E. hexadactylus*

SVL(mm)		Clutch size(no)		Correlation between SVL and Clutch size (r)
Mean±SD	**Range**	**Mean±SD**	**Range**	
133.86±37.25	155	5992±2128.61	7190	0.62

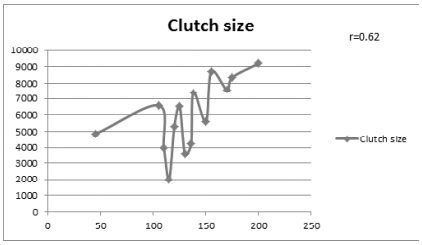


Fig.7 Graph illustrating the trend of clutch size and SVL of *Euphylctis hexadactylus.* (N=14)

Table 2. Mean, Standard deviation (SD), and Correlation between SVL and Clutch size of *P.maculatus*. (N=16)

SVL(mm)		Clutch size(no)		Correlation between SVL and Clutch size (r)
Mean±SD	Range	Mean±SD	Range	
61.94±12.18	36	387.25±155.18	509	0.99

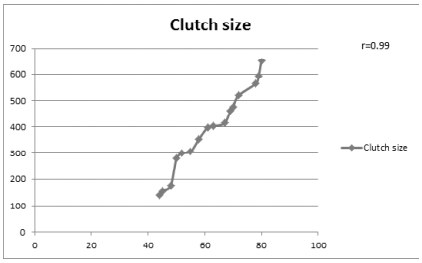
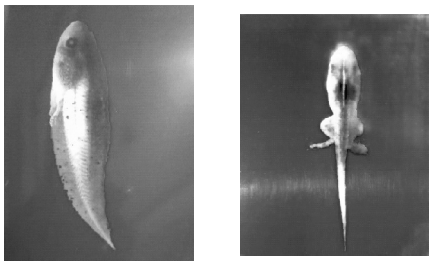


Fig.8 Graph illustrating the trend of clutch size and SVL of *Polypedates maculatus* (N=16)

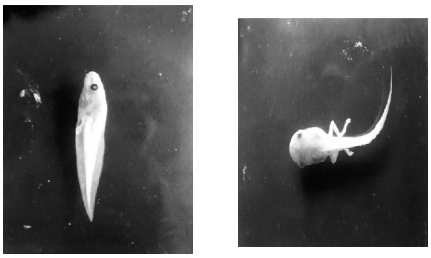
TADPOLE

Pigmentation is varied in dorsal, lateral part and tail of *E. hexadactylus*. Pigmentation is more prominent in tail. Tadpoles of *Polypedates maculatus* bottom dwellers. At late tail bud stage of *Polypedates maculatus* first movement of embryo is marked inside foam nest. Embryos are released into water during external gill stage.



A B

Fig.9 Premetamorphic tadpole with developing hind limbs of *E. hexadactylus*. (ALateral view, B-Dorsal view)



A B

Fig.10 Premetamorphic tadpole with developing hind limbs of *P.maculatus*. (ALateral view, B-Dorsal view)

Habitat utilisation, breeding behaviour and developmental variations have been analysed between selected species of ranid and rhacophorid in North Odisha. During breeding season gravid females are found larger in size than mature males. The Snout vent length correlationship among males and females was reported on *Rana tigerina* and *Rana crassa*[16]. The smallest size was considered in the present study attaining sexual maturity. The present study revealed that the smallest gravid female was 45 mm and male 35 mm for *E hexadactylus* and female 44 mm and male 40mm for *Polypedates maculatus*. The present study explored that interspecific variation in size was found during SVL data comparision. Correlation between body size and clutch size has been described by Terentjev[25], Matsui and Ota[12]. Similar observation is seen in *Polypedates maculatus*. In *Rana limnocharis* smallest female (SVL 34 mm) lays 120 eggs was reported by Mohanty[15]. In case of *Rana tigerina* (Dutta and Hejmadi*5* and *Rana crassa* (Dutta *et al*., 1993) of ranids are having larger body size and clutch size than *Rana limnocharis*[7].The SVL and clutch size when compared with *Polypedates maculatus* the clutch size of latter is much smaller and eggs are larger. More eggs are seen in several microhylids. However small species are more prone to predation. Smaller species need a suitable adaptaion to the annual uncertainity of the environment. They produce relatively larger clutch size in order to breed effectively[10]. The comparative study of clutch size of *Polypedates maculatus* with ranids concludes the others do not follow the specific pattern of more eggs for larger species as in case of *Polypedates maculatus*. In *Polypedates maculatus* the modes and sites of egg lying is more advantageous so we will get early development in well guarded environment thus ensuring high embryonic survival. Larger eggs are selectively advantageous than larger clutch size. Overall the clutch sizes, structure of tadpole of both families depend on the adapted environment which varies according to the change in habitat utilisation, predation and natural calamities.

REFERENCES

- Brockelman, W.Y., 1975. Competition, the fitness of offspring and optimal clutch size. *Naturalist*, 109, 677-699.
- Brouce, R.C., 1969. Fecundity in primitive plenthodontid salamanders. *Evolution*, 23, 50-54.
- Das, S.M., 1996. Morphometric, Growth, Breeding and Development of *Tomopterna rolandae* (Anura Ranidae). Ph.D Thesis, *Utkal University*, India.
- Duellman, W.E., and L. Trueb, 1986. Biology

of amphibians. McGraw Hill Book Co., New York.

- Dutta, S.K., P. Mahapatra, P. Mohanty- Hejmadi, 1993. Breeding and life history of Rana crassa. *Herpeton*. (In press)
- Dutta, S.K., 1992. Amphibians of India updated species list with distribution record. *Hamdrydad*, 17, 1-13.
- Dutta, S.K. & Mohanty- Hejmadi P. 1976. Breeding and life history of the Indian bull frog *Rana tigerina*. *Prakruti- Utkal Unv, J Sci*. 13 (1-2), 51-59.
- Dutta, S.K. & P. Mohanty-Hejmadi, 1976. Breeding and life history of the India bull frog, *Rana tigerina*. *Prakruti-utkal univ. J. sci*. 13(1-2): 51-59.
- Inger, R.F., 1966. The systematics and zoogeography of the Amphibia of Borneo. *Fieldiana Zool*. 52, 1-395.
- Kuramoto, M., 1978. Correlations of quantitative parameters of fecundity in amphibians. *Evolution*, 32(2), 287-296.
- Liem, S.S., 1970. The morphology, systematics and evolution of the old world tree frogs (Rhacophoridae and Hyperoliidae). *Fieldiana Zool*, 57, 1-127.
- Matsui, M. & H. Ota, 1984. Parameters of fecundity in Microhyla ornate from the Yaeyama group of the Ryukyu Archipelago. *Japanese. J. Herpetol*, 10(3), 73-79.
- McCann, C., 1940. Reptile and Amphibian miscellany. *J. Bombay. Nat. Hist. Soc*. 11, 44-65.
- Mohanty- Hejmadi, P. & S.K. Dutta, 1988. Life history of the common Indian tree frog, *Polypedates maculatus* (Anura: Rhacophoridae). *J. Bombay Nat. Hist. Soc*. 85(3), 512-517.
- Mohanty, A.K., 1994. Biology of Indian Paddy field frog, *Rana hmnochans*. Ph.D thesis, Utkal Unv, Orissa.
- Mohanty-Hejmadi, P. & S.K. Dutta, 1981. Studies on the sex ratio and size correlation of the Indian Bull frog, *Rana tigerina*. *Pranikee*, 2, 29-36.
- Mohanty-Hejmadi, P. & S.K. Dutta, 1988. Life history of the common Indian tree frog, *Polypedates maculatus* (Anura: Rhacophoridae). *J. Bombay Nat. Hist. Soc.*, 76(2), 291-296.
- Nayak, S., P.K. Mahapatra, R.K. Mohanty & S.K. Dutta, 2008. A skeletochronological analysis of age, growth and longevity of Indian green frog *Euphlyctis hexadactylus*. H*erpetozzoa*, 20(3/4), 99-107.
- Orton, G.L.,1953. The systematics of vertebrate larvae. Syst. Zool. 2: 63-75.
- Rath, S., 1995. Biology of Indian tree frog, *Polypedates maculatus* (Anura: Rhacophoridae). Ph.D. Thesis, *Utkal University*, India.
- Schoener, T.W., 1965. The evolution of gill size differences among sympatric congeneric species of birds. *Evolution*, 19, 189-213.
- Sen, N. & R. Matthew, 2004. Occurrence *of Euphlyctis hexadactylus* (Lesson, 1834) (Amphibia: Anura: Ranidae) in Northeast India with notes on its morphological characters. *Cobra*, 55: 1-6.
- Shaffer, H.B., 1988. Size and scaling in the Indian frogs *Nyctibatrachus* and *Nannobatrachus* (Ranidae). *Fieldiana Zoo! (New Senes)*, 46, 1-10.
- Taylor, E.H., 1962. The amphibian fauna of Thailand. *Univ. Kanas Sc. Bull*, 43(8), 265-599.
- Terentjev, P.V., 1960. Some quantitative peculiarities of frog eggs and tadpoles. *Zool. J. Acad. Sci*., USSA, 39, 779-781.
- Wells, K.D. & J.J. Schwartz, 2007. The Behavioral Ecology of Anuran Communication. Part of the Springer Handbook of Auditory Research book series SHAR, 28, 45-86.
- Woodruff, D.S. 1976. Courtship, reproductive rates and mating system in three Australian Pseudophryne (Amphibia, Anura, Leptodactylidae). *j. Herptol*. 10,316-318.