frog leg

Newsletter of the Amphibian Network of South Asia and Amphibian Specialist Group - South Asia

ANSA

No.14, May 2010

Contents

ASG IUCN/SSC

ZOO OUTREACH ORGANISATION | WILDLIFE INFORMATION LIAISON DEVELOPMENT | CONSERVATION BREEDING SPECIALIST GROUP | Journal of Threatened Taxa

OPEN ACCESS | FREE DOWNLOAD

Chiromantis vittatus recorded for the first time in Bangladesh

Md. Mofizul Kabir, Md. Kamrul Hasan & Mushfiq Ahmed

Department of Zoology, Jahangirnagar University, Savar, Dhaka, Bangladesh
Email: mofizulkabir@yahoo.com

A total of 26 species of amphibians are found in Bangladesh of which five species are in the family Rhacophoridae (Khan 2004). The number of amphibians might be found to be more, however, if the survey could be done properly. Recently, a survey was conducted in the Lawachara National Park (24^{0}19.682'N & 91^{0}47.377'E) from 19 to 21 May 2007 and the species *Chiromantis vittatus* (Boulenger, 1887) of the family Rhacophoridae was recorded for the first time in Bangladesh. There is no mention of its presence in Bangladesh (Khan 1982, 2004; Sarker & Sarker 1988; IUCN Bangladesh 2000; Frost 2010).

One specimen of *Chiromantis vittatus* was collected from the leaf of a bush about seven feet in height from the ground. Measurements were taken by a digital slide caliper with an accuracy of 0.02mm. Total length (SVL) of the frog 25mm. Vomerine tooth absent. Snout pointed, projecting slightly beyond the lower jaw, nostril nearer the end of the snout than the eye; eye diameter (3mm) larger than the tympanum diameter (0.5mm); fingers with rudimentary webbing. No webbing between the first and second fingers. Between the rest of the fingers as follows: II2½ - 3III2½ - 2IV, but the toe three-fourth webbed. The finger and toe disc pads circular with circum-marginal grooves. Sub-articular tubercles well developed. Tibio-tarsal articu-lation reaches up to the eye. The relative lengths of the toes 4>5>3>2>1. The dorsal colour of the species light brown and the ventral colour yellowish-white or off white. Skin smooth, granular on the belly and under the thighs. Throat smooth and transparent. Two broad yellowish-white lateral lines run forwards along the edge of the upper eyelid and the canthus rostralis which unite at the tip of the snout (Images 1, 2). The description of this species matched with the type description. The photograph of the present species also matched the photograph of Biswas & Pawar (1999). The specimen has been deposited in the Wildlife Museum of Department of Zoology, Jahangirnagar University, Savar, Dhaka (A-0011) and morphometric measurements are given in Table 1.

Image 1. Dorsal view of *Chiromantis vittatus* from Lawachara National Park, Bangladesh

This species is very rare in the Lawachara National Park as we hardly ever heard the call of this species during our survey. However, this species may be found in other forested areas of this country. According to IUCN's Global Amphibian Assessment (2006), this

Image 2. Dorsal view

species has a scattered distribution in southern and southwestern China (Fujian, Xizang, Yunnan, Guangxi and Hainan) and ranges from northeastern India (West Bengal, Assam, Nagaland, Arunachal Pradesh) through eastern Myanmar, mainland Thailand, Laos, and Cambodia to Vietnam. But according to Frost (2010) *C. vittatus* is distributed in the mountains of northeastern India (Mizoram and Nagaland), Myanmar and Thailand through Laos, southwestern Cambodia, and Vietnam to Hainan I., Guangxi, Guangdong, and Yunnan (China).

Table 1. Morphometric measurements of *Chiromantis vittatus* (in mm) from Lawachara, National Park, Bangladesh

Parameters	Measurements (mm)
Sex	Male
Snout to vent length	25
Head length (from back of the jaw to snout tip)	7.0
Head width (maximum distance from the rear of the jaw)	8.0
Tympanum	0.5
Eye diameter	3.0
Inter orbital distance	3.0
Pupil shape	horizontal
Distance between nostril	2.4
Distance between eye to nostril	2.0
Distance between snout to nostril	1.6
Diameter of disc of 4th finger	1.1
Tibia length	10.4
Diameter of 4th finger disc	1.1

References

Biswas & Pawar (1999). www.sbs.utexas.edu /hisasia/photogallery.htm.

Boulenger, G.A. (1890). *The fauna of British India including Ceylon and Burma. Reptilia and Batrachia*. London, i -xviii+541pp.

Daniel, J.C. (2002). *The book of Indian Reptiles and Amphibians*. Bombay Natural History Society and Oxford University Press, Mumbai, i-viii+238pp.

Frost, D.R. (2010). Amphibian Species of the World: an Online Reference. Version 5.4 (downloaded 8 April 2010). http://research.amnh.org/vz/herpetology/amphibia/American Museum of Natural History, New York, USA

IUCN, Conservation Inter-national and Nature Serve (2006). Global Amphibian Assessment.<www.globalamphibians.org> (accessed on 4th January 2008).

IUCN Bangladesh (2000). *Threatened Amphibians and Reptiles of Bangladesh*, IUCN- The World Conservation Union, 95pp.

Khan, M.AR. (1982). *Wildlife of Bangladesh*: A checklist. University of Dhaka, Dhaka, Bangladesh, 174pp.

Khan, M.A.R. (2004). Checklist of herpetofauna of Bangladesh. *Cobra* 57:1-29.

Sarker S.U. & N.Z. Sarker (1988). *Wildlife of Bangladesh* (*A systematic list with status distribution and habitat*). The Richo Printers, Dhaka, x+59pp.

Marbled Balloon Frog *Uperodon systoma* (Schneider, 1799), a new record for Hyderabad, Andhra Pradesh, India

M. Seetharamaraju [1], Harpreet Kaur[1], C. Srinivasulu [2] & Bhargavi Srinivasulu [3]

[1,2] Wildlife Biology Section, Department of Zoology, University College of Science, Osmania University, Hyderabad, Andhra Pradesh 500007, India
[3] Biodiversity Research and Conservation Society, G4, MRK Towers, Swarnadhamanagar, Near Military Dairy Farm, Old Bowenpally, Secunderabad, Andhra Pradesh 500011, India
Email: [2] hyd2masawa@gmail.com (corresponding author)

As part of our on-going biodiversity assessment programme of Osmania University Campus, we have been conducting regular surveys to document floral and faunal elements of the campus since January 2008. During one such survey we collected a female specimen of the marbled balloon frog *Uperodon systoma* (Schneider, 1799) (Image 1) on 10 August 2008 at 1920.

The distribution range of the Marbled Balloon Frog *Uperodon systoma* (Schneider, 1799) includes Bangladesh, India, Nepal, Pakistan and Sri Lanka in South Asia. Although Global Amphibian Assessment database shows it to be distributed in most of Andhra Pradesh (IUCN, CI and NatureServe, 2006), this species has been recorded/ collected from Farahabad in Mahbubnagar district, Bairluty, Potharajupenta, Sunnipenta and Shikaram in Kurnool district, Sriharikota in Nellore district (Srinivasulu et al. 2006), Bukkapatnam in Anantapur Distirct (Sarkar et al. 1993) and ICRISAT campus (S.M.M. Javed, *pers. comm.*) in Medak district. This is the first record of its occurrence from Hyderabad, Andhra Pradesh.

Image 1. *Uperodon systoma* (Schneider, 1799) from Osmania University Campus, Hyderabad, Andhra Pradesh

The marbled Balloon Frog is fossorial by nature venturing out of its burrow during the monsoon. This specimen was caught following a week long heavy rains. Morphometric measurements such as snout-vent length, SVL; head length (from posterior margin of the lower jaw to tip of snout), HL; head width, HW; Eye length, EL; eye to nostril distance, EN; distance between nares, IND; distance between the anterior margin of the eyes (eye-eye distance), EE; tympanic membrane height, TYH; tympanic membrane length, TYL; Forearm length (from elbow to the proximal margin of thenar tubercle), ARM; tibia length, TL; thigh length, TH; foot length (from proximal border of inner metatarsal tubercle to tip of fourth toe), FL were taken (Table 1) and the specimen (NHMOU/ Amphi.2008.8) is deposited with the Natural History

Table 1. Morphometric measurements (*in mm.*) of Marbled Balloon Frog *Uperodon systoma* (Schneider, 1799) collected from Hyderabad, Andhra Pradesh

Snout–vent length (SVL)	73.16
Head length (HL)	13.74
Head width (HW)	17.92
Eye length (EL)	7.11
Eye to nostril distance (EN)	2.42
Distance between nares (IND)	6.31
Eye-eye distance (EE)	10.72
Tympanic membrane height (TYH)	2.34
Tympanic membrane length (TYL)	2.47
Forearm length (ARM)	44.17
Tibia length (TL)	23.29
Thigh length (TH)	31.15
Foot length (FL)	25.19

Museum of Department of Zoology, Osmania University.

The dorsum of the specimen was marbled extensively with yellow and dark brown, the ventral surface was pale yellowish to whitish in appearance. Skin smooth to weakly tuberculated dorsally while the venter was smooth all through. Head small, broader than long, nostrils equidistant from the tip of the snout and the eyes, pupil rounded; snout blunt and as long as the diameter of the eye; tympanum hidden; fingers free, toes short with rounded tips and partially webbed.

References

Srinivasulu, C. Bhargavi Srinivasulu & C.A. Nageswara Rao (2006). Amphibian fauna of Nagarjunasgar Srisailam Tiger Reserve, Andhra Pradesh. *Records of the Zoological Survey of India*, *Occasional Paper No. 245*: 1-57+4pl.

Sarkar, A.K., P.K. Chandra & S. Ray (1993). *Amphibia*. pp. 65-87. *In:* Director, ZSI (ed.). *Fauna of Andhra Pradesh, Part 1 (Reptilia, Amphibia, Fishes)*. Zoological Survey of India, Calcutta.

IUCN, Conservation International and NatureServe (2006). Global Amphibian Assessment. www.globalamphibians.org. Accessed on 22 August 2008.

Acknowledgements

We thank Prof. T. Tirupathi Rao, Honourable Vice Chancellor, Osmania University and the Head, Department of Zoology, Osmania University for encouragement and providing necessary facilities.

Rhacophorus lateralis in Madikeri, Kodagu, Karnataka

Sanjay Molur[1,2] & Payal Molur[2]

[1] Zoo Outreach Organisation/Wildlife Information Liaison Development, 9A Lal Bahadur Colony, Peelamedu, Coimbatore, Tamil Nadu 641004, India
[2] F5/GoWild Workshops, D2 GEM Nirmaalayam, VG Rao Nagar, Ganapathy, Coimbatore, Tamil Nadu 641006, India
Email: [1] herpinvert@gmail.com, [2] payal.bmolur@gmail.com

The Small Tree Frog *Rhacophorus lateralis* was rediscovered by Daniel Bennet and his team of frog observers of the Aberdeen University Western Ghats Project in 1998 (Bennet et al. 2000; Das 2000) in Luckunda Estate, Coorg (12^{0}03'N & 76^{0}03'E; 900m elevation), bordering the Nagarahole National Park. The species had been officially rediscovered after 117 years since its description in 1883 by Boulenger. Coincidentally, Biju (2000) also reported its occurrence from Wynaad in Kerala. Since then there have been sporadic reports of its occurrence, some reported but mostly not documented. We wish to put on record the occurrence of this species in two localities in Coorg, north of from where the species was recorded by Bennet et al. (2000).

Image 1. *Rhacophorus lateralis* male showing off his colour changing ability and translucent webbing.

On an evening's observation in the coffee plantation of Shanthi Estate (12°24'28.1"N & 75°44'24.2"E; 935m elevation) near Madikeri in May 2005, we were documenting a population of *Rhacophorus malabaricus* at a man-made pond adjacent to a cardamom plantation. A *Terminalia* tree, a garden guava plant and some brush adjacent to the pond were abound with *R. malabaricus*, their numbers having increased by more than 100% from the same period in the previous year. Their call being lond and distinct, we almost missed the call of *R. lateralis* that were in the bushes. A chance sighting revealed one individual and on careful search we found five males of *R. lateralis*, but no females. As the evening progressed, we found the tiny frogs coming out and occupying the exposed leaves of the bush along with *R. malabaricus*. The females were, however, never sighted.

Out of curiosity, and excited we had discovered yet another population of this species, we kept two males in

Image 2. A contrasting and plain underside.

captivity for observation. The animals wore a bright green dorsum with neon green dots when they were calling. However, when handled, both the animals changed colour to a bright brown with coffee coloured dots. The lateral strip remained a deep red and the bright yellow lateral line remained unchanged. The frogs changed colour from green to brown in a matter of five seconds. When released, they changed their colour back to green in about 30 seconds (Images 3 & 4). Our observations of this colour change seem to differ from Bennet et al. (2000) where they found the calling frogs to be brown in colour, which when handled turned green. They attribute colour change to stress and we agree with their observation as we found the frequency and rapidity of the change in colour reducing after the individuals were handled repeatedly.

Images 3 & 4. The species changes colour from brown to green and vice-versa in a matter of seconds.

We observed the males in close association with *R. malabaricus* individuals for the whole week we were there, but never once observed the female. On our subsequent visit to Shanthi Estate in 2006, we did not observe any *R. malabaricus* or *R. lateralis* around the pond, may be because the brush was cleared completely and the *Terminalia* tree had been drastically pruned.

We have subsequently searched for *R. lateralis* wherever we sighted *R. malabaricus* in Coorg, but did not come across them or hear their call. Only recently, Dr. Anurag Goel of Rainforest Retreat reported the occurrence of this species along with a rapidly increasing population of *R. malabaricus* in their pond (see Goel & Goel 2010, this newsletter).

References

Bennet, D., K. Hampson, K. Sanders & M. Anderson (2000). Frogs of Coorg, Karnataka, India. Final Report of the Aberdeen University Western Ghats Project, 1998.

Biju, S.D. (2000). 2 frogs and 100 years. Occasional Publication of the Indian Society for Conservation Biology (ISCB), Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India, 14pp.

Das, I. (2000). Nomenclatural history and rediscovery of *Rhacophorus lateralis* Boulenger, 1883 (Amphibia: Rhacophoridae). *Current Herpetology* 19(1): 35-40.

Observations on *Rhacophorus lateralis* and *R. malabaricus* in northern Coorg

Anurag Goel [1] & Maya Goel [2]

[1,2] Mojo Platation, Rainforest Retreat, P.O. Box 101, Madikeri, Kodagu, Karnataka 571201, India
Email: [1] annugoel@gmail.com

Image 1. Adult female *R. lateralis*

The Western Ghats are known for their amphibian diversity and new species are being discovered every year. In light of the fact that amphibian populations are in drastic decline globally, it is important to identify and monitor some of these populations. We have documented healthy growing populations of the Malabar Gliding Frog *Rhacophorus malabaricus,* and its smaller cousin, the Small Tree Frog *Rhacophorus lateralis* (which is considered extremely rare and was recently rediscovered in Kodagu after 117 years; Image 1). Both species are thriving on our organic spice farm (Mojo Plantation; 12°28'32.1"N & 75°42'38.7"E; 1060m elevation) located 10km northwest of Madikeri in Kodagu District, Karnataka. This can be attributed to the presence of two open tanks, which we constructed 14 years ago next to our house to harvest rainwater (Image 2). The surrounding trees and bushes have grown over the years to provide an ideal habitat for the two *Rhacophorus* species, which apparently occupy the same niche and are usually found together (Image 4). These frogs mate and deposit their eggs on leaves (Image 6) overhanging a water body and when the tadpoles hatch, they fall into the water below.

One or two specimens of *R. malabaricus* were occasionally spotted in the vicinity of these tanks approximately 10 years ago and in the past five years we have seen this population grow dramatically to its present status. The first *R. lateralis* specimen (male) was observed in 2007, and during the 2009 monsoon approximtely a dozen males and several females were seen and their mating behavior documented (Image 3). The courtship and mating behavior of *R malabaricus* has been reported by Kadadevaru & Kanamadi (2000). They have noted that in altered environmental conditions, these frogs have adapted from mating and nesting on leaves of trees overhanging a body of water to mating and constructing terrestrial foam nests on the slopes of ponds and other water bodies. They have suggested that this modification in reproductive mode from arboreal to terrestrial may

Image 2. The tanks at Rainforest Retreat that have helped the growth of *Rhacophorus malabaricus* and *R. lateralis* populations.

be an adaptation to changing environmental conditions. Our observations of prolific mating and nesting on the sides of our man-made tank (and even a bamboo pole in the tank) support these earlier observations and may account for the fact that this species is fairly common within its range while *R. lateralis* is very rare. In both species the female covers the foam with leaves – a process described as nest building. Interestingly, most *malabaricus* nests were left uncovered – presumably, due to the unavailability of leaf material but the females were sometimes observed attempting to cover the nest with weeds growing on the tank.

Mating and nesting of *R. lateralis* was strictly arboreal and (unlike *malabaricus*) they were not observed swimming in the tanks. After dark, the males descend to the lower branches overhanging the tank and emit a soft 'thk' sound to attract females. Coupling and mating behavior is very similar to *malabaricus* but they do not mate as prolifically (males take a long time to attach onto the female and mating invariably occurred late at light. After mating the female protects the nest by folding the leaf together or covering with a second leaf. The texture of the foam is quite sticky and gel-like, perhaps to aid in this process. This process of nest building has been described by Biju (2009). The nest size is much smaller than *malabaricus* with 1 to 2 dozen eggs per nest while the eggs are surprisingly the same size as the larger species. The eggs hatch into tadpoles in approximately two weeks on the leaf itself and wriggle themselves free (aided by rain) and drop into the water. The tadpoles take about 8-10

Images 3-6. 3 - Female *R. lateralis* attracting attention from two males; 4 - *R. lateralis* is usually seen with *R. malabaricus*; 5 - A froglet of *R. lateralis*; 6 - Spawn of *R. lateralis* in a curled leaf on a over hanging branch above the man made tanks at Rainforest Retreat.

weeks to develop and emerge under cover of darkness where they attach to a leaf and the tail dries up in 24-48 hr (Image 5). As the monsoon finishes these frogs climb up into the canopy and become inactive until the next pre-monsoon rains. In 2009 both species were observed mating as early as April and continued until September end.

References

Biju, S.D. (2000). 2 frogs and 100 years. Occasional Publication of the Indian Society for Conservation Biology (ISCB), Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India, 14pp.

Biju, S.D. (2009). A novel nesting behaviour of a treefrog, *Rhacophorus lateralis* in the Western Ghats, India. Current Science 97(3): 433-437.

Kadadevaru, G.G. & R.D. Kanamadi (2000). Courtship and nesting behaviour of the Malabar gliding frog, *Rhacophorus malabaricus* (Jerdon, 1870). Current Science 79(3): 377-380.

frog leg

May 2010 **#14**

Editor: Sanjay Molur
Edtorial Advisor: Sally Walker
ANSA and ASG-SA Co-chairs: Sanjay Molur & Karthikeyan Vasudevan

frog leg is the Newsletter of the Amphibian Network of South Asia (ANSA) and the Amphibian Specialist Group-South Asia (ASG-SA)

frog leg is published by WILD, ZOO and CBSG-SA as a service to the amphibian conservation community as well as conservation actioners and enthusiasts of South Asia.

For communication:
Amphibian Network of South Asia
c/o Zoo Outreach Organisation/WILD
PB 1683, 9-A Lal Bahadur Colony,
Gopal Nagar, Peelamedu, Coimbatore
Tamil Nadu 641004, India.
E-mail: herpinvert@gmail.com

frog leg is available online at www.zoosprint.org

Sexual dimorphism in Fungoid Frog *Hylarana malabarica* (Tschudi, 1838)

Vijay Mala Nair [1] & K. Santhosh Kumar [2]

[1] Reader, [2] Research scholar, Department of Applied Zoology, Mangalore University, Mangalagangotri 574 199.
Email:[1] vijaymalanair@yahoo.com

Sexual dimorphic characters among anurans have been recorded in a few ranids from southern India (Boulenger 1920; Inger et al. 1984; Krishnamurthy & Shakuntala 1999; Vasudevan 2003).

Sexual dimorphic characters viz a pair of vocal sacs on the ventral side in the throat area has been reported (Saidapur & Nandkarni 1975) to be distinct in the male frog, *Hoplobatrachus tigerinus*. In addition the first finger of the male frog has been recorded to be thick/swollen called copulatory pads (Talesara & Mala 1977) used to hold the female in amplexus.

The usage of a few morphological criteria however pose problems in differentiating the sex of an individual particularly if the pigmentation over the ventral surface obscures the vocal sacs as observed in the Fungoid Frog, *Hylarana malabarica.* The present study therefore is an attempt to compare morphological characters and morphometric data of the male and female Fungoid Frog.

Materials and Methods

The amplexed pairs of frog, *Hylarana malabarica* collected each from Konaje, (12°47'50"-12°52'03"N & 74°52'45"-74°57'53"E; 100m) Mangalore District, Karnataka and Udumbunthala village, Kasargod District (11°18'-12°48'N & 74°52-75°26E; 19m) Kerala during July 2005 were photographed and morphological characters were listed. Morphometric measurements were recorded using vernier caliper. Sex of the individual was confirmed by locating the gonads within the body cavity.

Result and Discussion

The morphological characters seen in male and female (Images 1 & 2) are as detailed in Table 1. The sex of the amplexed pair was confirmed subsequently by opening the abdominal cavity showing the presence of the testis and the ovary laden with eggs (Image 3).

The color of the dorsum is bright orange red in male and crimson red in female frog (Image 1).

The tympanum touches the dorso-lateral fold and the fold of the skin adjoining upper jaw in the male but it lies free in between the dorso-lateral fold and the fold of the skin adjoining the upper jaw in the female frog (Image 1). The earlier report (Vasudevan 2003) in case of *Hylarana temporalis* however, documents that the tympanum lies free between the folds of skin adjoining the upper jaw and the dorso-lateral fold in the male unlike as observed


a

Image 1. *Hylarana malabarica.* a - male; b - female; c - in amplexus

in the male Fungoid Frog in the present study.

A conspicuous yellow area / spot is seen behind the tympanum in the case of the breeding male frog (Image 1a and 1c). The ventral throat area exhibited varied pigmentation obscuring the vocal sacs (Image 2).

The morphometric characters indicate (Table 2) that the female is larger than the male exhibiting a difference of approximately 20mm in total length, 10mm in snout vent length and 10mm in hindlimb length between the male and the female individuals of the amplecting pair pointing towards sexual size dimorphism. However, the morphometric values expressed as ratio to snout vent length indicates no significance difference between the individuals of

Table 1. Morphological characters of male and female Fungoid Frog from Konaje and Kerala

Character	Male	Female
Color - Dorsum	Bright orange red	Crimson red
Black spot on dorsum	Jet black	Light black
Color - Ventral side	Uniformly pigmented- black with white patches (night time). Yellowish throat area with black area around vocal region (day time).	Uniformly pigmented -black with white patches (night time). Whitish throat area with no black area around vocal region (day time).
Yellow patch - Lateral side	Distinct yellow area behind the tympanum	No yellow area behind the tympanum
Color of rectal gland and its distance from the glandular fold of the upper lip.	Yellowish touching the glandular fold of the upper lip.	Whitish with a distinct gap from the glandular fold of the upper lip.
Distance between eye and tympanum	1mm	2mm
Tympanum area	Packed between the dorsolateral fold and the fold of the skin adjoining upperjaw	Lying free between the dorsolateral fold and the fold of the skin adjoining upperjaw
Digit tips	Swollen, smaller in size	Swollen, bigger in size
Subarticular tubercle size	Smaller	Bigger
Nuptial pad at the base of first finger	Pronounced	Not well marked

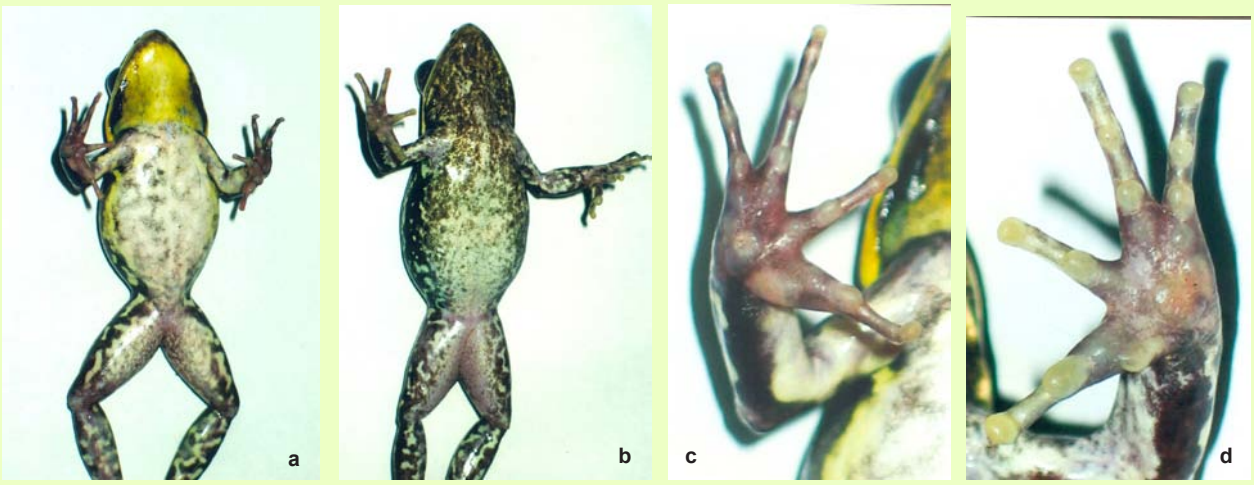


Image 2. Ventral side of *Hylarana malabarica* exhibiting throat area in male (a) and female (b), and copulatory pad in male (c) and female (d).

Table 2. Morphometric measurements (in mm) and values for t-test for individual characters of *Hylarana malabarica*

	Kerala		Karnataka		t - test
Sex (F or M)	**M**	**F**	**M**	**F**	
Weight(g)	21. 32	26.18	10.8	25	
Total length(SVL+HLL)	162	182	137	157	0.375305
Snout to Vent Length	65	75	54	63	0.363476
Head Length	17.5	19	15	18.5	0.188893
Head Width	22	24	19	22	0.29986
Snout Length	5	5.5	5.5	7	0.33333
Nostril to Eye	3.5	4	3.5	5.5	0.237507
Nostrils to the tip of Snout	1	1	1	1	0
Width of Upper Eyelid	5.5	6.5	5	6.5	0.03775
Inter-Orbital Width	4	5	4	5	0
Inter-Narial Width	5	5.5	4.5	5.5	0.095466
Eye Diameter	6	7	6	7	0
Tympanum Diameter	7.5	6.5	6.5	6	0.311753
Tym size as %of Eye	125	92.86	108.33	85.71	-
Forelimb Length	40	46	35	42	0.179447
1st Finger Length	9	10	8	8	0.698489
2nd Finger Length	7.5	8.5	6.25	7	0.464697
3rd Finger Length	10	11	8.5	9	0.609433
4th Finger Length	7	8	6	6.5	0.492907
Hindlimb Length	97	107	83	94	0.386322
1st toe length	7	9	6.5	9	0.012122
2nd toe length	12	14	10.5	13	0.129937
3rd toe length	18	21	16	19	0.16795
4th toe length	27	30	24	28	0.19171
5th toe length	18	21	16	19	0.16795
Femur	27	30	24	28	0.19171
Tibia	29	33	26	29	0.296474
Fore arm muscle	6	5.5	5.5	4	0.33333
Fore Arm Diameter	6	5	5	4.5	0.311753

SVL - Snout to Vent Length;
HLL - Hindlimb Length.
Pvalue- (0.05)

Table 3. Comparison of various measurements expressed as ratio to snout vent length and total length among individuals of the amplexed pairs of *Hylarana malabarica*

	I pair- Kerala		II pair - Karnataka	
Sex (F or M)	M	F	M	F
Total length : Snout vent length	01:00.4	01:00.4	01:00.4	01:00.4
Total length: Hindlimb Length	01:00.6	01:00.6	01:00.6	01:00.6
SVL: Head Length	01:00.3	01:00.3	01:00.3	01:00.3
SVL: Head Width	01:00.3	01:00.3	01:00.4	01:00.3
SVL: Snout Length	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Nostril to Eye	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Nostrils to the tip of Snout	01:00.0	01:00.0	01:00.0	01:00.0
SVL: Width of Upper Eyelid	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Inter-Orbital Width	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Inter-Narial Width	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Eye Diameter	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Tympanum Diameter	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Forelimb Length	01:00.6	01:00.6	01:00.6	01:00.7
SVL: 1st Finger Length	01:00.1	01:00.1	01:00.1	01:00.1
SVL: 2nd Finger Length	01:00.1	01:00.1	01:00.1	01:00.1
SVL: 3rd Finger Length	01:00.2	01:00.1	01:00.2	01:00.1
SVL: 4th Finger Length	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Hindlimb Length	01:01.5	01:01.4	01:01.5	01:01.5
SVL: Femur length	01:00.3	01:00.4	01:00.4	01:00.4
SVL: Tibia length	01:00.4	01:00.4	01:00.5	01:00.5
SVL: 1st toe length	01:00.1	01:00.1	01:00.1	01:00.1
SVL: 2nd toe length	01:00.2	01:00.2	01:00.2	01:00.2
SVL: 3rd toe length	01:00.3	01:00.3	01:00.3	01:00.3
SVL: 4th toe length	01:00.4	01:00.4	01:00.4	01:00.4
SVL: 5th toe length	01:00.3	01:00.3	01:00.3	01:00.3
SVL: FAMS	01:00.1	01:00.1	01:00.1	01:00.1
SVL: Fore Arm Diameter	01:00.1	01:00.1	01:00.1	01:00.1

SVL = Snout to Vent Length

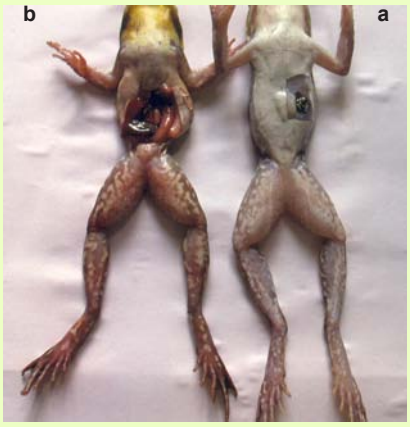


Image 3. The ventral side of the frog was opened confirming the presence of testis in male (a) and ovary laden with eggs in female (b).

the amplecting pairs, (Table 3) suggesting an isometric pattern of growth. The forearm musculature, however, is observed to be bulkier in the male compared to the female (Table 2 and 4). In addition the size of the tympanum expressed as a percentage of the eye diameter in the female is negative by a difference of approximately 32 percent (Table 2 and 4). The varied tympanum growth may be of help to distinguish the sexes.

Narahari et al. (2004, 2005) in the case of an Indian Bullfrog *Hoplobatrachus tigerinus* and the Skipper Frog *Euphlyctis cyanophlyctis* (Schneider) have suggested that males tend to be smaller than females in naturally occurring breeding populations and these differences appears to be due to the presence of males and females of different age groups rather than differences in early growth rates. Morphological and demographic data reported by Monnet & Cherry 2002 have also suggested that most of the variation in size dimorphism in the anurans can be explained in terms of differences in the age structure between sexes in the breeding population.

The larger female size of the amplecting pair may be of help in providing space for maturing eggs in relation to the gamete size. However, there is a need to study further as to why the females select smaller sized males for breeding. Does it point to the absence of the bigger

Table 4. Morphometric measurements expressed as ratios of male to female values

	Ratio between M and F	
Site of collection	Kerala	Konaje
Sex	♂ : ♀	♂ : ♀
Snout to Vent Length	01:01.1	01:01.2
Head Length	01:01.1	01:01.2
Head Width	01:01.1	01:01.2
Snout Length	01:01.1	01:01.3
Nostril to Eye	01:01.1	01:01.6
Nostrils to the tip of Snout	01:01.0	01:01.0
Width of Upper Eyelid	01:01.2	01:01.3
Inter-Orbital Width	01:01.3	01:01.3
Inter-Narial Width	01:01.1	01:01.2
Eye Diameter	01:01.2	01:01.2
Tympanum Diameter	1: 0.87 *	1: 0.92 *
Tympanum size % of eye	01:01.4	01:01.3
Forelimb Length	01:01.1	01:01.2
1st Finger Length	01:01.1	01:01.0
2nd Finger Length	01:01.1	01:01.1
3rd Finger Length	01:01.1	01:01.1
4th Finger Length	01:01.1	01:01.1
Hindlimb Length	01:01.1	01:01.1
1st toe length	01:01.3	01:01.4
2nd toe length	01:01.2	01:01.2
3rd toe length	01:01.2	01:01.2
4th toe length	01:01.1	01:01.2
5th toe length	01:01.2	01:01.2
Femur	01:01.1	01:01.2
Tibia	01:01.1	01:01.1
Fore Arm Diameter	1: 0.83 *	1: 0.90 *

* Female is smaller compared to male with respect to fore arm and tympanum diameter (in mm)

sized males in the breeding population?

References

Boulenger, G.A. (1920). A monograph on the South Asian Papuan Melanesian and Australian frogs of the genus Rana. *Records of the Indian Museum* 20: 1-226.

Inger, R.F., H.B. Shaffer, M. Koshy & R. Bakde (1984). A report on a collection of amphibians and reptiles from the Ponmudi, Kerala, South India. *Journal of the Bombay Natural History Society* 81(2): 406-427.

Krishnamurthy, S.V. & K. Shakuntala (1999). Sexual dimorphism in *Rana curtipes* (JERDON). *Zoos' Print Journal* 14(5): 21-22

Monnet, Jean-Matthieu & I.C. Michael (2002). Sexual size dimorphism in anurans. *Proceedings of the Royal Society of Lonon* B 269: 2301-2307.

Narahari, P.G., B.A. Shanbhag & S.K. Saidapur (2004). Growth, sexual maturation and body size dimorphism in the Indian bullfrog, *Hoplobatrachus tigerinus*. *Herpetologica.* 60 (4): 414-419.

Narahari, P.G., B.A. Shanbhag & S.K. Saidapur (2005). Post-metamorphic growth, sexual maturation and body size dimorphism in the skipper frog, *Euphlyctis cyanophlyctis* (schneider). *The Herpetological Journal* 15(2): 113-119.

Talesara, C.L. & V. Mala (1977). Sex-linked variation in the histochemical profile of the forelimb muscle of the common frog, *Rana tigrina* (Daud).Indian *Journal of experimental Biology* 5 (8): 619-623.

Vasudevan, K. (2003). A report on sexual dimorphism in *Rana temporalis (*Gunther, 1864). *Hamadryad* 27(2): 276-280.

Observations on developmental abnormalities in a wild specimen of *Duttaphrynus melanostictus* (Schneider, 1799) from Nagpur, Maharashtra, India

Rajshekhar V. Hippargi [1], Laxmikant J. Harkare [2] & Abhishek D. Garg [3]

[1] Department of Zoology, Institute of Science, Nagpur, Maharashtra 440001, India
[2] Patrakar Sahniwas, B 3/1, Civil Lines, Nagpur, Maharashtra, India
[3] G.H. Raisoni National College, Pt. Ravishankar Shukla University, Raipur, Chhattisgarh, India
Email: [3] abhishekdgarg@gmail.com (corresponding author)

Amphibians usually give the impression of being developmentally susceptible to environmental mutations, due to their distinctive zoological features like permeable skin, shell-less eggs and a multifaceted life-cycle, which touches both aquatic as well as terrestrial ecosystems during its operation. Yet, amphibian populations don't show as much mutational load in normal environment as one would expect based upon the above notion. They usually show deformities only in the presence of unique or exceptional environmental pollutants or developmental disruptors; thereby making them potential "bioindicators" of environmental health (Blaustein 1994).

Reports on amphibian deformities are available since the 18th century (Vallisneri 1733), yet global scientific attention to the possibility of widespread decline in amphibian populations wasn't received until early 1980s (Carey & Bryant 1995). Concerns about amphibians further heightened in 1995 after the Minnesota farm incidence involving the discovery of widespread malformations in frogs (Schmidt 1997). Since then, many developmental deformities have been reported in amphibians especially in frogs (Ouellet et al. 1997) and major abnormalities out of those have involved partially or fully missing limbs, multiple extra limbs and/or digits, incomplete limb formations, misshapen eyes or tails and skin lesions. More than 60 different species of amphibians with severe abnormalities have been reported from several countries around the world. Under the continued stress of human exploitation, many amphibian populations have disappeared or are in a state of decline globally. Although intense research, beginning in the early 1990s, has led to a better understanding of why amphibian populations are declining, yet there exists little knowledge regarding the causes and implications of amphibian deformities (Blaustein & Johnson-Pieter 2003; Blaustein & Johnson 2003).

Most of the above mentioned deformities have been reported in frogs (Blaustein & Johnson 2003; Kiesecker et al. 2003). In toads, especially within the genus *Bufo*, reports of wildly occurring toad deformities have been scarce. Correspondingly, developmental abnormalities in wild specimens of Indian Common Toad (*Duttaphrynus melanostictus* (Schneider, 1799)) have never been reported previously from India or other areas of Southeast Asia (Johnson et al. 2001). Reports on natural amphibian malformations from India have been very few. Most recent of these reports have cited impacts of pesticides, chemical fertilizers and large-scale intensive agriculture on anuran deformities in the Western Ghats (Daniels 2003; Gurushankara et al. 2007). Most reports on anuran deformities from India are restricted to laboratory-scale studies e.g. studies on the role of vitamin A in the induction of limb deformities

Image 1. The leg of deformed *D. melanostictus* specimen showing brachydactyly.

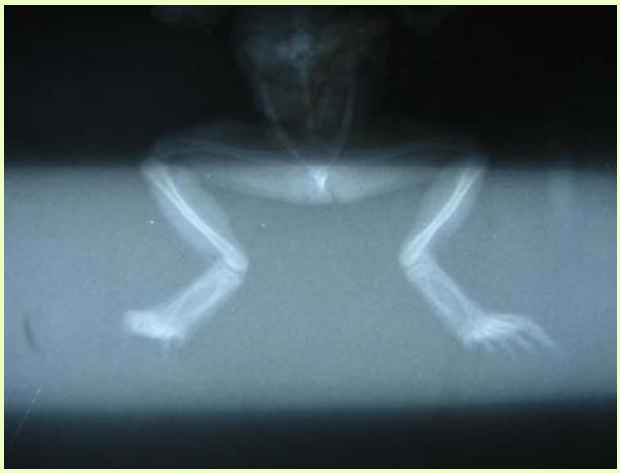


Image 2. Radiograph of deformed *D. melanostictus* leg showing deformity in phalanges.

in *D. melanostictus* (Das & Mohanty-Hejmadi 2000). However, the natural absence of all or part of limb/ digit and deformities of the eyes has not been reported for *D. melanostictus* from India or other parts of Southeast Asia.

We present here, probably the first report of its kind on the developmental malformations in a wild specimen of *D. melanostictus* from Nagpur, Maharashtra, central India. The Nagpur region is presently one of the most rapidly developing areas in central India. Previously it was purely an agriculture intensive area with ample forest cover and little industrialization or urbanization. But in recent times this region has experienced intense urbanization and industrialization. The ecosystem of Nagpur region is under high peril of complete annihilation owing to unsustainable human activities. In this regard, it is very vital to improve upon the knowledge on biodiversity of the Nagpur region in order to develop proper conservation strategies and bio-monitoring systems. A major action strategy implemented for environmental conservation involves the establishment of biological monitoring systems (Reaka-Kundla et al. 1997). Such programs usually identify environmental disturbances in a given ecosystem using selected groups of organisms called "bioindicators" (Garg & Hippargi 2007). Organisms like *D. melanostictus* may be regarded as potential bioindicators. Nagpur city covers an area of about 220km^2 within 9897km^2 of Nagpur District. Politically, Nagpur is a city in the central part of India, in the state of Maharashtra. Geographically, the state of Maharashtra is located between 16.40^0-22.10^{0}N & 72.60^0-80.90^{0}E. Nagpur District is located between 20.30^0-21.45^{0}N & 78.15^0-79.45^{0}E. Nagpur is located in the Deccan Plateau. Nagpur primarily has tropical deciduous forests and a dry tropical weather with 20%-70% humidity. It is located at an altitude of about 312.42m. Nagpur City experiences an average annual precipitation of 1,242mm.

Methods

As a part of our ongoing study on the diversity of snakes and amphibians of Nagpur, which started about 3-4 years ago (Harkare et al. unpub.); we have been conducting regular field surveys. Field study for amphibians utilized the methodology of visual encounter surveys during nights (Meteyer et al. 2000). Surveys were not conducted specifically for documenting deformities of amphibians; hence, this report is based on a single isolated adult specimen of *D. melanostictus*. The

Image 3. The left eye of deformed *D. melanostictus* showing micro-ophthalmia.

Image 4. Smaller left eye's orbit of deformed *D. melanostictus* visible from inside.

deformed *D. melanostictus* specimen was procured from Khamla area situated in Western Nagpur on 19-4-2007 during night hours. The specimen was examined alive immediately after capture and deformities were diagnosed with naked eyes. A radiograph was taken to ascertain the deformity internally. The descriptions of toad malformations are based on terminologies used by Meteyer et al. (2000). The specimen weighed 17gm with 70mm snout to vent (S-V) length, inter-orbital distance (IO) of - 5mm, inter-nasal distance (IN) of - 6mm, Height to length ratio of right eye (H: L R) - 10:11mm and Height to length ratio of left eye (H:L L) - 8:11mm (indicating micro-ophthalmia).

Results

Abnormalities observed were confined to the left hind limb and left eye. In the hind limb deformities, brachydactyly is very distinct. Brachydactyly refers to disproportionately short or reduced toes. Here, the normal numbers of metatarsal bones are present but the numbers of phalanges are reduced. Photograph (Image 1) and x-ray radiograph (Image 2) shows that the first toe on the left limb is normal, but the remaining four toes have been merged together with no visible development of phalanges. The second deformity corresponds to a small left eye i.e. micro-ophthalmia (Image 3). Smaller left eye's orbit is distinctly visible from inside (Image 4). This left eye also shows two other eye-related deformities. Firstly, the iris of this left eye is noticeably absent. Secondly, this left eye shows pupil irregularities as well as presence of multiple white and green streaks within the pupil-iris region (Image 5).

Discussion

Although statistically insignificant, this finding definitely raises a question. Is this an isolated case? Or representative of a widespread problem in natural population of anurans in India, which we are not aware of? Deformity oriented monitoring programs should be designed at local levels to find the range, frequency, character and causes of anuran malformations. Right now we are not in a position to explain the causative agent behind these above stated deformities. Usually, no one genetic or environmental factor can be accused of being responsible for such deformities found in natural amphibian populations (Meteyer et al. 2000). Apart from genetic reasons, many environmental factors have been proved to cause deformities in the wild including, (1) Ultraviolet (UV)-B radiations, which are capable of retarding growth as well as causing malformations of limbs, body

Image 5. Iris-pupil abnormality and abnormal iris color in the deformed *D. melanostictus*.

and eyes (Fite et al. 1998; Ankley et al. 2000, 2002); (2) Chemical contaminants and pollutants, like pesticides, herbicides, steroid-mimicking contaminants, gasoline, oil, ice-melting agents, metals, and radioactive wastes, among others can kill or cause deformities in amphibians (Hall & Henry 1992; Chambon 1993; Kirk 1988; Marco et al. 1999; Hayes et al. 2002) and (3) Parasitic infections and diseases e.g. trematode infections, which could synergistically cause anuran deformities along with other factors like chemical contaminants and global warming (Johnson et al. 1999; Johnson et al. 2001; Kiesecker 2002). With regard to the above listed factors we are of the opinion that the limb and eye deformities reported here for *D. melanostictus* may have been caused by pesticides. The reason for this opinion is that Nagpur is an agriculture-intensive area where cotton and oranges are grown widely. Presently in the Nagpur region, many pesticides such as Endosulfan, Dimethoate, Monocrotophos, Acephate, Cypermdthrin etc. are used for controlling pest populations especially those causing problems to cotton and orange (Garg 1978; Agarwal et al. 1984). Surface run-offs from agricultural fields sprayed with the above pesticides may cause amphibian deformities. In fact, the pesticide Endosulfan has already been experimentally proved to cause deformities in larval stages of *D. melanostictus* (Mercy & Andrews 2000).

In view of the above report, we need to generate good scientific data about the major stressors at local level and also the background rates of deformities to assess the seriousness of the problem. A strong link between the causative agents and deformities once established may answer some newer problems of the local amphibian populations of which we are completely unaware. The study of amphibian deformities is still not the major focus of environmental research in India. Elevated occurrence of malformations in amphibian populations may jeopardize the chances of their population's survival (Johnson et al. 2001). Malformations of limbs impair mobility, decrease food intake, increase susceptibility to predators and parasites, and may eventually impact entire populations. Frogs and toads serve important functions to human societies. In tropical areas, their dietary intake of mosquitoes can help in the control of malaria. In some developing countries, frogs and toads are an important source of animal protein consumed by local people. Scientifically, embryologic processes and genomic structures are highly conserved in vertebrates; thus, research on frogs and toads has had and continues to have far-reaching implications. On the other hand, the dermal glands in the skin of amphibians secrete diverse range of compounds with varied medical and pharmacological properties. Our own preliminary studies on the antibacterial potency of cutaneous secretions isolated from Indian toad, *D. melanostictus,* confirmed that some unexplored bactericidal components were present in skin secretions of *D. melanostictus* (Garg et al. 2007). With declining amphibian populations our chances of finding new and novel compounds from amphibian skin will also dwindle.

References

Agarwal, R.A., G.P. Gupta & D.O. Garg (1984). *Cotton Pest Management in India*. Researchco Publications, Delhi, India.

Ankley, G.T., S.A. Diamond & J.E. Tietge (2002). Assessment of the risk of solar ultraviolet radiation

to amphibians. I. Dose-dependent induction of hind limb malformations in the northern leopard frog (Rana pipiens). *Environmental Science & Technology* 36:2853-2858.

Ankley, G.T., J.E. Tietge & G.W. Holcombe (2000). Effects of laboratory ultraviolet radiation and natural sunlight on survival and development of Rana pipiens. *Canadian Journal of Zoology* 78: 1092-1100.

Blaustein, A.R. (1994). Chicken little or Nero's fiddle? A perspective on declining amphibian populations. *Herpetologica* 50: 85-97.

Blaustein, A.R. & T.J. Johnson-Pieter (2003). The complexity of deformed amphibians. *Frontiers in Ecology and the Environment* 1 (2): 87-94.

Blaustein, A.R. & P.T.J. Johnson (2003). Explaining frog deformities. *Scientific Amercian* 288: 60-65.

Carey, C. & C.J. Bryant (1995). Possible interrelations among environmental toxicants, amphibian development, and decline of amphibian populations. *Environmental Health Perspectives* 103(suppl. 4): 13-17.

Chambon, P. (1993). The molecular and genetic dissection of the retinoid-signaling pathway. *Gene* 135: 223-228.

Daniels, R.J. (2003). Impact of tea cultivation on anurans in the Western Ghats. *Current Science* 85:1415-1422.

Das, P. & P. Mohanty-Hejmadi (2000). Vitamin a mediated limb deformities in the common Indian toad *Bufo melanostictus* (Schneider). *Indian Journal of Experimental Biology* 38(3):258-264.

Fite, K.V., A.R. Blaustein, L. Bengston & H.E. Hewitt (1998). Evidence of retinal damage in Rana cascadae: a declining amphibian species. *Copeia* 4:906-914.

Garg, A.D. & R.V. Hippargi (2007). Significance of frogs & toads in Environmental Conservation. In: Souvenir of National Seminar on Eco-Environmental Impact and Organism Response, at Dept. of Chemistry, Kamla Nehru Mahavidalaya, RTM Nagpur University, Nagpur, India.

Garg, A.D., D.V. Kanitkar, R.V. Hippargi & A.N. Gandhare (2007). Antimicrobial activity of skin secretions isolated from Indian Toad, Bufo melanostictus Schneider 1799. *Nature Precedings* DOI: 10.1038/npre.2007.1204.1.

Garg, A.D., D.V. Kanitkar, R.V. Hippargi & A.N. Gandhare (2007). Preliminary studies on antibacterial potency of cutaneous secretions isolated from Indian toad *Bufo melanostictus*. In *BioInfoBank Library*: http://lib.bioinfo.pl/blid:377.

Garg, D.O. (1978). *Insect Pests of Citrus Fruits*. Agri-Horticultural Publishing House, Nagpur, India.

Gurushankara, H.P., S.V. Krishnamurthy & V. Vasudev (2007). Morphological abnormalities in natural populations of common frogs inhabiting agroecosystems of central Western Ghats. *Applied Herpetology* 4(1): 39-45.

Hall, R.J. & P.F. Henry (1992). Assessing effects of pesticides on amphibians and reptiles. *Herpetology Journal* 2: 65-71.

Harkare, L., R.V. Hippargi, A.D. Garg, B. Bawiskar & P.A. Gawande (un pub.). Checklist of Snakes and Amphibians of Nagpur City, Maharashtra State, Central India. Nagpur, India: Institute of Science, Civil Lines, Nagpur, India (Unpublished work).

Hayes, T.B., A. Collin, M. Lee, M. Mendoza, N. Noriega, A.A. Stuart & A. Vonk (2002). Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses. *Proceedings of National Academy of Sciences of USA* 99:5476-5480.

Johnson, P.T.J., K.B. Lunde, E.G. Ritchie & A.E. Launer (1999). The effect of trematode infection on limb development and survivorship. *Science* 284:802-804.

Johnson, P.T.J., K.B. Lunde, E.G. Ritchie, J.K Reaser & A.E. Launer (2001). Morphological abnormality patterns in a California amphibian community. *Herpetologica* 57:336-352.

Johnson, P.T.J., K.B. Lunde, R.W. Haight, J. Bowerman & A.R. Blaustein (2001). Ribeiroia ondatrae (Trematoda: Digenea) infection induces severe limb malformations in western toads (*Bufo boreas*). *Canadian Journal of Zoology* 79:370-379.

Kiesecker, J.M. (2002). Synergism between trematode infection and pesticide exposure: A link to amphibian deformities in nature? *Proceedings of National Academy of Sciences of USA* 99: 9900-9904.

Kiesecker, J.M., L.K. Belden, K. Shea & M.J. Rubbo (2003). Amphibian decline and emerging disease. *Amercian Scientist* 92: 138-147.

Kirk, J.J. (1988). Western spotted frog (*Rana pretiosa*) mortality following forest spraying of DDT. *Herpetology Review* 19: 51-53.

Marco, M., C. Quilchano & A.R. Blaustein (1999). Sensitivity to nitrate and nitrite in pond-breeding amphibians from the Pacific Northwest, USA. *Environmental Toxicology & Chemistry* 18: 2836-2839.

Mercy, M. & M.I. Andrews (2000). Effect of Endosulfan on the hatching rate and larval survival of common Indian Toad (*Bufo melanostictus* Schneider). In: *Proceedings of the 12th Kerala Science Congress*, at Kerala, India.

Meteyer, C.U., I.K. Loeffler, J.F. Fallon & K.A. Converse (2000). Hind limb malformations in free-living northern leopard frogs (*Rana pipiens*) from Maine, Minnesota, and Vermont suggest multiple etiologies. *Teratology* 62: 151-171.

Ouellet, M., J. Bonin & J. Rodrigue (1997). Hindlimb deformities (Ectromelia, Ectrodactyly) in free living anurans from agricultural habitats. *Journal of Wildlife Diseases* 33: 95-104.

Reaka-Kundla, H.L., D.E. Wilson & E.O. Wilson (eds.) (1997). *Biodiversity II: Understanding and Protecting Our Biological Resources*. Joseph Henry Press Washington, D.C.

Schmidt, C.W. (1997). Amphibian deformities continue to puzzle researchers. *Environmental Science & Technology* 31: 324-326.

Vallisneri, A. (1733). Opere fisico-mediche. *Venezia* 2: 551.

Checklist and habitat of anuran species in the Sangli District, Maharashtra

S.M. Kumbar & S.S. Patil

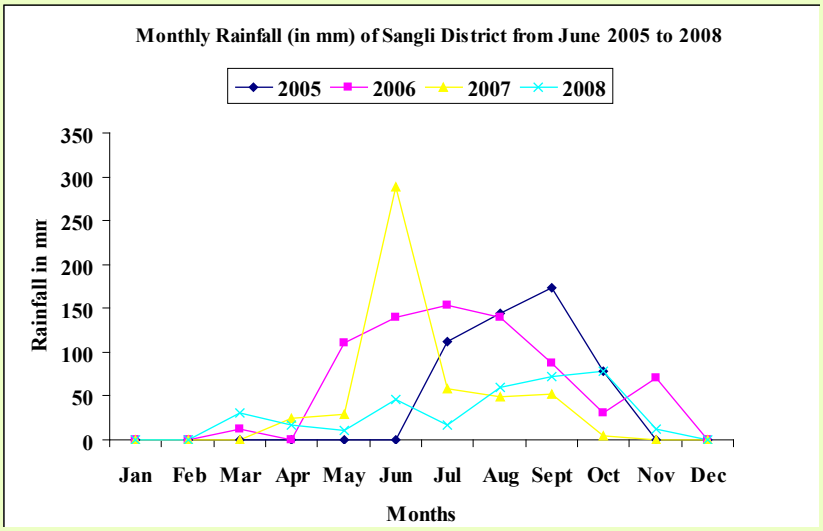
Department of Zoology, Arts, Commerce and Science College Palus, Sangli District, Maharashtra 416310, India
Email: smkumbar@rediffmail.com

Amphibians play an important role in the ecosystem as secondary consumers in food chains, bio-monitors in controlling insect pests and also as excellent ecological indicators owing to their high degree of sensitivity to even a slight change in the environment (Lips 1998; Daniels 2003). The global decline in the amphibian populations in recent years is alarming and is a matter of great concern for biologists (Daniels 2003). Hence, quantitative assessment of amphibian species is most important. The Global amphibian assessment group has reported that at least 6433 species of amphibians are present in the world, of which anurans contribute the most species richness (5679), followed by Urodela (580) and Gymnophiona (174). However, a lot of information has been accumulated in the field of biodiversity and conservation of amphibians from different regions of India such as, Western Ghats (Daniels 1992; 2001; Biju 2001; Dahanukar & Padhye 2005), Eastern Ghats (Daniels 1994), Andaman & Nicobar Islands (Daniels 1997) and Peninsular region of India (Daniels 2003). Recently with the increased consciousness for biodiversity census and monitoring, many new species have been discovered and rediscovered (Bossuyt et al. 2004; Kohler et al. 2005; Voris 2006). This aspect prompted with scientific methodology will form baseline information for future in-depth studies. As a result of scientific efforts India has recorded 238 amphibian species which include 1 salamander, 21 caecilians and 216 species of frogs and toads (Daniels 2005). This amounts to near about 4% of the world's amphibian species (Dahanakar & Padhye 2005).

The Sangli District is situated (16º45'N & 73º42'E) in the southern part of India. The total study area is about 30km^2 from the Palus Tehsil, which includes Sagareshwar Wildlife Sanctuary (total area is 10.87Km^2) and the Krishna River basin. The study area lies about 500m with high mountain peaks at 900m. The natural vegetation is southern dry mixed deciduous and southern thorn forest. The familiar flowering plants are Tamarind, Mango, Neem, Kashid, Subabool, Gulmolhar, Anjan, Nilgiri, Mango, Ficus Spp. Acacia, Pangara, Chilar, Sisoo, Agave, Khair, Karnaj, Shiras, Char,

Table 1. Number of anuran species in various families and their habitat in Sangli District.

Family	Genus & Species	Habitat
Bufonidae	*Duttaphrynus melanostictus*	Around human habitat and moist places
	Duttaphrynus beddomii	Under leaf litter, below rocks and stones
Dicroglossidae	*Euphlyctis cyanophlyctis*	In rivers, ponds, pools, and stagnant water.
	Hoplobatrachus tigerinus	Banks of rivers, wells and paddy fields
	Fejervarya limnocharis	In the paddy field, near tanks, pools, ponds, under stones, leaf litters and in small burrows
	Fejervarya keralensis	Surrounding areas of Krishna River
Microhylidae	*Microhyla ornata*	Near tanks, pools, pond, under stones, leaf litters and in small burrows
	Microhyla rubra	In crevices and burrows near ponds, pools, tanks and human habitat.
Rhacophoridae	*Polypedates maculatus*	Walls of buildings, on bushes and trees.



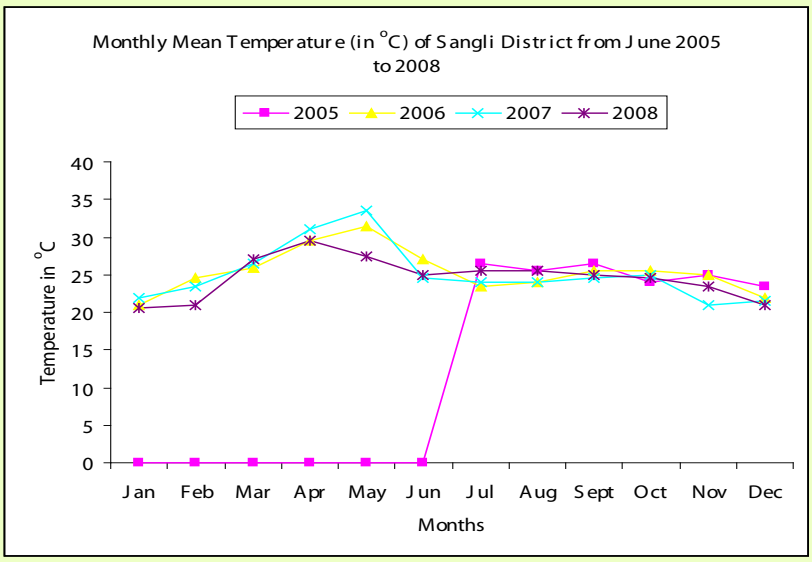


Figure 1. Monthly variation in rainfall and mean temperature in Sangli District from June 2005 to December 2008

Bahava, Dhavada, etc. The mountain slopes are covered with various grasses. The most commercial cultivating crops are Sugar Cane, Paddy, Turmeric, Ginger, Grapes, Banana, Betel, etc. Major fauna found in this area are Sambar (Deer), Blackbucks, Wild Boar, Barking Deer, peafowl, monkeys, mongoose, etc. Small carnivores like hyena, fox and porcupines are also observed and a large number of insects, birds (about 80 species, my personal data) and reptiles like Cobra, Pythons, Dhaman, Vipers, Crocodiles, Tortoise, Varanus, Chameleon etc. (Sathe 2005). Amphibian fauna of Maharashtra state in general and with special reference to Pune City and the Western Ghats of Maharashtra has been studied. For instance, 31 species of amphibians in Pune City (Padhye et al. 2002), 43 species in the Maharashtra state (Padhye & Ghate 2002) and 23 species at Tamhini, northern Western Ghats (Dahanukar & Padhye 2005) are reported. However, there are no specific reports on anuran fauna and their habitat in Sangli District. Therefore, the present study was conducted to document the anuran species checklist and their habitat found in the Sangli District.

Observations on anuran species in the Sangli District were conducted from June 2005 to August 2008. The specimens were identified by different techniques viz. visual encounter surveys, acoustic searching, turning rocks and logs, digging through leaf litter, and excavating burrows. Surveys were conducted during the day and late night, and specimens were collected by hand or by using small nets. The specimens were photographed and identification of species was done using available literature (Padhye & Ghate 2002; Daniels 2005).

As a consequence of the extensive survey of the study area, we documented the presence of nine species of anurans belonging to four families and seven genera (Table 1). The documented species included *Duttaphrynus melanostictus*, *D. beddomii*, *Euphlyctis cyanophlyctis*, *Hoplobatrachus tigerinus*, *Fejervarya limnocharis*, *F.*

keralensis, Microhyla ornata, M. rubra and *Polypedates maculatus.* The most abundant family was Dicroglossidae with four species, followed by Bufonidae with two, Microhylidae with two species each and Rhacophoridae with only one specie (Table 1). When the microhabitat of the anurans is considered, the anurans of the Sangli District is dominated by burrowing habitat (44.4%) which were found in sugar cane field, paddy field, and thick vegetation with rocks and stones and sometimes *M. ornata* and *M. rubra* were found in small burrows near the water bodies; 22% of aquatic, which were found always in water bodies such as rivers, ponds, pools and even in stagnant water, whereas semi-aquatic (11.1%) were observed on the banks of water bodies such as wells and rivers; *D. melanostictus* (11.1%) which has a terrestrial habitat, was more commonly seen in and around domestic places, whereas *P. maculatus* (11.1%) which leads an arboreal life, was observed on the walls of buildings, trunks of bushes and trees.

The abundance of burrowing species in the Sangli District could be explained on the basis that these species are found in deep burrows, on the outskirts of the city and are relatively less exposed to anthropogenic threat and predation. However, the decline in amphibian population is more prominent than any other vertebrates due to various reasons (Stuart et al. 2004). The possible reasons for the decline in amphibian population could be habitat loss, diseases, parasites, global warming, acid precipitation, over-harvesting, environmental pollutants and increases in ultraviolet B-radiation and predation (Sower et al. 2000; Daniels 2003). The amphibians particularly, are more sensitive to chemical pollutants due to their bimodal habitat (land and water) and the absorbing nature of their skin (Roy 2002). In the present study area highly commercially important crops like Sugar Cane, Paddy, Turmeric, Ginger, Grapes, Banana, Betel, etc are being cultivated (Patil et al. 2003). The fertilizers, herbicides, and various pesticides like organophosphate, carbamate, organo-chlorines, nitro and chlorophenols, and pyridyl derivatives etc. are extensively used to get high yield and also to control pests. (Patil et al. 2003). In the present study, the decline in aquatic species might be due to contamination of water bodies with chemical hazards. In addition, predation may also be another contributing factor for the decline of aquatic anurans as most of water bodies were rich in serpent fauna at the time of field observation.

The impact of changes in environmental factors may affect the survival of amphibians. For example, increasing global warming (Daniels 2003), changes in rainfall pattern and acid precipitation (Sower et al. 2000; Stuart et al. 2004) cause decline in amphibian population. The data on annual rainfall and mean temperatures recorded during June 2005 to August 2008 in the present study area reveals a decrease in the annual rainfall and increase in the mean temperature (Fig. 1). It appears that changes in the rainfall and temperature might be a reason for the decline in the diversity of semi-aquatic, terrestrial and arboreal anurans as indicated by the presence of only single species in each habitat in the present study. However, the possibility of anthropogenic stress, habitat destruction and predation might also be other contributing factors.

Overall, the results of the present investigation suggest that there is much variation in the habitation of anuran species owing to external factors (anthropogenic stress, predation, and chemical contamination) although located at the same altitude and experiencing similar environmental factors.

References

Biju, S.D. (2001). A synopsis to the frog fauna of the Western Ghats. *Indian Occas. Publication of Indian Society of Conservation Biology* 1: 1-24.

Bossuyt, F., M. Meegas-kumbura, N. Beenaerts, D.J. Gower, R. Pethiyagoda, K. Roelants, A. Mannaert, M. Wilkinson, M.M. Bahir, K. Manamendra-Arachchi, P.K.L. Ng, C.J. Schneider, O.V. Oommen & M.C. Milinkovitch (2004). Local endemism within the Western Ghats-Sri-Lanka biodiversity hotspot. *Science* 306: 479-481.

Dahanukar, N. & A. Padhye (2005). Amphibian diversity and distribution in Tamhini, Northern Western Ghats, India. *Current Science* 88: 1496-150.

Daniels, R.J.R. (1992). Geographical distribution patterns of amphibians in the Western Ghats, India. *Journal of Biogeography* 19: 521-529.

Daniels, R.J.R. & N.M. Ishwar (1994). Rarily? and the herpetofauna of the Eastern Ghats, India. *Cobra* 16: 2-14.

Daniels, R.J.R. (1997). Patterns of distribution of vertebrate diversity on the Great Nicobar Biosphere Reserve. Technical Report submitted to the *Ministry of Environment and Forest Government of India.*

Daniels, R.J.R. (2001). Amphibians and Reptiles of Tamil Nadu Eastern and Western Ghats. *Cobra* 43: 1-8.

Daniels, R. J. R. (2003). Impact of tea cultivation on anurans in the Western Ghats. *Current Science* 85:1415-1422.

Daniels, R.J.R. (2005). *India – A lifescape Amphibians of Peninsular India.* University Press, 268.

Kohler, J., D.R. Vieites, R.M. Bonett, F.H. Garcia, F. Glaw, D. Steinke & M. Vences (2005). New amphibians and global conservation: a boost in species discoveries in a highly endangered vertebrate group. *Bioscience* 55: 693-696.

Lips, K. R., (1998). Decline of a tropical montane amphibian fauna. *Conservation Biology* 12: 106–117.

Padhye, A.D. & H.V. Ghate (2002). An overview of amphibian fauna of Maharashtra state. *Zoos Print Journal* 17: 735-740.

Padhye, A.d., M. Mahabeleshwarkar & H.V. Ghate (2002). An overview of amphibian fauna of Pune district with special reference to their status in and around Pune city. *Zoos Print Journal* 17: 757-763.

Patil J. A., A. J. Patil & S. P. Govindwar (2003). Biochemical effects of various pesticides on sprayers of grape gardens. *Indian Journal of Clinical Biochemistry* 18: 16-22.

Roy, D. (2002). Amphibians as environmental sentinels. *Journal of Bioscience* 27:187-188.

Sathe, (2005). Ecology and Biodiversity of Sagareshwar Sanctuary. *UGC Minor Research Project Report.*

Stuart, S.N., J.S. Chanson, N.A. Cox, B.E. Young, Ana S.L. Rodrigues, D.L. Fisherman & R.B. Waller (2004). Status and trends of Amphibian declines and extinctions Worldwide. *Science Express* 306: 1783-1786.

Sower, S.A., K.L. Reed & K.J. Babbitt (2000). Limb malformations and abnormal sex hormones concentrations in frogs. *Environmental Health Perspectives* 108: 1085-1090.

Voris, H.K. (2006). Assessment of biodiversity among Southeast Asian Amphibians and Reptiles. *The Natural History Journal of Chulalongkorn University* 6: 1-10.

Acknowledgement

The Authors thanks to our beloved Principal Dr. B.N. Pawar for his precious inspiration and Prof. V.M. Shendage, Head of Department of Botany, for his help in identifying the plant species of the study area. The Authors are also grateful to the Department of Geography, Secondary High School and Junior College Bhilawadi, Dist: Sangli for providing the meteorological data.

Commensalism relationship between some species of microhylid frog and arachnid members

Raju Vyas

505, Krishnadeep Tower, Mission Road, Fatehgunj, Vadodara, Gujarat, India.
Email: razoovyas@hotmail.com

Recently, Siliwal & Ravichandran (2008) presented an interesting example of a relationship between a microhylid frog and myglomorph spider as a commensalism: a relationship between two predatory species, where one species is benefited and the other is neither harmed nor benefited with this association. They also provided a few examples of commensalisms between microhylid frog and myglomarph spider from other literatures.

Here, I take the liberty to add one more example of the commensalism relationship between a microhylid frog and an arachnid. During the biodiversity study of Purna Wildlife Sanctuary, Dangs, Gujarat, I have also observed a commensalism relationship between Jerdon's Ramanella (*Ramanella montana)* and a black scorpion (*Heterometrus* sp.).

On 28 October 2001, while surveying in Bheshkatri and Kalibel for documenting herpetofaunal diversity, I was trekking up the Rupgadh Hill, where, on the top, are a few remains of the Rupgadh Fort. On the forest floor is rockier and covered with moss and grasses. In search of reptiles, I turned a big boulder to look for any hidden creatures and under one rock something moved deep inside a burrow. After digging out a small lump of soil, I saw an adult Jerdon's Ramanella sitting inside the burrow. I carefully dug the burrow a little deeper for collecting the frog. Inside this burrow, I saw a very large black scorpion (about 12-15cm long) behind the frog. Both were sitting very close together, deep inside the burrow. I dug deeper to collect these animals and to satisfy my curiosity about what resided inside? and how many different animals used the burrow? At the end of the burrow, I found one more individual of Jerdon's Ramanella Frog. This was a very unusual and remarkable example of the co-existence of two predators. It is very interesting when both species are insectivorous and hidden in the same burrow.

A previous report of such co-existence was by Rao & Ramana (1925) between a black scorpion (*Heterometrus* sp.) and *Ramanella variegata*. Both these observations show that co-existence between microhylid frog and scorpion are remarkable.

One theory explains this relationship as the frog secretes a chemical which makes it distasteful to the spider, the spider avoids preying on it. Such a secretion could be due to a diet that mainly consists of ants, but this requires more extensive research (Miller 2003). Whereas, the other theory of Csakany (2002) advocates that the frog in this relationship is benefited by getting food from the decaying prey of the spider, thus, the frog protects the burrow and egg sac of the spider against ant attacks.

A few recorded examples of such commensalism rela-tionship between five species of microhylid frogs and four species of theraphosid spiders (Table 1), may help in discovering the relationship between microhylid frogs and scorpions too, but at this point it is difficult to say anything about this commensalisms relationship, especially bet-ween microhylid frogs and scorpions.

Also, there are a few records of predation of amphibian by various species

Table 1. List of observation on commensalisms relationship between various species of microhylids and arachinds.

No	Relations between two species	Country	Source
1	*Ramanella variegata* and *Heterometrus sp.*	India	Rao & Ramana 1925
2	*Ramanella montana* and *Heterometrus sp.*	India	Present study
3	*Microhyla sp.* and *Haploclastus kayi*	India	Siliwal & Ravichandran 2008
4	*Kaloula taprobranica* and *Poecilotheria hunumavilasumica*	India	Siliwal & Ravichandran 2008
5	*Gastrophryne olivacea* and *Dugesiella bentzi*	USA	Hunt 1980
6	*Chiasmocelis ventrimaculata* and *Xenesthis immanis*	Peru	Crocraft & Hambler 1989
7	*Chiasmocelis ventrimaculata* and *Xenesthis immanis*	Peru	Csakany 2002
8	*Hamptophryes boliviana* and *Xenesthis immanis*	Bolivia, Peru	Miller 2003

of spiders from the neo-tropical region, including theraphosid spiders. Theraphosid spiders are also reported to predate upon various frog species from two families: Boufonidae and Hylidae frogs (Menin et al. 2005) but none regarding microhylid frogs.

However, both scorpions and spiders, belong to the same class, Arachnida. To some extent, biology and ecology of both the groups are similar. Therefore, there is a requirement for a further detailed study on the subject to find the proper relationship between various species of microhylids and arachnids and to what degree it benefits each other, in the context of Indian fauna.

References

Crocraft, R.B. & K. Hambler (1989). Observation of a commensal relationship of the microhyid frog *Chiasmocelis ventrimaculata* and the burrowing theraphosid spider *Xenesthis immanis* in southeastern Peru. *Biotropica* 21(1): 2-8.

Csakany, J. (2002). Study on the chemical communication between the Microhylid frog, *Chiasmocelis ventrimaculata*, and a Theraphosid spider involved in commensal relationship. Masters dissertation report submitted to State University of New York, 13pp.

Foelix, R.F. (1982). *Biology of Spider*. Harvard University Press, Cambridge, Massachusetts. 250pp.

Hunt, R.H. (1980). Frog sanctuary in a tarantula burrow. *Natural History* 89(3): 48-53.

Menin, M., D.J. Rodrigues & D. Azevedo (2005). Predation on Amphibian s by spiders (Arachnida: Araneae) in the Neotropical region. *Phyllomeduso* 4(1): 39-47.

Miller, G. (2003). Observation of commensalisms between burrowing theraphosid spiders and the microhylid frog species, *Hamptophryes boliviana*. *CNR Student Research Symposium*, April 11, 2003. College of Natural Resources, University of Wisconsin, Stevens Point: 24 (Abstract).

Rao, C.R.N. & B.S. Ramana (1925). On a new genus of the family Engystomatidae (Batrachia). *Proceedings of the Zoological Society of London* 39: 587-597.

Siliwal, M. & B. Ravichandran (2008). Commensalism in microhylid frog and mygalomorph spider. *Zoos' Print* 23(8): 13.

An innovative computer-based (digitization). Animal alternatives (cd-rom) in teaching/learning practices and their role in the conservation of frogs used in zoology/ life sciences/ animal sciences for practicals in laboratories

M.C. Sathyanarayana

Department of Zoology and Wildlife Biology, A.V.C. College
Mayiladuthurai, Tamil Nadu 609305, India
Email: mcsathya@yahoo.com

We, the Teachers/ Educators/Scientists/ Herpetologists/Biodiversity Conservationist/ Environmentalists must be aware of the availability of the new and innovative modern Digital technology and animal alternatives (CDROMS) to replace the killing of frogs, calotes and other animals for dissection in the Zoology and other laboratories

As an Educator, I am very glad to inform that there is a dramatic evolution in thinking, attitudes and practice regarding the use of animals in Zoology/Animal science education. The concept of animal dissections in the Zoology Curriculum was incorporated from the western countries. These countries have banned animal dissection in the recent past. The animal dissections are the major component of the Practical curriculum for B.Sc and M.Sc Zoology courses. These courses were offered by only a limited number of colleges and university departments. Prof. Akbarsha, Head, Department of Animal Sciences, Bharathidasan University, Tamilnadu says that with the expansion of higher education more colleges have come up, and therefore more students, warranting sacrifice of more animals. This resulted in the gross depletion of green frog and garden lizard populations, animals that are indiscriminately killed for the purpose of dissections in laboratories. A ban on frogs and calotes appears desirable since the suppliers to schools and colleges invariably collect them in the field which may have a serious impact on the ecological balance. Fresh water Frogs [*Rana* spp.] is included under Schedule IV Wildlife (Protection) Act, 1972. Vide Notification No.FL-28/78 FRY (WL) dated 9th September, 1980, published in the Gazette of India, Ext., pt II,S.3(i),p.431 dated 2nd October,1980. It is estimated that over six million animals are killed for the dissection industry each year, Akbarsha (2007) in his article on Movement to curtail animal dissections in zoology curriculum: review of the Indian experience (ALTEX24, Alternatives to animal experimentation –3/2007 pp 163-164). As a Zoologist every one of us must ask the pertinent question whether frog dissection is a process of learning or skill development? Most Zoologists accept that from the skill development point of view also, dissection is no more relevant. If such is the case why still dissections? asks Dr. Akbarsha. The teachers also realize the practical difficulties of getting animals such as frogs and calotes for dissection. Further the students also suffer due to non-availability and difficulty in handling the animals, especially girl students.

Dr. Akbarsha asks the teaching community, "As Zoology teachers and Biodiversity Conservationists why do we not change our attitude? When we realize that from the biodiversity as well as the ethical and moral perspectives, killing of animals should be avoided, we should be inclined towards dispensing with the practice, and change for the good. What prevents us from changing,

now that technology has changed. Now that Computer aided services have started developing, students can be trained in animal anatomy using computers, and even on line. The teachers have the right and academic freedom to change the Zoology Practical Curriculum to replace dissections, that involve the killing of animals"

The curriculum can be seen as a metaphor for scientific investigations that progresses with the impact of new information and from assessment. Accompanying this change is the excitement of creative course design and of being an effective educator. The innovative nature of new technological developments, such as multimedia software, can be exciting for students and teachers alike, which adds to the learning experience and is an important part of the informal training for professions where computer skills will play a crucial role.

It is necessary that we have to develop technology whereby good substitutes for flesh and blood bodies. This is one area in which our computer software specialists could take the lead by taking up a problem that almost certainly will demand novel approaches and test their skills. The curricular transformation is not only a challenge to an educator but it is of great opportunity for reaping benefits of every kind -Scientific, Economic and Humanitarians. The curriculum planners and decision makers need to drive change, taking on new, collaborative roles and using innovative thinking to integrate the emerging "science of learning" into the educational systems. The students should have the opportunity to attend dynamic, high-quality curriculum designed to meet the challenges of the Digital Age.

You must do today's job with today's tools if you do today's job with yesterday's tools tomorrow you will be out of business

It is high time for the Zoology/Animal science teachers to take a decision regarding minimizing, or total replacement of, the use of animals for B.Sc and M.Sc practicals to acquire skill. It is also necessary to change the Practical syllabi so as to enable us to minimize or totally replace the use of animals for the purpose of practicals. When we talk about Biodiversity conservation, it is our duty to safeguard the existing populations of the animals.

The concept of Educational Technology has taken many "Avatars"

from Programmed Learning to Virtual Learning, grown more complex and its scope has grown wider with the focus and thrust on the integration of Information and Communication Technology (ICT) into Teaching and Learning in this digital age. How well are teachers able to go beyond chalk and talk to utilize these technologies? What challenges and opportunities are on the anvil in the digital age? Is the new digital age the answer to the prayers of teachers? Does it lessen or add to the their workload? Digitization refers to creating a digital object (i.e., one existing inside a computer) from a physical object. A digital image can be edited, manipulated, e-mailed across the world, deleted or copied and inserted into other files, World Wide Web pages and publications.

The Curricula for the digital era and emerging technologies can be powerful allies to improve teaching and learning. The Internet and multimedia software available on CD-ROM and DVD are playing significant and powerful roles in a number of educational institutions. The attitude of teachers has changed/is changing and they have come forward and proposed substituting the use of computer simulations, multimedia presentation in place of conventional dissection: from virtual dissections and experiments in laboratories that the students can perform on screen, to full virtual reality simulations and a very high degree of interactivity. The present digital age keyboard, mouse and interactive multimedia software package on CD-ROM in Animal sciences not only supplement the black board but also play a significant role in the conservation of animals. This alternative besides being non-invasive, prevents indiscriminate killing of animals from the wild, which can cause a serious disturbance to the natural ecosystems, that are already under threat due to environmental contamination. Further, computer aided CD Rom alternatives leads to creativity of teachers from the conventional dissection process. The virtual physiology CD ROMs designed to encourage active learning with practice oriented tasks in a virtual laboratory was found by both students and teachers to be pedagogically, scientifically and ethically superior to the conventional animal practicals. In Virtual dissection or anatomy programmes, students can perform tasks step by step, repeating as necessary, and learn functional anatomy as they work through the programme. The soft ware offers the facility to highlight or incrementally dissolve specific organs or organ systems by controlling their opacity within a composite image; present physiological processes such as digestion or the activation of muscles through the technique of 'morphing'; spin organs and skeletal systems and present animations and fly through any part of the body. These opportunities absent in the real lab but available on demand at high speed in simulation, can provide a very rich and sensory experience which allows a much fuller appreciation of structure and structural relationships. The teacher can make use of the assessment methods viz., quiz, tag, labeling and testing available in the CDROM such as Dissection Works and Frog pro dissector. Sincere efforts were taken to identify the significant role played by creativity in the Zoology/ Animal Science/Life Science Practical Curriculum. The practical advantages include financial savings, the wise use of resources and reduced environmental impact. Many students can make use of one CDROM for instance, but dissections requires that multiple animals be purchased time after time. Combinations of alternatives will invariably be employed throughout the curriculum, so studies should also reflect the diversity of tools and approaches used to gain knowledge and skills. Teaching techniques are constantly evolving and should

be re-evaluated regularly. The computer simulation provides hands on experience.

Animal digital cd rom - not only beyond chalk and talk but also beyond bloodshed

The Inter NICHE, UK invited the author (Dr. M.C. Sathyanaryana) as Trainer to sensitize and train college/university teachers and researchers during the Workshop on Alternatives, Animal Welfare and the Curriculum, organized by the International Network for Humane Education (Inter NICHE) , People For Animals, India and the World Society for the Protection of Animals(WSPA), held across India in different cities form 23 August to 01 September 2004. There was a good response from the teachers for the alternatives. We organized a Workshop on animal use in practicals - Pros & Cons for college teachers on 25th September 2001 at the Department of Zoology and Wildlife Biology, A.V.C.College, Mayiladuturai, Tamilnadu. We organized a One Day Training Workshop on Animal Alternatives (CD ROM) To Replace the Use of Animals in Zoology dissections/ Practicals for Zoology teachers on 15th March 2005 sponsored by ICARE,Chennai. Fifty Zoology Lecturers/ Lecturers(SS) Lecturers (SG), Readers, Chairpersons and members of B.Sc and M.Sc Zoology Board of Studies affiliated to Bharathidasan University, Trichy Tamilnadu participated in this workshop. We gave training and Hands on Experience with Animal Alternative CDROM [frog, earthworm, shark, rat, pigeon, crayfish, physiology] using computers during the workshop.

Dr. M.C. Sathyanarayana and Dr. Akbar sha are campaigning to reduce animal dissection in the Zoology/Animal Science curriculum of several universities and colleges taking advantage of their nomination in the Board of Studies. The Bharathidasan University at M.Sc level has changed the Zoology Practical curriculum of affiliated colleges. Instead of killing the animals, Video clippings of dissections of shark, frog, calotes and rat can be shown to the students. A student can make use of material available on any web site for online dissection of shark, frog, calotes and rat using Apple quick time software. Dr.Sathyanarayana was very glad to inform that the Bharathidasan University, Trichy was the first university to revise the M.Sc and B.Sc Zoology Practicals by replacing/reducing the killing of animals. The Department of Zoology and Wildlife Biology, A.V.C.College, Mayiladuturai, Tamilnadu also revised the Zoology Practical curriculum and replaced the killing of frogs and calotes. The Kongunadu Arts and Science College and PSG College of Arts and Science College also joined in stopping animal killings. Many colleges in Tamilnadu have come forward to stop killing of frogs and calotes for dissections in their Zoology Laboratories. The author of this article Dr. M.C. Sathyanarayana, Dr. Akbarsha and other Zoology teachers have played a major role in conserving the existing threatened populations of frogs in Tamilnadu.

I am sure that many Institutes/Colleges/ Universities in India will join us in safeguarding the dwindling populations of amphibians.

The author Dr. M.C. Sathyanarayana is planning to organize a number of hands-on training programmes in collaboration with the Amphibian Network of South Asia of Zoo Outreach Organization (Z.O.O.).

Response to Dr. S.K. Dutta's article

M.C. Sathyanarayana

Department of Zoology and Wildlife Biology, A.V.C. College, Mayiladuthurai, Tamil Nadu 609305, India
Email: mcsathya@yahoo.com

This is in response to Dr. S.K. Datta's article on Field studies, collection, identification, legal and ethical issues, conservation and distribution status of South Asian Amphibians in frog leg Newsletter of the Declining Amphibian Populations Task Force-South Asia No. 11: 15-16 August 2004.

With reference to Animal Ethics Committee and Permission to collect amphibians I am one of the members of the Committee for the Purpose of Control and Supervison of Experiments on Animals [CPCSEA], Animal Welfare Board, Ministry of Environment and Forests, Government of India/ Institutional Animal Ethics Committee [IAEC] nominee.

Prior to the performance of a program of research, experimental animal use should be subjected to independent expert review, for both scientific and animal welfare considerations.

Institutional animals Ethics Committee [IAEC]

The Researchers/ Scientists/Teachers/Students must be aware that the use of experimental animals in research must be first reviewed and approved by the Institutional Animal Ethics Committee. Such reviews are essential to determine whether the use of experimental animals is justified scientifically and ethically.

Composition of Institutional animals Ethics Committee:

IAEC should include; a biological scientist, two scientists from different biological disciplines, a veterinarian involved in the care of animals, the scientist in charge of the animals facility of the establishment concerned, a scientist from outside the institute, a non-scientific socially aware member and a representative or nominee of the Committee. A specialist may be co-opted while reviewing special projects using hazardous agents such as radioactive substance and deadly micro organisms.

Powers and Duties of the Members of the IAEC

Every member of the IAEC shall scrutinize the Research proposal and justify the need for the use of animals and the methodology detailed. Whenever a nominee of CPCSEA as any Institutional Animal Ethics Committee disagrees with the proposal for experimentation on animals which comes before the concerned Institutional Animal Ethics Committee, then the Institutional Animal Ethics Committee will not be empowered to give permission for pursuing that experiment. Such proposal should be referred to the Expert Consultant in the office of CPCSEA for placing the proposal before the sub-committee. The expert consultant will communicate the decision of the sub-committee to the organization for experimentation and only then experimentation can be commenced. If the organization has any disagreement with the decision of the sub-committee in this regard, it may appeal to CPCSEA for reconsideration, CPCSEA'S decision will, however, be final. Institutional Animal Ethics Committee will give permission to conduct experiments on only small laboratory animals viz. guinea-pigs, rabbits, rats, mice, hamsters

Statement of Dr. Dutta

"Another recent issue relates to ethics and currently animal ethics committee is everywhere. The main task of animal ethics committee is either to approve or disapprove

animal sacrifice for research."

Reply given by Dr. M.C. Sathyanarayana

It is not like that— The research proposals submitted by the researchers/ investigators are sent to the IAEC members one month prior to the meeting to scrutinize. During the meeting the individual researcher is invited to explain/clarify and justify the need for animal use and numbers to be used.

Then the researcher is permitted to carry out the research programme. The IAEC committee is constituted of experts from the different faculties of the institute and out side.

Statement of Dr. Dutta

"Perhaps the worst sufferers in the hands of animal ethical committee could be taxonomists and systematists, who certainly need to sacrifice animals as and when required. However, I am still confused whether we taxonomists or systematists still need the approval of the animal ethics committee for sacrificing organisms as and when required.

Is it possible to seek the approval of the committee when we are conducting field survey when specimens need to be sacrificed?"

Solution given by Dr. M.C. Sathyanarayana

This is not concerned with the IAEC committee. The competent authority is the Chief Wildlife Warden of concerned State Forest department.

Statement of Dr.Dutta

"I also do not understand the deal between the authority involved in issuing collection permits(for example the 'Forest department of Govt. of India or of a state) and the animal ethics committee."

"There are some peculiar restrictions, which never permit a researcher to conduct a proper field survey and collect samples. This is a major hazard in India and I am sure several of us face this problem."

Information given by Dr. M.C. Sathyanarayana

The Fresh water Frogs [*Rana* spp.] is included under Schedule IV Wildlife (Protection) Act, 1972. Vide Notification No.FL-28/78 FRY (WL) dated 9th September, 1980, published in the Gazette of India, Ext., pt II, S.3(i), p.431 dated 02 October, 1980.

Grant of permit for special purposes- Notwithstanding anything contained elsewhere in this Act, it shall be lawful for the Chief Wildlife Warden to grant a permit, by an order in writing stating the reasons therefore, to any person, on payment of such fee as may be prescribed, which shall entitle the holder of such permit to hunt, subject to such conditions as may be specified therein, any wild animals specified in such permit, for the purpose of,----

(a) education;
(b) scientific research;
(c) scientific management;
(d) collection of specimens for museums and similar institutions;
(e) in respect of any other wild animal (other than Schedule I wild animal), except with the previous permission of the State Government.

Grant of Permit

The Chief Wildlife Warden may, on application, grant to any person a permit to enter or reside in a sanctuary for all or any of the following purposes, namely-

(a) investigation or study of wildlife and purposes ancillary or incidental thereto;
(b) photography
(c) scientific research.

I am sure that I have clarified the points raised by Dr. S.K. Dutta.