CHAPTER - III

STUDY OF BIODIVERSITY
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3.1 INTRODUCTION

The first record on the amphibian fauna of South Asia was by Kelaart (1852) who published 20 species of amphibians from Sri Lanka. The first publication that provided systematic description of amphibians of British India is that of Gunther (1864). A total of 37 species of Anuran and 2 species of Caecilians were described in Gunther's "Reptiles of British India". Stoliczka (1870) has contributed to the study of India and Malayan amphibian. The standard publication on the amphibian fauna of British India including Ceylon and Burma has been provided by Boulenger (1890). Boulenger reported 124 species of anurans, one species of salamander and five species of caecilians from "British India". Most of the taxonomic information on the amphibian fauna of South East Asia has been documented in the outstanding contribution "A monograph of the South Asian, Papuan, Melanesian and Australian frogs of the genus *Rana*" of Boulenger (1920). Van Kampen (1923) gave a description on the amphibia of the Indo-Australia Archipelago. Smith (1927) studied the herpetology of the Indo - Australian region. Cochran (1930) has documented the herpetological collections made by Dr. H. M. Smith in Siam from 1923 - 1929. Subsequently, Smith (1930) contributed to the
study of amphibia of Malay Peninsula. “A monograph on the frogs of the family Mycrohylidae” was published by Parker (1934).


Some of the earlier workers on Indian amphibians can be mentioned here. They were Blyth (1852), Theobald (1866), Jerdon, (1870). Stolicza (1872) studied amphibians and reptiles of Punjab including description of *Rana vicina*, *Euphlyctis cyanophlyctis* and *Bufo viridis*. Beddome (1878) studied some new batrachians from south India. Sclater (1892) published a list of the Batrachia of the Indian Museum. Ferguson (1904) has published 10 anuran species from Southern Kerala (Travancore). Annandale (1909) has provided notes on Indian Batrachia. Annandale and Rao (1918) have published a paper on the tadpoles of the families Ranidae and Bufonidae found in the plains of India. Smith (1924) described about Indian and Indochinese tadpoles. 20 species of anurans from south India were reported by Rao(1937). Bhaduri (1944) gave the locality record of *Rana hexadactyla*. Romer (1947) has described the habitat of *Rana erythraea*. Acharji and Kriplani (1951) studied the
amphibian fauna of Kangra and Kulu valley of western Himalayas. Daniel (1962) published a paper on the amphibians of Darjeeling area. Subsequently Daniel (1963a, 1963b and 1975) published a series on "Field guide to the amphibians of Western India", Part I, Part II and Part III. Sarkar (1984) has provided an account on the taxonomic and ecological studies on the amphibians of Calcutta and its environs. Chanda (1986) studied the anuran amphibians of Darjeeling and Sikkim Himalayas. The first comprehensive list of Indian amphibians was provided by Inger and Dutta (1986) where they included 181 amphibian species distributed in different states of India. Chanda and Ghosh (1988) have added few species to the list of Indian amphibians. Daniel and Sekar (1989) published a field guide for the identification of amphibians of Western India along with details on their distribution. Chanda and Deuti (1997) made a study on the endemic amphibians of India. Daniels (1997a, b, and c) published field guides for the identification of frogs and toads in the Western Ghats.

Dutta (1997) brought out a checklist of the amphibians of India and Sri Lanka based on museum specimens all over the world. This compilation includes 216 species occurring in India. Das and Dutta (1998) have provided a checklist of the amphibians of India with English common names. Biju (2001) has studied the frog fauna of the Western Ghats and reported 196 species of amphibians including 11 new species.

In India the total number of amphibians has been updated to 305 (amphibiaweb.org, accessed on May 2, 2010).

**STUDY OF AMPHIBIA IN NORTH EAST INDIA**

The northeast India is situated at the confluence of the Indo-Malayan, Indo-Chinese and Indian biogeographical regions. The study of literature reveals that its biological affinities of amphibian fauna are close to South Asia, and it is considered a distinct biogeographic zone within the Indian Subcontinent (Mani, 1974). The North East India is comprised of the state of Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram and Tripura. This is the only region of the country where all the three living orders of amphibian namely Gymnophona (limbless amphibians) Caudata (tailed amphibians) and Anura (tailless amphibians) are found.
Anderson (1872) reported the occurrence of Caecilians from Goalpara, Assam and Meghalaya. The first systematic study on the amphibian of this area was made by Boulenger (1890) who on his Fauna of British India listed 32 amphibians from North East India. Annandale (1912) published his survey report on Zoological results of the Abor expedition, Arunachal Pradesh and described 25 amphibian species including some species new to science. Boulenger (1919) described three new batrachians from the Garo hills, Assam. Hora (1923) has published his report on the amphibian fauna of certain torrential streams in the Khasi hill, Meghalaya. Smith (1929) has published his survey report on a collection of Amphibians and Reptiles from upper reaches of Brahmaputra. Romer (1949) described the herpetological observation in Assam and Bengal including the description of *Rana leptoglossa*, *Bufo melanostictus* and *Kaloula pulchra*. Roonwal and Kripalani (1951, 1961) have reported *Philautus shillongensis* (Family: Rhachophoridae) and *Philautus cherrapunjiae* (Family: Rhachophoridae) from Assam. Yazdani and Chanda (1971) provided a report on a new toad *Ansonia meghalayana* (Family: Bufonidae) from Meghalaya with observations on its breeding behaviour. Pillai and Chanda (1973) gave a description of the frog *Philautus shillongensis* from Meghalaya. Pillai and Yazdani (1973) described the taxonomy ecology and breeding habits of rock toad *Ansonia meghalayana* under a new genus *Bufoides*. Pillai and Chanda (1976)
reported 40 species of amphibian belonging to 11 genera and 6 families (Pelobatidae, Hylidae, Bufonidae, Microhylidae, Ranidae and Rhacophoridae) and their distribution in the 4 states of North East India (Meghalaya, Assam, Arunachal Pradesh and Manipur). Mansukhani et al. (1976) published a report on the occurrence of the Himalayan Newt, Tylototriton verrucosus Anderson, from Arunachal Pradesh. Pillai and Chanda (1977) reported 2 new species of frogs Rana danieli and Rana mawphlagensis from Khasi hills, Meghalaya. Pillai and Chanda (1979) have worked out the amphibian fauna of Khasi hills of Meghalaya and reported 20 species of frogs and toads including 2 new species. Bhaduri and Saha (1980) reported range extension of the narrow mouthed frogs Uperodon globulosus to Kamrup district, Assam. Pillai and Chanda (1981) have worked out the amphibian fauna of Garo hills of Meghalaya and reported 11 species. Sarkar and Sanyal (1985) have recorded 14 species of amphibians including 2 new species from Namdapha National Park in Tirap district of Arunachal Pradesh. Kiyasetuo and Khare (1986) published a new genus of frog Pterorana khare from Nagaland. Chanda (1994) compiled the list of the amphibians from North East India and reported 54 species of toads and frogs belonging to 18 genera under six families. He has mentioned 20 amphibian species from the present political boundary of Assam and 22 species from Arunachal Pradesh. Singh (1995) reported 10 species of reptiles and 15 species of amphibian
and Birand (2001) with a record of 45 amphibians from this region. Borah and Bordoloi (2001) have reported 20 species of anurans with 9 new records from Arunachal Pradesh. Bordoloi et al. (2001) made a new record of the Ranid frog *Paa annandalii* (Boulenger 1920) from northeastern region (Arunachal Pradesh) with detailed taxonomic description of the adults and tadpoles. Chanda (2002) in his handbook on Indian amphibians reported 64 species from North East India.

Bordoloi et al. (2002) published a survey report on amphibian and insect fauna of Dehang-Debang Biosphere Reserve of Arunachal Pradesh and recorded 30 Amphibian species including *Rhacophorus translineatus*, a new record from India. Chakravorty et al. (2002) have provided a description on anatomical peculiarities and morphometry of tadpoles of 6 species of amphibia collected from lotic and lentic water bodies of the Brahmaputra valley, Assam. Ao et al (2003) have provided a survey report of 32 amphibian species of Nagaland with nineteen new records from the state including five new records for India namely *Megophrys wuliangshanensis, Megophrys glandulosa, Amolops viridimaculatus, Rana humeralis* and *Rhacophorus gongshanensis*. Sen (2004) has reported 83 species of amphibians comprising of 78 anurans, 4 gymnophiona and 1 caudata from North East India. As per Sen (2004) the amphibian fauna of Assam is represented by 48 species under 8 families and 2 orders. Das et al. (2004) described a new species of Microhylid frog *Kaloula assamensis*
Sanctuary and adjacent regions, Assam and recorded 23 species of amphibia from the study area. Kamei et al. (2009) reported three new species of striped *Ichthyophis* (Amphibia: Gymnophiona: Ichthyophiidae) from Manipur and Nagaland. Sengupta et al. (2009) gave a detailed account of the taxonomy and biogeography of *Kaloula* species of eastern India. Bortamuli et al. (2010) provided a detailed description of the external morphology, buccopharyngeal anatomy and ontogenic data of the tadpoles of two Asian Ranidae (Amphibia: Anura) *Hylarana humeralis* (Boulenger, 1887) and *Hylarana leptoglossa* (Cope, 1868).

3.2 METHODOLOGY

The present survey of amphibian fauna was carried out in different parts of Charaideo subdivision of Sivasagar district. Most of the wetlands of Charaideo subdivision were surveyed in search of adult and tadpole stages. So certain lentic and lotic habitats were identified as suitable breeding grounds of different species of frogs. And these habitats were monitored covering all the breeding seasons for last four years (from 2004 to 2008) in search of different species. Collection was done by visual encounter survey and survey of breeding sites.
IDENTIFICATION OF ADULT

Accurate identification in the field is rarely possible and all field identification was treated as tentative. Collected specimens were compared with the voucher specimens in different museums.

Generally frogs were recorded in the field. Sometimes frogs killed for other purposes (food, medicine) were kept as samples. For identification, publication such as Boulenger (1890, 1920), Chanda (1994, 2002), Dutta (1997), Dubois and Ohler (2000), Ao et al. 2003 etc. were consulted. Specimens of already published papers present at IASST museum were compared for confirmation of Identification.

Measurements of only few samples of each species have been taken as most of the species collected in the present study are very common and recorded earlier from different parts of North East India (except the new species).

Morphometric measurements of specimens were taken with a Mitutoyo dial vernier calliper (to the nearest 0.02 mm). Morphological characters were described following Ohler (2002). The terminologies used in the text are briefly discussed.

NARCOTISATION AND PRESERVATION

Photographs were taken in the habitat as well as in the laboratory after preservation. Adult individuals were narcotised by exposing them to fumes of chloroform in an air-tight glass jar. After proper stretching they
were preserved in 8% formaldehyde solution. As the fixative may not penetrate to the inner tissues or organs, a small incision was made in the belly and formaldehyde was injected. After proper preservation each specimen was tagged or labelled with waterproof paper, with certain field data (collection date, locality, collectors name, collection number etc.). Samples were deposited in the Museum of Gargaon College.

ABBREVIATIONS USED IN MORPHOMETRY OF AMPHIBIANS

- **SVL**: Snout-vent length.
- **HW**: Head width.
- **HL**: Head length, from the back of the mandible to the tip of snout.
- **MN**: Distance from the back of the mandible to the nostril.
- **MFE**: Distance from the back of the mandible to the front of the eye.
- **MBE**: Distance from the back of the mandible to the back of the eye.
- **IFE**: Distance between the front of the eyes.
- **IBE**: Distance between the back of the eyes.
- **IN**: Internasal space.
- **EN**: Distance from the front of the eye to the nostril.
- **EL**: Eye length.
- **NS**: Distance from the nostril to the tip of the snout.
- **SL**: Distance from the front of the eye to the tip of the snout.
- **TYD**: Greatest tympanum diameter.
TYE : Distance from tympanum to the back of the eye.
IUE : Minimum distance between upper eyelids.
UEW : Maximum width of inter upper eyelid.
HAL : Hand length (from the base of the outer palmar tubercle to the tip of the toe).
FLL : Forelimb length (from the elbow to the base of the outer tubercle).
TFL : Third finger length (from the base of the first subarticular tubercle).
PA I-IV : Width of pads of fingers I to IV.
WA I – IV : Width of fingers I to IV.
FL : Femur length (from vent to knee).
TL : Tibia length.
FOL : Foot length (from the base of the inner metatarsal tubercle to the tip of the toe).
FTL : Fourth toe length (from the base of the first subarticular tubercle).
PP I – IV : Width of pads of toes I to V.
WP I – V : Width of toes I to V.
IMT : Length of inner metatarsal tubercle.
ITL : Inner toe length.
MTTF : Distance from the distal edge of the metatarsal tubercle to the maximum incurvation of the web between third and forth toe.

TFTF : Distance from the maximum incurvation of the web between third and fourth toe to the tip of fourth toe.

MTFF : Distance from the distal edge of the metatarsal tubercle to the maximum incurvation of the web between fourth and fifth toe.

FFTF : Distance from the maximum incurvation of the web between fourth and fifth toe to the tip of fourth toe.

WTF : Webbing between third and fourth toe (from the base of the first subarticular tubercle).

WFF : Webbing between fourth and fifth toe (from the base of the first subarticular tubercle).

WI : Webbing between third and fourth toe when folding along fourth toe (from the base of the first subarticular tubercle).

WII : Webbing between fourth and fifth toe when folded along fourth toe (from the base of the first subarticular tubercle).
3.3 LIST OF SPECIES WITH CLASSIFICATION

The specimens recorded were identified in the laboratory and classification was done. For classification all the recent publications and latest classification given in the website (www.iucnredlist.org 2010) were followed.

Table – 3: Classification of species recorded with IUCN status

Class : Amphibia Gray, 1825
Order : Anura Fischer von Waldheim, 1813

<table>
<thead>
<tr>
<th>Current Family / Species</th>
<th>IUCN Status</th>
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<tbody>
<tr>
<td><strong>FAMILY: BUFONIDAE</strong> Gray, 1825</td>
<td></td>
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<tr>
<td><em>Bufo melanostictus</em> Schneider, 1799</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY: MICROHYLEIDAE</strong> Gunther, 1858</td>
<td></td>
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<tr>
<td><em>Microhyla ornata</em> (Dumeril &amp; Bibron, 1841)</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY: RHACOPHORIDAE</strong> Hoffman, 1932</td>
<td></td>
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<tr>
<td><em>Polypedates teraiensis</em> (Dubois, 1987)</td>
<td>LC</td>
</tr>
<tr>
<td><em>Rhacophorus maximus</em> Gunther, 1858</td>
<td>LC</td>
</tr>
<tr>
<td><em>Rhacophorus bipunctatus</em> Ahl, 1972</td>
<td>LC</td>
</tr>
<tr>
<td><em>Rhacophorus suffry</em> Bordoloi, Bortamuli &amp; Ohler, 2007</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY : RANIDAE</strong> Rafinesque- Schmaltz, 1814</td>
<td></td>
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<tr>
<td><em>Euphlyctis cyanophlyctis</em> (Schneider, 1799)</td>
<td>LC</td>
</tr>
<tr>
<td><em>Euphlyctis hexadactylus</em> (Lesson, 1834)</td>
<td>LC</td>
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<th>Current Family / Species</th>
<th>IUCN Status</th>
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<tr>
<td><strong>FAMILY: MEGOPHYRIDAE</strong> Bonaparte, 1850</td>
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<tr>
<td>Xenophrys parva (Boulenger, 1893)</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY: HYLIDAE</strong> Rafinesque, 1815</td>
<td></td>
</tr>
<tr>
<td>Hyla annectans (Jerdon, 1870)</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY: MICROHYLIDAE</strong> Gunther, 1858</td>
<td></td>
</tr>
<tr>
<td>Microhyla rubra (Jerdon, 1853)</td>
<td>LC</td>
</tr>
<tr>
<td><strong>FAMILY: RACHOPHORIDAE</strong> Hoffman, 1932</td>
<td></td>
</tr>
<tr>
<td>Rhacophorus tuberculatus (Anderson, 1871)</td>
<td>DD</td>
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<tr>
<td><strong>FAMILY: RANIDAE</strong> Rafinesque- Schmaltz, 1814</td>
<td></td>
</tr>
<tr>
<td>Limnonectes laticeps (Boulenger, 1882)</td>
<td>LC</td>
</tr>
</tbody>
</table>

3.4 DESCRIPTION OF SPECIES STUDIED

FAMILY: BUFONIDAE

*Bufo melanostictus* Schneider, 1799

Plate - I (Fig. 6)

**Material examined:** One male and two females.

**Distribution:** This species occurs widely from northern Pakistan through Nepal, Bangladesh, India (including the Andaman and Nicobar Islands), Sri Lanka, Southern China (including Taiwan, Hong Kong and Macau), Myanmar, Lao People’s Democratic Republic, Vietnam Thailand and Cambodia to Malaysia, Singapore, Indonesia and New Guinea. It has been recorded from Sea level up to 1800 m asl.

**Description:**

**Head:** Wider than long, snout short and blunt, loreal region nearly flat, Canthus rostralis angular; nostrils nearer to tip of snout than to eyes; tympanum large, very distinct; parotid glands large and elongated.

**Fore limbs:** Short and stout; fingers free; tips of fingers rounded; subarticular tubercles prominent.

**Hind limbs:** Short and stout; tibiotarsal articulation reaching back of tympanum; webbing moderate; tips of toes rounded inner metatarsal tubercle elliptical; outer metatarsal tubercle small.

**Skin:** Surface of skin rough numerous warts bearing horny spinules.
**Colouration:** Live colouration of the specimen is dorsally light brown to dark brown

**Morphometric measurement (in mm):** Large sized frog, snout vent length (SVL) 66.42 (male), 78.32 – 79.95 (female); length of head (HL) 22.1 – 25.6; width of head (HW) 25.6 – 33.44; length of snout (SL) 7.74 – 8.7; length of eye (EL) 8.26 – 8.6; interorbital space (IUE) 4.7 – 6.2; length of arm (FLL) 18.64 – 19.7; length of tympanum (TYD) 4.8 – 4.9; relative length of fingers III>IV>I>II; length of tibia (TL) 27.8 – 30.46; relative length of toes IV>III>V>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

**Remarks:** Frost (2006) has named this genus as *Duttaphrynus*.

**FAMILY: MICROHYLIDAE**

*Microhyla ornata* (Dumeril and Bibron, 1841)

Plate - 1 (Fig. 3)

**Material Examined:** 4 males.

**Distribution:** This is a very widespread species, occurring through most of South Asia (Bangladesh, Bhutan, India, Nepal, and Pakistan) including Sri Lanka. It occurs up to 2000 m asl.

**Description:**

**Head:** Head as wide as large. Snout pointed, projecting slightly beyond lower jaw; Canthus rostralis obtuse; nostrils closer to tip of snout than to eyes; internarial space is equal to interorbital width; tympanum hidden.
**Forelimbs:** Slender and moderately long; fingers free, tips of fingers dilated into small discs; subarticular tubercles small and prominent.

**Hindlimbs:** Long; tibiotarsal articulation reaching back of eyes, toes with rudimentary web, tips of toes dilated into small discs, subarticular tubercles small; inner metatarsal tubercle present; outer metatarsal tubercle absent.

**Skin:** Head. Dorsal surface of body; limbs smooth.

**Colouration:** Live colouration of the specimen is reddish to dark brown. Dorsally a large dark brown, irregular shaped marking extends from between the eyes to lower part of back and widening posteriorly. Limbs with incomplete dark cross bars. Ventral surface of the throat in male is dark.

**Morphometric measurements (in mm):** Snout vent length (SVL) 19.2 – 20.7 (Male); Length of head (HL) 6.4 – 6.6, width of head (HW) 6.18 – 6.42, length of snout (SN) 2.6 – 2.8, length of eye (TYD) 1.82 – 1.96, Inter orbital space (IUE) 1.82 – 1.92, length of arm (FLL) 3.34 – 3.52, relative length of fingers III>IV>II>I, length of tibia (TL) 10.3 – 10.96, relative length of toes IV>III>V>II>I.

**Status:** IUCN Red List Category: Least Concern (LC)
**FAMILY: RHACOPHORIDAE**

*Polypedates teraiensis* (Dubois, 1987)

Plate - I (Fig. 5)

**Material examined:** 2 males and 2 females.

**Distribution:** Throughout Northeast India. North Bengal, Nepal, Bangladesh and Myanmar.

**Description:**

**Head:** As wide as large. Cephalic skin of large adults usually co-ossified with frontoparietals, squamosals and nasals, of granular appearance. Snout pointed, projecting slightly beyond lower jaw; Canthus rostralis distinct; loreal region concave, nostrils nearer to tip of snout than to eyes; tympanum large and distinct; vomerine teeth slightly oblique in position.

**Forelimbs:** Forelimbs moderately long; fingers with rudimentary web; discs well developed with circum-marginal grooves; subarticular tubercles small and not well developed.

**Hind limbs:** Long, tibiotarsal articulation reaching between eye and nostril. Toes not entirely webbed. Tip of toes with discs having distinct circum-marginal grooves; inner metatarsal tubercle small, prominent; outer metatarsal tubercle absent.

**Skin:** Head, dorsal surface of body, limbs; belly and ventral surface of thighs granulated; supratympanic fold present.
**Colouration:** The live colouration of the specimen reddish brown dorsally. Four to six dark brown longitudinal lines extending from snout to vent. Limbs with dark cross bands. Ventral surface almost white.

**Morphometric measurements (in mm):** Snout vent length (SVL) 51.0 – 53.4 (male); 71.0 – 76 (female); length of head (HL) 19.5 – 25.8, width of head (HW) 17.5 -25.16, length of snout (SL) 2.0 – 3.34, length of eye (EL) 5.5 – 7.7, inter orbital space (IUE) 4.89 – 9.7, length of arm (FLL) 10.4 – 15.0, length of tympanum (TYD) 2.9 – 4.44, relative length of fingers I<II<IV<III, length of tibia (TL) 26.6 – 38.6, relative length of toes IV>V>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

**_Rhacophorus maximus_** Gunther, 1958

Plate - II (Fig. 9)

**Material examined:** 2 males and 2 females.

**Distribution:** This species is known from eastern Nepal, northern Bangladesh, India (Assam, Meghalaya, Nagaland, Arunachal Pradesh, Sikkim, West Bengal and Manipur), northern Myanmar, Western Thailand (Southern Xizang and Southern Yunnan) and China. It has been recorded from 500 – 2000 m asl.
Description:

**Head:** Wider than long, depressed; snout rounded, feebly projecting beyond lower jaw; Canthus rostralis prominent, supratympanic fold distinct; tympanum distinct, vomerine teeth oblique in position; tongue

**Forelimbs:** Strong and stout; fingers two-third webbed, large well developed discs with circum marginal grooves; subarticular tubercles well developed.

**Hind limbs:** Long and stout, tibiotarsal articulation reaching back of eyes. Toes entirely webbed. Tip of toes with developed discs having circummarginal grooves. Discs of toes are little smaller than finger discs, inner metatarsal tubercle. Small, prominent; outer metatarsal tubercle absent.

**Skin:** Head, dorsal surface of body, limbs; belly and ventral surface of thighs granular (tree frog belly skin).

**Colouration:** The live colouration of the specimen is leafy green dorsally and ventral surface is creamy white. Flank and webbing with light gray reticulation, lower jaw white.

**Morphometric measurements (in mm):** Snout vent length (SVL) 70.41 – 75.0 (male); 74.5 – 96.3 (female); length of head (HL) 27.0 – 33.1; Width of head (HW) 25.4 – 35.0; length of snout (SN) 3.4 – 6.1; length of eye (EL) 7.3 – 8.6; inter orbital space (IUE) 8.0 – 10.9, length of arm (FLL) 13.4 – 20.4; length of tympanum (TYD) 3.74 – 5.52; relative
length of fingers III>IV>II>I; length of tibia (TL) 32.6 – 45.8; relative length of toes IV>V>III>II>I

Remarks: IUCN Red List Category: Least Concern (LC).

*Rhacophorus bipunctatus* Ahl, 1927

**Material examined:** One male.

**Distribution:** This species is widely distributed from northern India (Meghalaya, Arunachal Pradesh, Assam, Nagaland, Tripura, Mizoram and Manipur) and Bangladesh through Myanmar, Western and Southern Thailand, Southern China to Peninsular Malaysia. It has been recorded from 100 – 2200 in asl.

**Description:**

**Head:** Head slightly broader than long, slightly depressed; snout obtusely pointed, projecting a little beyond the lower jaw; Canthus rostralis not sharp, nostrils closer to tip of snout than to eyes; tympanum distinct; vomerine teeth oblique in position; tongue

**Fore limbs:** Moderately long, fingers two-thirds webbed, well developed discs with circum marginal grooves; subarticular tubercles prominent.

**Hind limbs:** Long, tibiotarsal articulation reaching posterior corner of eye; toes entirely webbed. Tip of toes with well developed discs having circum-marginal grooves; a small inner metatarsal tubercle present and outer metatarsal tubercle absent.
Skin: Head, dorsal surface of body, limbs; belly and ventral surface of thigh granulated tympanic fold.

Coloutration: The live colouration of the specimen is dorsally light green sprayed with tiny black dots. One large black spot on flanks, webbing of hind limbs reddish coloured, webbing of fore limbs is yellow coloured and limbs with cross bands, ventral surface yellowish.

Morphometric measurements (in mm): Snout vent length (SVL) 40.14 (male); length of head (HL) 14.56; Width of head (HW) 14.72; length of snout (SN) 2.52; length of eye (EL) 5.56; inter orbital space (IUE) 5.6 (3.0), length of arm (FLL) 8.56; length of tympanum (TYD) 3.0; relative length of fingers III>IV>II>I; length of tibia (TL) 20.7; relative length of toes IV>V>III>II>I

Remarks: IUCN Red List Category: Least Concern (LC).

Rhacophorus suffry Bordoloi, Bortamuli, Ohler, 2007

Plate - II (Fig. 8)

Material examined: 5 males and 7 females collected from neighbouring areas of Suffry Tea Estate (26°55'- 27°00' N, 94°55'- 95° 02.5' E) Sivasagar, Assam, India.

Specimen Registration number: IASST A61- A71.

Distribution: This species is known only from five sites (iucnredlist.org, accessed on May 28, 2010) in north eastern India: Suffry tea
estate(26°55' - 27°00 N, 94°55' - 95° 02.5' E), in Assam (Bordoloi et al. 2007) at 60 - 100m asl; Nameri National Park in Assam (S. Sengupta, pers. comm.); Dihingpatkai Wildlife Sanctuary in Assam (S. Sengupta, pers. Comm.); Wokha district in Nagaland (S. Bordoloi, pers. comm.); Pakke Wildlife Sanctuary in Arunachal Pradesh (S. Sengupta, pers comm.) and Eaglenest Wildlife Sanctuary (27° 04'15'' N 92°24' 06'' E), in Arunachal Pradesh (I. Agarwal, pers. comm.)

Five males and seven females of Rhacophorus suffry collected in the month of September, 2005 are described here. As the frogs were collected outside the breeding season, they are not in reproductive state and some individuals are not fully mature.

**DESCRIPTION OF ADULT MALE (R. suffry)**

The description (all measurements in mm) is based on 5 males. Measurements are given in Table 4.

**Body and Head:** Moderate - sized frogs (SVL 38.5 - 52.9 mm). Body rather slender. Head moderate, about as wide (HW 15.2 - 19.5 mm) as long (HL 14.8 - 19.6 mm) and flat above. Snout rounded, protruding longer (SL 5.82 - 8.6 mm) than horizontal diameter of eye (EL 5.1 - 5.76 mm). Canthus rostralis sharp and concave. Interorbital space flat, larger (IUE 4.32 - 5.88 mm) than upper eyelid (UEW 4.05 - 4.8 mm). Distance between front of eyes (IFE 7.5 - 10.5 mm) is 1.7 times in distance between back of eyes (IBE 13.4 - 17.2 mm). Nostril rounded without flap
of skin, closer to tip of snout (NS 2.52 - 3.6 mm) than to eye (EN 3.22 - 4.54 mm). Pupil rounded and horizontal. Tympanum (TYD 2.38 - 2.86 mm) very distinct, rounded, its distance to eye (TYE 0.98 - 1.12 mm) scarcely half of tympanum diameter. Pineal ocellus absent. Vomerine ridge horizontal in position, near anterior corner of nasal opening, very slightly oblique, almost horizontal; space between the two ridges is less than the length of the ridge. Tongue moderately notched; median lingual process absent.

**Forelimbs:** Arms (FLL 8.46 - 10.64 mm) thin, shorter than hand (HAL 12.06 - 15.2 mm), forearm not enlarged. Fingers rather short, thick (TFL 6.76 - 8.62 mm). Relative length of fingers I < II < III < V < IV. Discs present on tip of fingers, with distinct circum-ventral grooves. Fingers without dermal fringe on inside of fingers. Webbing present well developed: I 1-2 II 1-2 III 1-1 IV. Subarticular tubercles present, distinct, rounded, and single. Prepolax oval, prominent; palmer tubercles indistinct, flat; supernumerary tubercles present on base of fingers II to IV.

**Hindlimbs:** Shank thin (TL 17.7 - 26.9 mm), five times longer than wide (TW 3.76 - 5.0 mm), longer than foot (FOL 17.4 - 24.3 mm) and thigh (FL 19.4 - 24.9 mm). Toes long and thin (FTL 9.1 - 12.3 mm). Relative length of toes, shortest to longest: I < II < III < V < IV. Discs present on tip of toes, with distinct circum-ventral grooves. Webbing present, complete: I 0 0 II 0 0 III 0 0 IV 0 0 V. Dermal fringe present from tip of toe to
the base of tarsus, well developed. Subarticular tubercles prominent, rounded and simple. Inner metatarsal tubercle distinct, oval (IMT 1.1 - 1.86 mm), 3.17 in length of toe I (ITL 4.26 - 5.9 mm). Tarsal fold absent. Outer metatarsal tubercle, supernumerary tubercles and tarsal tubercle absent.

**Skin:** Skin of snout smooth, between eyes granular, side of head smooth with very fine granules. Anterior part of back with minute granules and skin folds, posterior part of back with very fine granules. Upper part of flank and lower part of flank with minute granules. Dermal folds on forearm, heel, tarsus, metatarsus and vent absent; latero-dorsal folds absent; “fejervarya” line absent; lateral line system absent; supratympanic fold narrow, flat; cephalic ridges absent; co-ossified skin absent. Forelimb smooth, thigh granular, leg and tarsus smooth. Skin of ventral part of body granular (tree frog belly skin). Macroglands absent.

**Coloration in life:** Dorsal and lateral part of head and body leafy green (Plate II, Fig.8). Flank upper part leafy green lined with light yellow colour. Lower part light green with few, creamy white scattered spots. Loreal region, tympanic region, upper lip and tympanum leafy green. Iris yellowish gold. Forelimb, dorsal part of thigh, dorsal part of leg leafy green. Dorsal part of foot between fourth and fifth toes are green, others are orange red. Throat creamy white. Margin of throat light gray. Chest and belly creamy white. Thigh and webbing orange red.
DESCRIPTION OF ADULT FEMALE (*R. suffry*)

The description (all measurements in mm) is based on 7 females. Measurements are given in Table 4.

**Body and Head:** Moderate - sized frogs (SVL 31.5 – 61.0 mm). Body rather slender. Head moderate, about as wide (HW 13.1 -24.0 mm) as long (HL 12.2 – 22.2 mm) and flat above. Snout rounded, protruding longer (SL 4.9 – 9.7 mm) than horizontal diameter of eye (EL 4.58 – 6.3 mm). Canthus rostralis sharp and concave. Interorbital space flat, larger (IUE 4.02 – 7.2 mm) than upper eyelid (UEW 3.5 – 5.52 mm). Distance between front of eyes (IFE 6.2 – 11.6 mm) is 1.7 times in distance between back of eyes (IBE 10.7 – 20.2 mm). Nostril rounded without flap of skin, closer to tip of snout (NS 2.12 – 3.68 mm) than to eye (EN 2.76 – 5.12 mm). Pupil rounded and horizontal. Tympanum (TYD 1.96 – 3.24 mm) very distinct, rounded, its distance to eye (TYE 0.68 – 1.36 mm) scarcely half of tympanum diameter. Pineal ocellus absent. Vomerine ridge horizontal in position, near anterior corner of nasal opening, very slightly oblique, almost horizontal; space between the two ridges is less than the length of the ridge. Tongue moderately notched; median lingual process absent.

**Forelimbs:** Arms (FLL 6.7 – 12.4 mm) thin, shorter than hand (HAL 9.9 – 18.6 mm), forearm not enlarged. Fingers rather short, thick (TFL 5.4 –
10.5 mm). Relative length of fingers I < II < III. Discs present on tip of fingers, with distinct circum-ventral grooves. Fingers without dermal fringe on inside of fingers. Webbing present, well developed: I 1-2 II 1-2 III 1-1 IV. Subarticular tubercles present, distinct, rounded, and single. Prepolax oval, prominent; palmer tubercles indistinct, flat; supernumerary tubercles present on base of fingers II to IV.

**Hindlimbs:** Shank thin (TL 14.7 - 32.0 mm), five times longer than wide (TW 4.64 - 1.78 mm), longer than foot (FOL 14.9 - 29.5 mm) and thigh (FL 16.5 - 30.7 mm). Toes long and thin (FTL 8.2 - 14.9 mm). Relative length of toes, shortest to longest: I < II < III < V < IV. Discs present on tip of toes, with distinct circum-ventral grooves. Webbing present, complete: I 0 - 0 II 0 - 0 III 0 - 0 IV 0 - 0 V. Dermal fringe present from tip of toe to the base of tarsus, well developed. Subarticular tubercles prominent, rounded and simple. Inner metatarsal tubercle distinct, oval (IMT 0.94 - 2.32 mm), 3.17 in length of toe I (ITL 3.22 - 8.06 mm). Tarsal fold absent. Outer metatarsal tubercle, supernumerary tubercles and tarsal tubercle absent.

**Skin:** Skin of snout smooth, between eyes granular, side of head smooth with very fine granules. Anterior part of back with minute granules and skin folds, posterior part of back with very fine granules. Upper part of flank and lower part of flank with minute granules. dermal folds on forearm, heel, tarsus, metatarsus and vent absent; latero-dorsal folds
absent; "fejervarya" line absent; lateral line system absent; supratympanic fold narrow, flat; cephalic ridges absent; co-ossified skin absent. Forelimb smooth, thigh granular, leg and tarsus smooth. Skin of ventral part of body granular (tree frog belly skin). Macroglands absent.

**Coloration in life:** Dorsal and lateral part of head and body leafy green. Flank upper part leafy green lined with light yellow colour. Lower part light green with few, creamy white scattered spots. Loreal region, tympanic region, upper lip and tympanum leafy green. Iris yellowish gold. Forelimb, dorsal part of thigh, dorsal part of leg leafy green. Dorsal part of foot between fourth and fifth toes are green, others are orange red. Throat creamy white. Margin of throat light gray. Chest and belly creamy white. Thigh and webbing orange red.

**Variation.** – Measurements of males and females are given in Table 3. Size differences reflect differences in age of the specimens. Colour pattern is very similar in all frogs observed.

**Status:** IUCN Red List Category: Least Concern (LC).

**Remarks:** In the present study this species is described as new to science.
Table – 4: Measurements of males and females of *Rhacophorus suffry*

<table>
<thead>
<tr>
<th>Measurements (in mm)</th>
<th>Male Range</th>
<th>Male Mean ± Standard Deviation</th>
<th>Female Range</th>
<th>Female Mean ± Standard Deviation</th>
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<tbody>
<tr>
<td>SVL</td>
<td>38.5 - 52.9</td>
<td>47.21 ± 5.41</td>
<td>31.5 - 61.0</td>
<td>44.05 ± 9.32</td>
</tr>
<tr>
<td>HW</td>
<td>15.2 - 19.5</td>
<td>17.94 ± 1.68</td>
<td>13.1 - 24.0</td>
<td>17.26 ± 3.47</td>
</tr>
<tr>
<td>HL</td>
<td>14.8 - 19.6</td>
<td>17.84 ± 1.82</td>
<td>12.2 - 22.2</td>
<td>16.89 ± 3.20</td>
</tr>
<tr>
<td>IFE</td>
<td>7.5 - 10.5</td>
<td>9.20 ± 1.10</td>
<td>6.2 - 11.6</td>
<td>8.92 ± 1.65</td>
</tr>
<tr>
<td>IBE</td>
<td>13.4 - 17.2</td>
<td>15.36 ± 1.37</td>
<td>10.7 - 20.2</td>
<td>14.85 ± 2.88</td>
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<tr>
<td>IN</td>
<td>4.08 - 6.0</td>
<td>5.07 ± 0.69</td>
<td>3.22 - 6.56</td>
<td>4.85 ± 0.98</td>
</tr>
<tr>
<td>SL</td>
<td>5.82 - 8.6</td>
<td>7.59 ± 1.06</td>
<td>4.9 - 9.7</td>
<td>7.19 ± 1.56</td>
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<tr>
<td>NS</td>
<td>2.52 - 3.6</td>
<td>3.15 ± 0.40</td>
<td>2.12 - 3.68</td>
<td>2.94 ± 0.50</td>
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<tr>
<td>EN</td>
<td>3.22 - 4.54</td>
<td>4.06 ± 0.50</td>
<td>2.76 - 5.12</td>
<td>3.77 ± 0.80</td>
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<tr>
<td>EL</td>
<td>5.1 - 5.76</td>
<td>5.70 ± 0.52</td>
<td>4.58 - 6.3</td>
<td>5.51 ± 0.52</td>
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<td>TYD</td>
<td>2.38 - 2.86</td>
<td>2.69 ± 0.20</td>
<td>1.96 - 3.24</td>
<td>2.53 ± 0.40</td>
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<tr>
<td>TYE</td>
<td>0.98 - 1.12</td>
<td>1.06 ± 0.06</td>
<td>0.68 - 1.36</td>
<td>1.02 ± 0.20</td>
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<tr>
<td>IUE</td>
<td>4.32 - 5.88</td>
<td>5.15 ± 0.57</td>
<td>4.02 - 7.2</td>
<td>5.05 ± 1.05</td>
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<td>UEW</td>
<td>4.05 - 4.8</td>
<td>4.47 ± 0.28</td>
<td>3.5 - 5.52</td>
<td>4.41 ± 0.78</td>
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<td>FLL</td>
<td>8.46 - 10.64</td>
<td>9.82 ± 0.88</td>
<td>6.7 - 12.4</td>
<td>9.16 ± 1.70</td>
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<td>HAL</td>
<td>12.06 - 15.2</td>
<td>14.30 ± 1.50</td>
<td>9.9 - 18.6</td>
<td>13.53 ± 2.84</td>
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<td>TFL</td>
<td>6.76 - 8.62</td>
<td>8.03 ± 0.81</td>
<td>5.4 - 10.5</td>
<td>7.53 ± 1.64</td>
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<td>TL</td>
<td>17.7 - 26.9</td>
<td>23.32 ± 3.44</td>
<td>14.7 - 32.0</td>
<td>22.06 ± 5.66</td>
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<td>FOL</td>
<td>17.4 - 24.3</td>
<td>21.78 ± 2.60</td>
<td>14.9 - 29.5</td>
<td>20.62 ± 4.76</td>
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<td>FTL</td>
<td>9.1 - 12.3</td>
<td>11.28 ± 1.27</td>
<td>8.2 - 14.9</td>
<td>10.45 ± 2.29</td>
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<td>IMT</td>
<td>1.1 - 1.86</td>
<td>1.69 ± 0.33</td>
<td>0.94 - 2.32</td>
<td>1.55 ± 0.48</td>
</tr>
<tr>
<td>ITL</td>
<td>4.26 - 5.9</td>
<td>5.32 ± 0.70</td>
<td>3.22 - 8.06</td>
<td>5.43 ± 1.48</td>
</tr>
<tr>
<td>FL</td>
<td>19.4 - 24.9</td>
<td>23.02 ± 2.37</td>
<td>16.5 - 30.7</td>
<td>21.61 ± 4.55</td>
</tr>
<tr>
<td>TW</td>
<td>3.76 - 5.0</td>
<td>4.55 ± 0.52</td>
<td>4.64 - 1.78</td>
<td>3.79 ± 1.04</td>
</tr>
</tbody>
</table>
FAMILY: RANIDAE

*Euphlyctis cyanophlyctis* (Schneider, 1799)

Plate - II (Fig. 7)

**Material examined:** 2 males and 2 females.

**Distribution:** This species ranges throughout much of South Asia (Nepal, Pakistan, Bangladesh, and India) including Southern Afghanistan and Sri Lanka. It is also present in Southern Iran. It is present from sea level to 2500 m asl.

**Description:**

**Head:** Longer than wide; snout pointed, slightly projecting beyond mouth; loreal region concave; nostrils equidistant from eyes and tip of snout; tympanum distinct, vomerine teeth oblique in position.

**Fore limbs:** Moderately long, fingers free and tips of fingers pointed; subarticular tubercles small and prominent.

**Hind limbs:** Long and stout, tibiotarsal articulation reaching anterior corner of eyes; webbing complete; tips of toes pointed; inner metatarsal tubercle pointed and digitiform, outer metatarsal tubercle absent.

**Skin:** Dorsal skin finely granular and ventrally smooth.

**Colouration:** The live colouration of the specimen is dorsally greyish olive, with dark olive spots; a dark light-edged band along each flank; lower parts white or vermiculate.
**Morphometric measurements (in mm):** Moderate sized frog, snout vent length (SVL) 36.1 – 36.8 (males), 44.3 – 45.8 (females); length of head (HL) 14.08 – 18.16; width of head (HW) 13.26 – 16.46; length of snout (SL) 5.56 – 7.0; length of eye (EL) 4.0 – 4.76; inter orbital space (IUE) 1.34 – 1.76; length of arm (FLL) 7.3 – 8.2; length of tympanum (TYD) 2.56 – 3.6; relative length of fingers III>IV>II=I; length of tibia (TL) 18.6 – 23.5; relative length of toes IV>V>III>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

**Euphlyctis hexadactylus** (Lesson, 1834)

**Material examined:** 3 Females.

**Distribution:** This species is widespread in India, Sri Lanka and Bangladesh. It has been reported from Pakistan also. It is present from sea level to approximately 760 m asl.

**Description:**

**Head:** Longer than wide, snout, pointed, slightly projecting beyond mouth; loreal region concave; nostrils slightly closer to tip of snout than to eyes; vomerine teeth oblique in position.

**Fore limbs:** Moderately long, fingers free and tips of fingers pointed, subarticular tubercles small and prominent.
**Hind limbs:** Long and stout, tibiotarsal articulation reaching between eyes and nostrils; webbing complete; tips of toes pointed; inner metatarsal tubercle pointed and digitiform, outer metatarsal tubercle absent.

**Skin:** Dorsal skin with minute porous warts, ventral surface smooth.

**Colouration:** The live colouration of the specimen is dorsally olive in colour; white ventrally.

**Morphometric measurements (in mm):** Moderate sized frog, snout vent length (SVL) 51.4 – 56.1 (female); length of head (HL) 19.9 – 21.5; width of head (HW) 18.4 – 20.26; length of snout (SL) 7.9 – 8.6; length of eye (EL) 4.7 – 5.4; inter orbital space (IUE) 1.56 – 1.92; length of arm (FLL) 9.86 – 10.47; length of tympanum (TYD) 4.0 – 4.2; relative length of fingers III>IV>I>II; length of tibia (TL) 26.1 – 28.5; relative length of toes IV>V>III>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

*Fejervarya nepalensis* (Dubois 1975)

Plate – II (Fig. 12)

**Material examined:** 7 males and 10 females

**Distribution:** *Fejervarya nepalensis* was originally described by Dubois in 1975 from Nepal and was placed in the genus *Rana*. But it was subsequently placed in the subgenus *Fejervarya* by Dubois (1984). *F. nepalensis* is included in IUCN Red list category as Least Concern (LC)
species because of their wide distribution, large population and tolerance of a broad range of habitats. This species is widely distributed in North eastern region of India. Ao, Bordoloi and Ohler (2003) recorded *F. nepalensis* from the state of Nagaland. Bordoloi et al. (2002) recorded the species from Dehang- Debang Biosphere Reserve of Arunachal Pradesh. Nigombam and Bordoloi (2007) provided a record from Manipur. Borthakur et al. (2007) have described *F. nepalensis* from Assam. It is commonly found in open grasslands, near by area of shallow pools and water bodies, paddy fields etc. In spite of the large population and common occurrence scientific data and information are not available on tadpole taxonomy as well as on normal development.

**DESCRIPTION OF ADULT MALE (*F. nepalensis*)**

The description (all measurements in mm) is based on 7 adult males. Measurements are given in Table 5.

**Body and Head:** Rather small sized frog (SVL 25.6 - 28.4 mm), body rather elongate; head small, longer than wide (HW 8.82 - 9.66; HL 9.88 - 11.6; MN 8.54 - 9.78; MFE 7.02 - 7.82; MBE 3.76 - 4.38 mm) snout pointed projecting beyond the mouth, its length (SL 4.1 - 4.84 mm) longer than the horizontal diameter of the eye (EL 3.7 - 4.64 mm); canthus rostralis sharp, loreal region obtusely concave; interorbital space flat, less (IUE 1.14 - 1.58 mm) than upper eyelid (UEW 2.40 - 3.0 mm) and internasal distance (IN 2.26 - 2.66 mm); distance between front of
eyes (IFE 3.64 – 4.12 mm) 1.9 times in distance between back of eyes (IBE 6.22 – 7.2 mm); nostrils rounded, as close to tip of snout (NS 2.0 – 2.26 mm) than to eye (EN 2.1 – 2.18 mm); pupils rounded, horizontal; tympanum distinct, rounded, its diameter (TYD 1.62 – 1.82 mm) less than half the diameter of the eye, larger than distance from tympanum to eye (TYE 0.7 – 0.94 mm); vomerine teeth present between choanae with an angle relative to body axis less closer to choanae than from each other, longer than distance between them; tongue moderate, notched, lingual papilla absent; supratympanic fold distinct, from back of the eye to base of the forelimb; parotid glands absent; cephalic ridges absent; co-ossified skin absent.

**Forelimbs**: Arm thin, fore-arm (FLL 4.48 – 5.48 mm) shorter than hand (HAL 6.02 – 6.9; TFL 2.96 – 3.40 mm); relative length of fingers: II<III<IV<II; tips of fingers pointed; fingers without dermal fringe, webbing absent; subarticular tubercles prominent, rounded, small, single, all present; palmer tubercles: 3, oval, small and prominent, prepollex oval and prominent.

**Hindlimbs**: Tibiotarsal articulation reaching eyes, heels overlapping when hindlimbs folded at right angles to the body; tibia more than three times longer (TL 11.8 – 12.76 mm) than wide TW 3.54 – 4.18 mm), longer than thigh (FL 10.94 – 12.9 mm), and shorter than distance from base of internal metatarsal tubercle to tip of toe IV(FOL 12.86 – 15.28
mm); toes long and thin, length of toe IV (FTL 7.34 - 8.82 mm) 2.3 times in distance from base of tarsus to tip of toe IV (TFOL 17.32 - 20.9 mm); relative length of toes: I < II < III < V < IV; tips of toes pointed, toes not fully webbed, one phalange of fourth toe free; dermal fringe absent; subarticular tubercles small but prominent, rounded, simple, all present; inner metatarsal tubercle distinct, oval and its length (IMT 1.18 - 1.46 mm) 1.9 times in length of toe I (ITL 2.2 - 2.54 mm); outer metatarsal tubercle present but feebly developed. The width of webbing between 4th and 5th toe is much larger than the other one.

Skin: Skin granular (fine) on dorsal parts of head and body dorsum with prominent several small glandular folds; upper part of flank granular (fine) but lower part smooth; latero-dorsal fold absent, "fejervarya" line present but not in all; dorsal part of forelimb smooth, thigh granular (fine), leg granular (fine), tarsus smooth; ventral parts of head, body and limbs smooth; macroglands absent.

Coloration in life: Dorsal part of head and dorsum deep brown with dark spots of varying size and shape; a prominent dark band present between two eyelids; upper part of flank deep brown, lower part deep brown with marbling, loreal region deep brown, tympanum and tympanic region light brown; upper lip dark markings; dorsal part of fore and hindlimbs deep brown with cross bands; posterior part of thigh with irregular block markings; ventral part of throat black (triangular shaped markings), half of
vocal sacs black and remaining half white; ventral part of chest, belly and thigh white, ventral surface of webbing of hindlimbs grey.

**Male secondary sexual characters:** Nuptial pads oval shaped; vocal sacs paired with a pair of rounded openings, in the floor of buccal cavity on both sides; other male secondary sexual characters are absent. Throat coloration dark patches in the form of a pair of triangle.

**DESCRIPTION OF ADULT FEMALE** (*F. nepalensis*)

The description (all measurements in mm) is based on 10 adult females. Measurements are given in Table 5.

**Body and head:** Rather small size frog (SVL 32.72 – 37.9 mm); body rather elongate; head small, longer than wide (HW 11.06 – 12.38; HL 12.48 – 14.58; MN 10.07 – 12.36; MFE 8.66 – 10.08; MBE 5.1 – 6.1 mm); snout pointed projecting beyond the mouth, its length SL (4.8 – 6.24 mm) longer than the horizontal diameter of the eye (EL 4,54 – 5.04 mm); canthus rostralis sharp, loreal region obtusely concave; interorbital space flat, less (IUE 1.66 – 1.88 mm) than upper eyelid UEW 7.18 – 8.48 mm) and internasal distance (IN 2.92 – 3.5 mm); distance between front of eyes (IFE 4.48 – 5.2 mm) 1.8 times in distance between back of eyes (IBE 8.0 – 9.02 mm); nostrils rounded, as close to tip of snout (NS 1.96 – 2.88 mm) than to eye (EN 2,58 – 3.1 mm); pupils rounded, horizontal; tympanum distinct, rounded, its diameter (TYD 1.94 – 2.2 mm) less than half the diameter of the eye, larger than distance from tympanum to eye (TYE 52
vomerine teeth present between choanae with an angle relative to body axis, less closer to choanae than from each other, longer than distance between them; tongue moderate, notched, lingual papilla absent; supratympanic fold distinct, from back of the eye to base of the forelimb; parotid glands absent; cephalic ridges absent; co-ossified skin absent.

**Forelimbs:** Arm thin, fore-arm (FLL 6.48 – 8.38 mm) shorter than hand (HAL 7.84 – 9.6; TFL 3.62 – 4.54 mm); relative length of fingers: II< I< IV< III; tips of fingers pointed; fingers without dermal fringe, webbing absent; subarticular tubercles small, prominent, rounded, single, all present; palmar tubercles: 3, oval, small and prominent, prepollex oval and prominent.

**Hindlimbs:** Tibiotarsal articulation reaching eyes, heels overlapping when hindlimbs folded at right angles to the body; tibia more than three times longer (TL 15.9 – 20.62 mm) than wide (TW 4.5 – 6.5 mm), longer than thigh (FL 13.62 – 18.38 mm), and shorter than distance from base of internal metatarsal tubercle to tip of toe IV(FOL 16.32 – 21.44 mm); toes long and thin, length of toe IV(FTL 9.38 – 12.0mm)2.3 times in distance from the base of tarsus to tip of toe IV(TFOL 21.12 – 28.56 mm); relative length of toes: I<II< III< V< IV; tips of toes pointed, toes not fully webbed (webbing moderate), one phalange of fourth toe free; dermal fringe absent; subarticular tubercles small but prominent, rounded, simple, all
present; inner metatarsal tubercle distinct, oval and its length (IMT 1.44 – 2.02 mm) 2.0 times in length of toe I (ITL 2.94 – 3.9 mm); outer metatarsal tubercle present but feebly developed. The width of webbing between 4th and 5th toe is much larger than the other one.

**Skin**: Skin granular (fine) on dorsal parts of head and body, dorsum with prominent several fine glandular folds; upper part of flank granular (fine) but lower part smooth; latero-dorsal fold absent, “fejervarya” line present but not in all; dorsal part of forelimb smooth, thigh granular (fine), leg granular (fine), tarsus smooth; ventral parts of head, body and limbs smooth; macro gland absent.

**Coloration in life**: Dorsal parts of head and dorsum deep brown with dark spots of varying size and shape; a prominent dark band present between two eyelids; upper part of flank deep brown, lower part deep brown with marbling, loreal region deep brown, tympanum and tympanic region light brown; upper lip with dark markings; dorsal part of forelimbs and hindlimbs deep brown; with cross bands posterior part of thigh with irregular black markings; ventral part of throat with numerous black spots belly and thigh white, ventral surface of webbing of hindlimbs grey.

**Female secondary sexual characters**: Oviduct zigzag, translucent; ovary with oocytes, small, pigmented, black and whitish; other female secondary sexual characters are absent.
SEXUAL DIMORPHISM

Sexual dimorphism is very much prominent in *Fejervarya nepalensis*. The body size is comparatively smaller in male than in female. The size of tympanum is larger in female than in male. During breeding season the male can easily be identified by the presence of nuptial pads and vocal sacs. The colour of the throat is remarkable in male. The throat region of *Fejervarya nepalensis* male is black (triangular shaped). While in female the throat region have numerous black spots.
Table-5: Measurements of males and females of *Fejervarya nepalensis*

<table>
<thead>
<tr>
<th>Measurement (in mm)</th>
<th>Range Male</th>
<th>Mean ± standard deviation(Male)</th>
<th>Range Female</th>
<th>Mean ± standard deviation (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVL</td>
<td>25.6 - 28.04</td>
<td>26.46 ± 0.94</td>
<td>32.72 - 37.9</td>
<td>35.53 ± 1.55</td>
</tr>
<tr>
<td>HW</td>
<td>8.82 - 9.66</td>
<td>9.28 ± 0.35</td>
<td>11.06 - 12.38</td>
<td>11.86 ± 0.46</td>
</tr>
<tr>
<td>HL</td>
<td>9.88 - 11.6</td>
<td>10.77 ± 0.53</td>
<td>12.48 - 14.9</td>
<td>14.0 ± 0.77</td>
</tr>
<tr>
<td>MN</td>
<td>8.54 - 9.78</td>
<td>9.19 ± 0.39</td>
<td>10.7 - 12.36</td>
<td>11.64 ± 0.51</td>
</tr>
<tr>
<td>MFE</td>
<td>7.02 - 7.82</td>
<td>7.48 ± 0.30</td>
<td>8.66 - 10.08</td>
<td>9.39 ± 0.48</td>
</tr>
<tr>
<td>MBE</td>
<td>3.76 - 4.38</td>
<td>4.11 ± 0.24</td>
<td>5.1 - 6.1</td>
<td>5.55 ± 0.37</td>
</tr>
<tr>
<td>IFE</td>
<td>2.64 - 4.12</td>
<td>3.83 ± 0.16</td>
<td>4.48 - 5.2</td>
<td>4.79 ± 0.26</td>
</tr>
<tr>
<td>IBE</td>
<td>6.22 - 7.2</td>
<td>7.0 ± 0.35</td>
<td>8.0 - 9.02</td>
<td>8.65 ± 0.37</td>
</tr>
<tr>
<td>FLL</td>
<td>4.84 - 5.48</td>
<td>5.23 ± 0.27</td>
<td>6.48 - 8.38</td>
<td>7.39 ± 0.58</td>
</tr>
<tr>
<td>HAL</td>
<td>6.02 - 6.9</td>
<td>6.49 ± 0.32</td>
<td>7.22 - 9.6</td>
<td>8.63 ± 0.81</td>
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<tr>
<td>TFL</td>
<td>2.96 - 3.4</td>
<td>3.19 ± 0.16</td>
<td>3.62 - 4.54</td>
<td>4.17 ± 0.33</td>
</tr>
<tr>
<td>TL</td>
<td>11.8 - 12.76</td>
<td>12.49 ± 0.34</td>
<td>15.9 - 20.62</td>
<td>18.49 ± 1.56</td>
</tr>
<tr>
<td>FOL</td>
<td>12.86 - 15.28</td>
<td>14.20 ± 0.91</td>
<td>16.32 - 21.44</td>
<td>19.55 ± 1.67</td>
</tr>
<tr>
<td>FTL</td>
<td>7.34 - 8.82</td>
<td>8.09 ± 0.55</td>
<td>9.38 - 12.0</td>
<td>11.21 ± 0.93</td>
</tr>
<tr>
<td>IN</td>
<td>2.26 - 2.66</td>
<td>2.46 ± 0.15</td>
<td>2.92 - 3.5</td>
<td>3.08 ± 0.18</td>
</tr>
<tr>
<td>EN</td>
<td>2.1 - 2.3</td>
<td>2.17 ± 0.06</td>
<td>2.58 - 3.1</td>
<td>2.88 ± 0.18</td>
</tr>
<tr>
<td>EL</td>
<td>3.7 - 4.64</td>
<td>4.01 ± 0.31</td>
<td>4.54 - 5.04</td>
<td>4.77 ± 0.17</td>
</tr>
<tr>
<td>TYD</td>
<td>1.62 - 1.82</td>
<td>1.72 ± 0.07</td>
<td>1.94 - 2.2</td>
<td>2.05 ± 0.09</td>
</tr>
<tr>
<td>TYE</td>
<td>0.7 - 0.94</td>
<td>0.75 ± 0.08</td>
<td>0.96 - 1.18</td>
<td>1.04 ± 0.06</td>
</tr>
<tr>
<td>IUE</td>
<td>1.14 - 1.58</td>
<td>1.33 ± 0.16</td>
<td>1.66 - 1.88</td>
<td>1.74 ± 0.08</td>
</tr>
<tr>
<td>UEW</td>
<td>2.4 - 3.0</td>
<td>2.68 ± 0.21</td>
<td>3.22 - 3.9</td>
<td>3.57 ± 0.23</td>
</tr>
<tr>
<td>IMT</td>
<td>1.18 - 1.46</td>
<td>1.29 ± 0.09</td>
<td>1.44 - 2.02</td>
<td>1.76 ± 0.16</td>
</tr>
<tr>
<td>ITL</td>
<td>2.2 - 2.54</td>
<td>2.31 ± 0.12</td>
<td>2.94 - 3.9</td>
<td>3.57 ± 0.28</td>
</tr>
<tr>
<td>FL</td>
<td>10.94 - 12.9</td>
<td>12.08 ± 0.622</td>
<td>5.64 - 18.38</td>
<td>15.40 ± 3.70</td>
</tr>
<tr>
<td>SL</td>
<td>4.04 - 4.84</td>
<td>4.30 ± 0.261</td>
<td>4.8 - 6.24</td>
<td>5.64 ± 0.48</td>
</tr>
<tr>
<td>NS</td>
<td>2.0 - 2.26</td>
<td>2.09 ± 0.087</td>
<td>1.96 - 2.88</td>
<td>2.58 ± 0.29</td>
</tr>
<tr>
<td>TW</td>
<td>3.42 - 4.18</td>
<td>3.81 ± 0.281</td>
<td>4.5 - 6.5</td>
<td>5.13 ± 0.56</td>
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<td>TFOL</td>
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<td>18.88 ± 1.175</td>
<td>21.12 - 28.56</td>
<td>25.5 ± 2.30</td>
</tr>
</tbody>
</table>
*Fejervarya pierrei* (Dubois, 1975)

Plate-II (Fig. 11)

**Material examined:** One male and one female.

**Distribution:** This species occurs in central and eastern Nepal, in southern and southeastern Bangladesh, and in Assam (Borthakur et al. 2007).

**Description:**

**Head:** Head longer than wide, snout pointed, projecting much beyond the lower jaw, loreal region concave; nostrils slightly nearer to tip of snout than to eyes; tympanum distinct.

**Forelimbs:** Thin and short, fingers free, tips of fingers pointed, subarticular tubercles prominent.

**Hindlimbs:** Thin and long, tibiotarsal articulation reaching anterior corner of eyes, toes two-third webbed, tips of toes pointed, inner metatarsal tubercle present, outer metatarsal tubercle is very small.

**Skin:** Irregular longitudinal folds on the dorsum prominent, ventral surface smooth.

**Colouroation:** The live colouration of the specimen is dorsally dark brown, a broad whitish mid dorsal line present from snout to vent, limbs cross banded.
Morphometric measurement (in mm): Small sized frog, snout vent length (SVL) 26.7 (male); 38.24 (female); length of head (HL) 10.6 – 14.8; width of head (HW) 8.06 – 12.6; length of snout (SL) 4.62 – 6.16; length of eye (EL) 3.1 – 4.0; inter orbital space (IUE) 1.24 – 1.92; length of arm (FLL) 4.42 – 6.46; length of tympanum (TYD) 1.82 – 2.1; relative length of fingers III>IV>I>II; length of tibia (TL) 13.66 – 19.9; relative length of toes IV>III>V>II>I.

Status: IUCN Red List Category: Least Concern (LC).

Fejervarya syhadrensis (Annandale, 1919)

Material examined: One male and one female.

Distribution: This species is widely distributed over much of central northern India and western Peninsular India, southern Nepal, eastern Pakistan and Bangladesh. It is found at elevation below 2000 m asl. It has been reported from Assam (Borthakur et al. 2007).

Description:

Head: Longer than wide, snout pointed, projecting beyond mouth; loreal region concave; nostrils slightly closer to tip of snout than to eyes; tympanum small and distinct.

Forelimbs: Thin and moderately long; fingers free and tips of fingers pointed; subarticular tubercles small and prominent.
**Hindlimbs:** Long and thin, tibiotarsal articulation reaching anterior corner of the eyes; webbing moderate; tips of toes pointed; inner metatarsal tubercle present and elongated in shape, outer metatarsal tubercle very small.

**Skin:** A narrow dull white mid dorsal line is present, skin with small glandular folds dorsally and ventrally smooth.

**Colouration:** The live colouration of the specimen is dark brown dorsally and white ventrally.

**Morphometric measurements (in mm):** Large sized frog, snout vent length (SVL) 81.4 (females); length of head (HL) 31.0; width of head (HW) 27.16; length of snout (SL) 13.2; length of eye (EL) 7.4; inter orbital space (IUE) 7.04; length of arm (FLL) 18.0; length of tympanum (TYD) 5.5; relative length of fingers III>IV>V>II; length of tibia (TL) 45.3; relative length of toes IV>V>III>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

*Fejervarya teraiensis* (Dubois, 1984)

Plate - II (Fig. 10)

**Material examined:** 9 males and 11 females

**Distribution:**

*Fejervarya teraiensis* was originally described by Dubois in 1884 from Nepal and was placed in the genus *Rana* and subgenus *Fejervarya.*
*F. teraiensis* is included in IUCN Red list category as Least Concern (LC) species because of their wide distribution, large population and tolerance of a broad range of habitats. This species has a large distribution in Northeastern region of India. Bordoloi et al. (2002) recorded the species from Dehang-Debang Biosphere Reserve of Arunachal Pradesh. Ao, Bordoloi and Ohler (2003) reported *F. teraiensis* from the state of Nagaland. Mathew and Sen (2005) provided a record from North East India. Nigombam and Bordoloi (2007) provided a record from Manipur. Borthakur et al. (2007) have described *F. teraiensis* from Assam. It is commonly found in open grasslands, nearby area of shallow pools and water bodies, paddy fields etc. In spite of the large population and common occurrence scientific data and information are not available on tadpole taxonomy as well as on normal development.

**DESCRIPTION OF ADULT MALE (*F. teraiensis*)**

The description (all measurements in mm) is based on 9 adult males. Measurements are given in Table 6.

**Body and Head:** Rather small size frog (SVL 38.04 – 50.9 mm, body rather elongate; head moderate, longer than wide (HW 12.66 – 17.2 mm; HL 14.84 – 18.7 mm); snout pointed projecting beyond the mouth, its length (SL 6.38 – 8.06 mm) longer than the horizontal diameter of the eye (EL 5.04 – 6.26 mm); canthus rostralis sharp, loreal region obtusely concave; inter orbital space flat less (IUE 2.0 – 2.34 mm) than upper eye
lid (UEW 4.08 – 4.8 mm) and internasal distance (IN 3.1 – 4.08 mm); distance between front of eyes (IFE 4.92 – 6.28 mm) 1.8 times in distance between back of eyes (IBE 8.8 – 11.68 mm); nostrils rounded, as close to tip of snout (NS 2.74 – 3.98 mm) than to eye (EN 3.12 – 4.0 mm); pupils rounded, horizontal; tympanum distinct, rounded, its diameter (TYD 2.4 – 2.9 mm) less than half the diameter of the eye, larger than distance from tympanum to eye (TYE 1.38 – 1.82 mm); vomerine teeth present between choanae with an angle relative to body axis, less close choanae than from each other, longer than distance between them; tongue moderate, notched, median lingual projection absent; supratympanic fold distinct, from back of the eye to base of the fore limb; parotid glands absent; cephalic ridge absent; co ossified skin absent.

**Forelimbs:** Arm strong, fore arms (FLL 7.56 – 10.26 mm) shorter than hand (HAL 8.86 – 10.70 mm; TFL 4.1 – 5.72 mm); relative length of fingers: II<1<IV<III; tips of fingers pointed; fingers without dermal fringe, webbing absent; subarticular tubercles prominent, rounded, single; prepollex prominent and oval, palmer tubercles: 3, oval and prominent.

**Hindlimbs:** Tibiotarsal articulation reaching tympanum or back of eye, hills overlapping when hind limbs folded at right angle of the body, tibia nearly 3 times longer (TL 15.80 – 24.92 mm) than wide (TW 5.3 – 7.18 mm), shorter than thigh (FL 15.96 – 21.10 mm) and shorter than distance from base of metatarsal tubercle to tip of toe IV (FOL 18.2 – 23.74 mm);
toes long than thin, length of toe IV (FTL 10.38 – 13.7 mm) 2.2 times in
distance from base of tarsus to tip of toe IV (TFOL 23.1 – 31.68 mm);
relative length of toes: I<II<III<V<IV; tips of toes pointed, toes not fully
webbed. One phalange of fourth toe free; dermal fringe absent;
subarticular tubercles small but prominent, rounded, simple, all present,
inner metatarsal tubercle distinct, oval and its length (INT 1.78 – 2.64
mm) 1.6 times in length of toes I (ITL 3.5 – 4.92 mm); outer metatarsal
tubercle present but feebly developed.

Skin: Skin granular on snout, between eyes, side of head, on upper
eyelids, and on dorsum and flanks; dorsum with several longitudinal
prominent glandular folds; latero-dorsal folds absent; “fejervarya” line
present; dorsal part of forelimb smooth, thigh granular, leg granular,
tarsus smooth; ventral part of head, body and limbs smooth; macroglands
absent.

Coloration in life: Dorsal part of head and dorsum deep brown with
irregular dark grey markings of varying size and shape; a prominent dark
band present between two eyelids; upper part of flank deep brown with
marbling, lower part white, loreal region deep brown, tympanum and
tympanic region light brown; upper lip with dark markings; dorsal side of
fore and hind limbs deep brown with cross bands; posterior part of thigh
with irregular black markings; ventral part of throat black (M shaped),
margin of throat black, half of vocal sacs black and remaining half white;
ventral part of chest, belly and thigh white, ventral surface of webbing of hindlimbs grey.

Secondary sexual character: Nuptial pads oval shaped; vocal sacs paired with a pair of rounded openings, in the floor of buccal cavity on both sides. Throat region have dark patch in the shape of a M. Other male secondary sexual characters are absent.

DESCRIPTION OF ADULT FEMALE (F. teraiensis)

The description (all measurements in mm) is based on 11 adult females. Measurements are given in Table 6.

Body and Head: Rather small sized frog (SVL 45.6-55.16), body rather elongate; head longer than wide (HW 15.48-19.50 mm; HL 16.62-19.88 mm; MN 14.12-16.9 mm; MFE 10.9-13.4 mm; MBE 6.28-8.38 mm); snout pointed, projecting beyond the mouth, its length (SL 6.7-8.84 mm) longer than the horizontal diameter of the eye (EL 5.14-6.6 mm); canthus rostralis sharp, loreal region obtusely concave; interorbital space flat less (IUE 2.02-2.76) than upper eyelid (UEW 4.20-5.54 mm) and internasal distance (IN 3.2-4.12 mm); distance between front of eyes (IFE 5.52-6.56 mm) 1.8 times in distance between back of eyes (IBE 10.48-12.26 mm; nostrils rounded, as close to tip of snout (NS 2.74-3.98 mm) than to eye (EN 3.66-4.62 mm) pupils rounded, horizontal; tympanum distinct, rounded, its diameter (TYD 2.54-3.1 mm) less than half the diameter of the eye, larger than distance from tympanum to eye (TYE 1.66-2.28 mm);
vomerine teeth present between choanae with an angle relative to body axis, less close to choanae than from each other, longer than distance between them; tongue moderate, notched, lingual papilla absent; supratympanic fold distinct, from back of the eye to base of the forelimb; parotid glands absent; cephalic ridges absent; co-ossified skin absent.

**Forelimbs:** Arm strong, fore-arm (FLL 9.08-11.48 mm) shorter than hand (HAL 9.32-11.78 mm); relative length of fingers: II<|I<IV<III; tips of fingers pointed; fingers without dermal fringe, webbing absent; subarticular tubercles prominent, rounded, single, all present; prepollex prominent and oval, palmar tubercles: 3, oval and prominent.

**Hindlimbs:** Tibiotarsal articulation reaching tympanum or back of eye, heels overlapping when hindlimbs folded at right angles to the body; tibia nearly three times longer (TL 20.46 – 27.52 mm) than wide (TW 6.98-9.8 mm), longer than thigh (FL 18.9-24.18 mm) and shorter than distance from base of inner metatarsal tubercle to tip of toe IV (FOL 20.12 – 25.90 mm); toes long and thin, length of toe IV (FTL 11.42 – 15.64 mm) 2.3 times in distance from base of tarsus to tip of toe IV (TFOL 27.04 – 38.56 mm); relative length of toes : I<II<III<IV<IV; tips of toes pointed, toes not fully webbed, one phalange of fourth toe free; dermal fringe absent; subarticular tubercles small but prominent, rounded, simple, all present; inner metatarsal tubercle distinct, oval and its length (IMT 2.3 – 3.08 mm)
1.5 times in length of toe I (ITL 3.12 – 5.64 mm); outer metatarsal tubercle present but feebly developed.

**Skin:** Skin granular on snout, between eyes, side of head, on upper eyelids, on dorsum and flanks; dorsum with prominent several longitudinal glandular folds; latero-dorsal folds absent; “fejervarya” line present; dorsal part of forelimb smooth, thigh and leg granular, tarsus smooth; ventral parts of throat, chest, belly, and thigh smooth; macroglands absent.

**Coloration in life:** Dorsal part of head and dorsum deep brown with irregular dark grey markings of varying size and shape; a prominent dark band present between two eyelids; upper part of flank deep brown with marbling, lower part white, loreal region deep brown, tympanum and tympanic region light brown; upper lip with dark markings; dorsal surface of fore and hindlimbs deep brown with cross bands; posterior part of thigh with irregular dark markings; ventral part of throat, chest, belly and thigh white, ventral surface of webbing of hindlimbs grey.

**Secondary sexual character:** Oviduct zigzag, translucent; ovary with oocytes, small, pigmented, black and whitish; other female secondary sexual characters are absent.
SEXUAL DIMORPHISM

Sexual dimorphism is very much prominent in *Fejervarya teraiensis*. The body size is comparatively smaller in male than in female. The size of tympanum is larger in female than in male. During breeding season the male can easily be identified by the presence of nuptial pads and vocal sacs. The colour of the throat is remarkable in male. The throat region of male is black (M shaped) and the female is completely white.
Table 6: Measurements of males and females of *Fejervarya teraiensis*

<table>
<thead>
<tr>
<th>Measurement (in mm)</th>
<th>Range</th>
<th>Mean ± standard deviation(Male)</th>
<th>Range</th>
<th>Mean ± standard deviation (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVL</td>
<td>38.04 - 50.9</td>
<td>42.38 ± 3.84</td>
<td>44.66 - 55.16</td>
<td>48.85 ± 3.80</td>
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<tr>
<td>HW</td>
<td>12.66 - 17.2</td>
<td>14.34 ± 1.52</td>
<td>15.48 - 19.5</td>
<td>17.0 ± 1.48</td>
</tr>
<tr>
<td>MN</td>
<td>12.38 - 15.4</td>
<td>13.52 ± 1.07</td>
<td>14.12 - 16.9</td>
<td>15.42 ± 0.81</td>
</tr>
<tr>
<td>MFE</td>
<td>10.2 - 12.58</td>
<td>10.87 ± 0.98</td>
<td>10.9 - 13.4</td>
<td>12.2 ± 0.85</td>
</tr>
<tr>
<td>MBE</td>
<td>5.0 - 7.64</td>
<td>6.21 ± 0.87</td>
<td>6.28 - 8.38</td>
<td>7.50 ± 0.74</td>
</tr>
<tr>
<td>IFE</td>
<td>4.92 - 6.28</td>
<td>5.47 ± 0.48</td>
<td>5.52 - 6.56</td>
<td>5.90 ± 0.32</td>
</tr>
<tr>
<td>IBE</td>
<td>8.8 - 11.68</td>
<td>10.25 ± 0.85</td>
<td>10.48 - 12.26</td>
<td>11.26 ± 0.68</td>
</tr>
<tr>
<td>FLL</td>
<td>7.56 - 10.26</td>
<td>8.72 ± 0.96</td>
<td>9.08 - 11.48</td>
<td>10.13 ± 0.87</td>
</tr>
<tr>
<td>HAL</td>
<td>8.86 - 10.7</td>
<td>9.41 ± 0.72</td>
<td>9.32 - 11.78</td>
<td>10.54 ± 0.87</td>
</tr>
<tr>
<td>TFL</td>
<td>4.1 - 5.72</td>
<td>4.62 ± 0.48</td>
<td>4.52 - 6.42</td>
<td>5.54 ± 0.64</td>
</tr>
<tr>
<td>TL</td>
<td>15.8 - 24.92</td>
<td>19.15 ± 3.04</td>
<td>20.46 - 27.52</td>
<td>24.17 ± 2.41</td>
</tr>
<tr>
<td>FOL</td>
<td>18.2 - 23.74</td>
<td>20.5 ± 1.83</td>
<td>20.12 - 27.7</td>
<td>24.43 ± 2.52</td>
</tr>
<tr>
<td>FTL</td>
<td>10.38 - 13.7</td>
<td>11.74 ± 1.07</td>
<td>11.42 - 15.64</td>
<td>14.08 ± 1.36</td>
</tr>
<tr>
<td>IN</td>
<td>3.1 - 4.08</td>
<td>3.42 ± 0.34</td>
<td>3.2 - 4.12</td>
<td>3.80 ± 0.30</td>
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<tr>
<td>EN</td>
<td>3.12 - 4.0</td>
<td>3.44 ± 0.32</td>
<td>3.66 - 4.62</td>
<td>4.07 ± 0.30</td>
</tr>
<tr>
<td>EL</td>
<td>5.04 - 6.26</td>
<td>5.54 ± 0.45</td>
<td>5.14 - 6.6</td>
<td>5.79 ± 0.48</td>
</tr>
<tr>
<td>TYD</td>
<td>2.4 - 2.9</td>
<td>2.53 ± 0.19</td>
<td>2.54 - 3.1</td>
<td>2.77 ± 0.20</td>
</tr>
<tr>
<td>TYE</td>
<td>1.38 - 1.82</td>
<td>1.53 ± 0.15</td>
<td>1.66 - 2.28</td>
<td>2.05 ± 0.21</td>
</tr>
<tr>
<td>IUE</td>
<td>1.96 - 2.34</td>
<td>2.09 ± 0.14</td>
<td>2.02 - 2.76</td>
<td>2.49 ± 0.27</td>
</tr>
<tr>
<td>UEW</td>
<td>4.08 - 4.8</td>
<td>4.24 ± 0.22</td>
<td>4.2 - 5.54</td>
<td>4.79 ± 0.42</td>
</tr>
<tr>
<td>IMT</td>
<td>1.78 - 2.64</td>
<td>2.21 ± 0.27</td>
<td>2.3 - 3.12</td>
<td>2.66 ± 0.31</td>
</tr>
<tr>
<td>ITL</td>
<td>3.5 - 4.92</td>
<td>4.0 ± 0.43</td>
<td>3.12 - 5.64</td>
<td>4.95 ± 0.77</td>
</tr>
<tr>
<td>FL</td>
<td>15.96 - 21.1</td>
<td>18.19 ± 1.90</td>
<td>18.9 - 24.18</td>
<td>22.03 ± 2.16</td>
</tr>
<tr>
<td>SL</td>
<td>6.38 - 8.06</td>
<td>6.83 ± 0.64</td>
<td>6.7 - 8.84</td>
<td>7.79 ± 0.66</td>
</tr>
<tr>
<td>NS</td>
<td>2.74 - 3.98</td>
<td>3.25 ± 0.364</td>
<td>2.74 - 3.98</td>
<td>3.43 ± 0.36</td>
</tr>
<tr>
<td>TW</td>
<td>5.3 - 8.3</td>
<td>6.26 ± 0.912</td>
<td>6.98 - 9.8</td>
<td>8.07 ± 0.98</td>
</tr>
<tr>
<td>TFOL</td>
<td>23.1 - 31.68</td>
<td>26.74 ± 3.021</td>
<td>27.04 - 38.56</td>
<td>33.12 ± 3.578</td>
</tr>
</tbody>
</table>
*Hoplobatrachus crassus* (Jerdon 1853)

Plate - 1 (Fig 1)

**Material Examined:** 2 males, 3 females.

**Distribution:**

- **Global:** The species is present throughout most of South Asia in Bangladesh, India, Nepal and Sri Lanka.
- **India:** Assam, Arunachal Pradesh, Nagaland, Peninsular India, South Central and Eastern India.

**Description:**

- **Head:** Longer than wide, snout pointed, loreal region concave, tympanum distinct.

- **Forelimbs:** Forelimbs short, Fingers free, without discs, subarticular tubercle oval prominent.

- **Hindlimbs:** Moderately long tibiotarsal articulation reaches back of tympanum. Toes entirely webbed. Tip of toes without discs, inner metatarsal tubercle shovel shaped. The heels do not overlap, and length of tibia as long as thigh.

- **Skin:** Dorsal surface of head, body and limbs smooth. Glandular fold present dorsally, ventral skin smooth.

- **Colouration:** Dorsal surface of male dark with black spots, ventral surface creamy white with black patches on the throat region. Colour of the female is also same with male.
Morphometric measurements (in mm): Snout vent length (SVL) 68.8 - 70.54 (Male); 74.5 - 79.28 (Female). Length of head (HL) 26.3 - 30.96, width of head (HW) 23.34 - 27.56, length of snout (SN) 4.64 - 5.32, length of eye (TYD) 4.28 - 5.5, Inter orbital space (IUE) 2.32 - 3.7, length of arm (FLL) 12.82 - 16.2, length of tympanum (TYE) 2.08 - 3.04, relative length of fingers III>IV>I>II, relative length of toes IV>V>III>II>I, tibia length 30.62 - 37.1.

Status: IUCN Red List Category: Least Concern (LC)

Hoplobatrachus tigerinus (Daudin, 1803)

Plate-I (Fig 2)

Material examined: One male and one female

Distribution: This species is found throughout most wetland areas of India, Bangladesh and much of northern Pakistan, and is recorded from the Southern parts of Nepal, and from upper and northern central Myanmar. It has been reported from Afghanistan also. It is found at elevations between 25 and 800 m asl.

Description:

Head: Triangular, longer than wide snout pointed, projecting beyond lower jaw, Canthus rostralis obtuse loreal region concave; nostrils nearer to tip of snout than eyes; tympanum large and very distinct, vomerine teeth oblique in position.
Forelimbs: Much shorter than hind limbs; fingers free, tips of fingers pointed, subarticular tubercles very prominent.

Hindlimbs: Stout and very long; tibiotarsal articulation reaching back of eye; toes entirely webbed, lips of toes pointed; inner metatarsal tubercle present; outer metatarsal tubercle absent.

Skin: Dorsal skin with short irregular glandular fold, ventral surface smooth. Supratympanic fold extends from eye to shoulder.

Colouration: The live colouration of the specimen is dorsally greenish or brown marked with large irregular blackish spots. A yellow mid dorsal line present from snout to vent. Limbs cross banded.

Morphometric measurement (in mm): Large sized frog, snout vent length (SVL) 77.0 (male); 109.9 (female); length of head (HL) 32.4 – 42.7; width of head (HW) 28.14 – 38.4; length of snout (SL) 14.5 – 17.9; length of eye (EL) 8.1 – 9.2; inter orbital space (IUE) 2.34 - ; length of arm (FLL) 14.8 – 20.0; length of tympanum (TYD) 5.5 – 7.7; relative length of fingers III>IV>I>II; length of tibia (TL) 40.8 – 55.6; relative length of toes IV>III>V>II>I

Remarks: This species is edible among the tea garden labours and a large numbers have been consumed in each breeding season.

Status: IUCN Red List Category: Least Concern (LC).
*Hylarana erythraea* (Schlegel, 1837)

**Material examined:** One female.

**Distribution:** This species is widely spread in Asia. It is found in Cambodia, Indonesia, Lao People’s Democratic Republic, Malaysia, Myanmar, Singapore, Thailand and Vietnam.

**Description:**

**Head:** Longer than wide, snout pointed, projecting beyond lower jaw; tympanum very large and distinct; vomerine teeth oblique in position. Nostrils nearer to tip of snout than to eyes.

**Forelimbs:** Moderately long, fingers free, tips of fingers dilated into discs having circum-ventral grooves; subarticular tubercles present and round shaped.

**Hindlimbs:** Long and slender; tibiotarsal articulation reaching between eyes and nostrils; toes moderately webbed, tips of toes with discs having circum-ventral grooves, inner metatarsal tubercle present and oval shaped, subarticular tubercles oval and prominent; outer metatarsal tubercle absent.

**Skin:** Dorsal surface of body smooth, dorso-lateral fold present from eyes to groin.

**Colouration:** Live colouration of the specimen is dull green dorsally, upper lip and ventral surfaces whitish; limbs without cross bands.
Morphometric measurements (in mm): Large-sized frog, snout vent length (SVL) 81.4 (females); length of head (HL) 31.0; width of head (HW) 27.16; length of snout (SL) 13.2; length of eye (EL) 7.4; interorbital space (IUE) 7.04; length of arm (FLL) 18.0; length of tympanum (TYD) 5.5; relative length of fingers III>IV>I>II; length of tibia (TL) 45.3; relative length of toes IV>V>III>II>I.

Status: IUCN Red List Category: Least Concern (LC).

*Hylarana humeralis* (Boulenger, 1887)

Plate-III (Fig. 14)

Material examined: 10 males and 10 females

Distribution: This species is known from northern Myanmar, eastern Bangladesh, eastern Nepal and Northeast India. In Northeast India it is found in Arunachal Pradesh, Assam, Manipur and Nagaland.

*Hylarana humeralis* was originally described by Boulenger in 1887 from upper Burma (Myanmar) and was placed in the genus *Rana*. But it was subsequently placed in the section *Hylarana* of the genus *Rana* by Dubois (1992), in the sub-genus *Humerana* Dubois (1992). Schleich and Kaestle (2002) reported this frog from Nepal. This species was subsequently reported as new record for India from Nagaland and Assam by AO et al. in 2003. Asmat et al. (2003) have reported this species from

**DESCRIPTION OF ADULT MALE** (*H. humeralis*)

The description (all measurements in mm) is based on 10 adult males. Measurements are given in Table 7.

**Size and general aspect:** Specimen of moderate size (SVL 54.1-63.06 mm), body rather elongate.

**Head:** Head moderate, longer than wide (HW 17.1-21.42), HL 21.7-24.78 mm), flat above. Snout rounded protruding beyond the mouth, its length (SL 9.08-11.36 mm) longer than the horizontal diameter of eye (EL 5.5-7.4 mm). Canthus rostralis sharp, loreal region concave. Interorbital space flat, less (IUE 3.34-5.3 mm) than upper eyelid (UEW 4.4-5.72 mm) and internasal distance (IN 5.64-6.18 mm); distance between front of eyes (IFE 8.4-10.16 mm) 1.5 times in distance between back of eyes (IBE 13.1-15.66 mm). Nostrils rounded with flap of skin laterally, closer to tip of
snout (NS 3.46-4.08 mm) than to eye (EN 5.1-6.4 mm). Pupils rounded, horizontal. Tympanum very distinct, rounded, horizontal; its diameter (TYD 3.9-5 mm) more than half the diameter of the eye, larger than distance from tympanum to eye (TYE 0.7-1.24 mm). Pineal ocellus absent. Vomerine ridge present, bearing few small teeth, anterior to choanae with an angle relative to body axis, close to choanae than from each other, as long as distance between them. Tongue moderate notched, median lingual projection absent. Tooth – like projections on maxilla absent. Supratympanic folds absent. Parotid glands absent. Cephalic ridges absent. Co-ossified skin absent.

**Forelimbs:** Arm long, strong fore – arm (FLL 10.66-13.32 mm) shorter than hand (HAL 13.94-16.92 mm; TFL 8.16-9.36 mm). Relative length of fingers, shortest to longest: I < II < IV < III. Tips of finger rounded, enlarged; discs present on fingers I – II – III – IV with distinct latero–ventral grooves. Fingers without dermal fringe, webbing absent. Subarticular tubercles prominent, rounded, single, all present. Prepollex oval and prominent, two oval flat palmar tubercles, supernumerary tubercles absent.

**Hindlimbs:** Tibiotarsal articulation reaching the nostrils, heels overlapping when the hindlimbs are folded at right angles to the body. Tibia nearly 4.7 times longer (TL 29.22-35mm) than wide (TW 6-8.4mm) longer than thigh (FL 24.46-30.44mm) as long as distance from base of
internal metatarsal tubercle to tip of toe IV (FOL 29.3-34.24mm). Toes long and thin, length of toe IV (FTL 16.52-19.5 mm) nearly 2.3 times in distance from base of tarsus to tip of toe IV (TFOL 39.5-48.94 mm). Relative length of toes, shortest to longest: I < II < III < V < IV. Tips of toes pointed, enlarged, disc present on all toes with distinct latero-ventral grooves. Webbing is not complete, webbing formula: I 0 – ½ II 0 – 1 III 0 – 1½ IV – 0 V. Dermal fringe absent. Subarticular tubercles prominent, rounded, all present. Inner metatarsal tubercle distinct, oval and its length (IMT 2.34-3.2 mm) 2.7 times in length of toe I (ITL 6.42-8.48mm). Tarsal fold absent. Outer metatarsal tubercle absent.

**Skin:** Dorsal and lateral parts of head and body: snout, between eyes and side of head smooth, dorsum and flank granular. Latero-dorsal folds prominent, glandular, from eye to hip. ‘Fejervarya’ line absent, lateral line system absent. Dorsal part of forelimbs smooth, thigh granular, leg granular, tarsus smooth; ventral parts of head, body and limbs smooth. Humeral gland present on the forelimb slight ventral to insertion of upper arm.

**Coloration in life:** Dorsal part of head and dorsum brown with few small round black spots. Upper part of flank green, lower part light green, loreal region dark brown, tympanic region and tympanum dark brown. Upper lip white, latero- dorsal folds brown. Dorsal part of forelimb, thigh, leg and foot brown. Posterior part of thigh marbling with black markings. Ventral
part of throat, chest, belly and thigh creamy white; webbing grey. Vocal sacs dark in colour.

**Secondary Sexual Characters (Male):** Nuptial pad present and oval shaped. The males have a pair of large external subgular vocal sacs. A large humeral gland present on the base of the forearms. Other male secondary sexual characters are absent.

**DESCRIPTION OF ADULT FEMALE (H. humeralis)**

The description (all measurements in mm) is based on 10 adult males. Measurements are given in Table 7.

**Size and general aspect:** Specimen of moderate size (SVL 54.82-74.62 mm), body rather elongate.

**Head:** Head moderate, longer than wide (HW 17.34-24.84 mm, HL 21.92-29.72 mm), flat above. Snout pointed, protruding beyond the mouth, its length (SL 9.18-12.24 mm) longer than the horizontal diameter of eye (EL 6.28-8.74 mm). Canthus rostralis sharp, loreal region concave. Interorbital space flat, less (IUE 4.54-6.4 mm) than upper eyelid (UEW 5-5.9 mm) and internasal distance (IN 5.3-7.4mm); distance between front of eyes (IFE 9.18-11.9 mm) 1.5 times in distance between back of eyes (IBE 12.94-17.92 mm). Nostrils rounded with flap of skin laterally, closer to tip of snout (NS 3.38-4.7 mm) than to eye (EN 5.54-7.5 mm). Pupils rounded, horizontal. Tympanum very distinct, rounded, horizontal; its diameter (TYD 3.52-5.8 mm) more than half the diameter of the eye,
larger than distance from tympanum to eye (TYE 1.14-2.06 mm). Pineal ocellus absent. Vomerine ridge present, bearing few small teeth, anterior to choanae with an angle relative to body axis, close to choanae than from each other, as long as distance between them, Tongue moderate notched, median lingual projection absent. Tooth-like projections on maxilla absent. Supratympanic folds absent. Parotid glands absent. Cephalic ridges absent. Co-ossified skin absent.

**Forelimbs:** Arm long, strong; fore-arm (FLL 12.3-16.38 mm) shorter than hand (HAL 15.48-20.84 mm; TFL 8.12-11.7 mm). Relative length of fingers, shortest to longest: I < II < IV < III. Tips of finger rounded, enlarged; discs present on fingers I – II – III – IV with distinct latero-ventral grooves. Fingers without dermal fringe, webbing absent. Subarticular tubercles prominent, rounded, single, all present. Prepollex oval and prominent, two oval flat palmar tubercles, supernumerary tubercles absent.

**Hindlimbs:** Tibiotarsal articulation reaching the nostrils, heels overlapping when the hindlimbs are folded at right angles to the body. Tibia nearly 5 times longer (TL 31.36-41.92 mm) than wide (TW 5.1-8.68 mm), longer than thigh (FL 27.44-35.4 mm) as long as distance from base of internal metatarsal tubercle to tip of toe IV (FOL 30.04-41.9 mm). Toes long and thin, length of toe IV (FTL 17.04-23.1 mm) nearly 2.3 times in distance from base of tarsus to tip of toe IV (TFOL 41.32-55.16 mm).
Relative length of toes, shortest to longest: $I < II < III < V < IV$. Tips of toes pointed, enlarged, disc present on all toes with distinct latero-ventral grooves. Webbing is not complete, webbing formula: $I 0 - \frac{1}{2} II 0 \quad I I I 0 - 1\frac{1}{2} IV - 0 V$. Dermal fringe absent. Subarticular tubercles prominent, rounded, all present. Inner metatarsal tubercle distinct, oval and its length (IMT 2.58-3.66 mm) 2.7 times in length of toe I (ITL 5.94-10.04 mm). Tarsal fold absent. Outer metatarsal tubercle absent.

**Skin:** Dorsal and lateral parts of head and body: snout, between eyes and side of head smooth, dorsum and flank granular. Latero-dorsal folds prominent, glandular, from eye to hip. ‘Fejervarya’ line absent, lateral line system absent. Dorsal part of forelimbs smooth, thigh granular, leg granular, tarsus smooth; ventral parts of head, body and limbs smooth. Humeral gland absent on the forelimb.

**Coloration in life:** Dorsal part of head and dorsum brown with few small round black spots. Upper part of flank green, lower part light green, loreal region dark brown, tympanic region and tympanum dark brown. Upper lip white, latero- dorsal folds brown. Dorsal part of forelimb, thigh, leg and foot brown. Posterior part of thigh marbling with black markings. Ventral part of throat, chest, belly and thigh creamy white; webbing grey.

**Secondary sexual characters (Female):** Oviduct zigzag, translucent. Ovary with oocytes, small pigmented, dark brown and whitish; other female secondary sexual characters are absent.
SEXUAL DIMORPHISM

Sexual dimorphism is prominent in *H. humeralis*. The body size is comparatively smaller in adult male (SVL 54.1 – 63.06 mm.) than in adult female (SVL 54.82 – 74.62 mm.). The size of tympanum is slightly larger in female than in male. The tympanum eye distance is also greater in female than in male. Otherwise no marked differences are observed between male and female except the external vocal sacs in males.
<table>
<thead>
<tr>
<th>Measurements (in mm)</th>
<th>Range Male</th>
<th>Mean ± standard deviation (Male)</th>
<th>Range Female</th>
<th>Mean ± standard deviation (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVL</td>
<td>54.1 - 63.06</td>
<td>58.66 ± 2.57</td>
<td>54.82 - 74.62</td>
<td>64.93 ± 6.35</td>
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<tr>
<td>HW</td>
<td>17.1 - 21.42</td>
<td>19.31 ± 1.55</td>
<td>17.34 - 24.84</td>
<td>21.10 ± 2.29</td>
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<td>HL</td>
<td>21.7 - 24.78</td>
<td>23.21 ± 0.95</td>
<td>21.92 - 29.72</td>
<td>25.70 ± 2.25</td>
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<td>MN</td>
<td>17.98 - 20.86</td>
<td>19.37 ± 0.94</td>
<td>18.6 - 25.44</td>
<td>21.71 ± 2.16</td>
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<td>MFE</td>
<td>13.42 - 15.4</td>
<td>14.33 ± 0.66</td>
<td>13.12 - 18.24</td>
<td>15.78 ± 1.63</td>
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<td>MBE</td>
<td>7.14 - 9.22</td>
<td>8.31 ± 0.52</td>
<td>7.62 - 10.68</td>
<td>9.54 ± 1.00</td>
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<tr>
<td>IFE</td>
<td>8.4 - 10.16</td>
<td>9.36 ± 0.55</td>
<td>9.18 - 11.9</td>
<td>10.43 ± 0.93</td>
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<tr>
<td>IBE</td>
<td>13.1 - 15.66</td>
<td>14.39 ± 0.76</td>
<td>12.94 - 17.92</td>
<td>15.42 ± 1.53</td>
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<tr>
<td>FLL</td>
<td>10.66 - 13.32</td>
<td>11.9 ± 0.99</td>
<td>12.3 - 16.38</td>
<td>13.91 ± 1.37</td>
</tr>
<tr>
<td>HAL</td>
<td>13.94 - 16.92</td>
<td>15.82 ± 0.72</td>
<td>15.48 - 20.84</td>
<td>17.73 ± 1.50</td>
</tr>
<tr>
<td>TFL</td>
<td>8.16 - 9.36</td>
<td>8.58 ± 0.35</td>
<td>8.12 - 11.7</td>
<td>9.91 ± 1.11</td>
</tr>
<tr>
<td>TL</td>
<td>29.22 - 35</td>
<td>32.34 ± 1.77</td>
<td>31.36 - 41.92</td>
<td>36.43 ± 3.37</td>
</tr>
<tr>
<td>FOL</td>
<td>29.3 - 34.24</td>
<td>31.92 ± 1.57</td>
<td>30.04 - 41.9</td>
<td>35.74 ± 3.66</td>
</tr>
<tr>
<td>FTL</td>
<td>16.52 - 19.5</td>
<td>18.09 ± 0.94</td>
<td>17.04 - 23.1</td>
<td>20.40 ± 4.02</td>
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<tr>
<td>IN</td>
<td>5.64 - 6.18</td>
<td>5.92 ± 0.20</td>
<td>5.3 - 7.4</td>
<td>6.50 ± 0.64</td>
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<tr>
<td>EN</td>
<td>5.1 - 6.4</td>
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<td>5.54 - 7.5</td>
<td>6.39 ± 0.68</td>
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<tr>
<td>EL</td>
<td>5.5 - 7.4</td>
<td>6.54 ± 0.57</td>
<td>6.28 - 8.74</td>
<td>7.25 ± 0.79</td>
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<td>TYD</td>
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<td>4.58 ± 0.63</td>
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<td>TYE</td>
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<td>1.14 - 2.06</td>
<td>1.48 ± 0.32</td>
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<td>IUE</td>
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<td>4.31 ± 0.47</td>
<td>4.54 - 6.4</td>
<td>5.32 ± 0.57</td>
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<td>UEW</td>
<td>4.4 - 5.72</td>
<td>5.02 ± 0.42</td>
<td>5.0 - 5.9</td>
<td>5.36 ± 0.29</td>
</tr>
<tr>
<td>IMT</td>
<td>2.34 - 3.2</td>
<td>2.77 ± 0.21</td>
<td>2.58 - 3.66</td>
<td>3.11 ± 0.39</td>
</tr>
<tr>
<td>ITL</td>
<td>6.42 - 8.48</td>
<td>7.4 ± 0.58</td>
<td>5.94 - 10.04</td>
<td>8.24 ± 1.30</td>
</tr>
<tr>
<td>FL</td>
<td>24.46 - 30.44</td>
<td>28.28 ± 1.60</td>
<td>27.44 - 35.4</td>
<td>31.32 ± 2.47</td>
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<tr>
<td>SL</td>
<td>9.08 - 11.36</td>
<td>9.94 ± 0.53</td>
<td>9.18 - 12.24</td>
<td>10.85 ± 0.89</td>
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<tr>
<td>NS</td>
<td>3.46 - 4.08</td>
<td>3.69 ± 0.18</td>
<td>3.38 - 4.7</td>
<td>4.03 ± 0.34</td>
</tr>
<tr>
<td>TW</td>
<td>6.0 - 8.4</td>
<td>7.22 ± 0.58</td>
<td>5.1 - 8.68</td>
<td>7.33 ± 1.01</td>
</tr>
<tr>
<td>TFOL</td>
<td>39.5 - 48.94</td>
<td>44.14 ± 2.53</td>
<td>41.32 - 55.16</td>
<td>48.32 ± 4.39</td>
</tr>
</tbody>
</table>
**Hylarana leptoglossa** (Cope, 1868)  
Plate –III (Fig 15)

**Material examined:** 10 males and 10 females

**Distribution:** This species is known from Myanmar, Bangladesh, Thailand and Northeast India.

*Hylarana leptoglossa* was originally described by Cope in 1868 from Burma (Myanmar) and was placed in the genus *Rana*. But subsequently it was placed in the subsection *Hylarana* of the genus *Rana* by Dubois (1992) and in the sub genus *Sylvirana* Dubois, 1992. The type locality of *H. leptoglossa* is Rangoon (Burma). Shortly after its description, the species was collected again at Sibsagar (Assam, India) and described by Anderson (1871) under the name *Hylarana granulosa*. Since then, it has been reported from Thailand (Nabhitabhata, 1989) and Bangladesh (Asmat et al., 2003). In India this species is reported from Assam, Manipur, Meghalaya, Mizoram, Nagaland and West Bengal (Power and Birand 2001; personal observation). Lalremsanga et al. (2007) reported the species from Mizoram. Chanda (1994) provided a brief account on *Rana leptoglossa*. Ahmed et al. (2009) also has described it briefly from northeastern India.
DESCRIPTION OF ADULT MALE (*H. leptoglossa*)

The description (all measurements in mm) is based on 10 adult males. Measurements are given in Table 8.

**Size and general aspect:** Rather moderate sized frog (SVL 45.64-54.56 mm), body rather elongated.

**Head:** Head moderate, longer than wide (HW 14.7-17.28, HL 17.28-20.64 mm), flat above; snout rounded protruding beyond the mouth, its length (SL 6.82-8.82 mm) longer than the horizontal diameter of eye (EL 4.86-5.98 mm); canthus rostralis sharp, loreal region concave; interorbital space flat, less (IUE 3.06-4.3 mm) than upper eyelid (UEW 4.3-5.48 mm) and internasal distance (IN 3.9-5.5 mm); distance between front of eyes (IFE 7.38-9.5 mm) 1.5 times in distance between back of eyes (IBE 11.04-13.34 mm); nostrils rounded without flap of skin laterally, as close to lip of snout (NS 2.38-3.16 mm) than to eye (EN 4.18-4.88 mm); pupil oval horizontal; tympanum very distinct, oval, horizontal, its diameter (TYD 3.78-4.5 mm) more than half the diameter of the eye, larger than distance from tympanum to eye (TYE 0.4-0.84 mm); pineal ocellus absent; vomerine ridge present, bearing few small teeth between choanae with an angle of 45° relative to body axis, less close to choanae than from each other, as long as distance between them; tongue moderate notched, median lingual projection absent; tooth-like projections on
maxilla absent; supratympanic fold absent; parotid glands absent; cephalic ridges absent; co-ossified skin absent.

**Forelimbs:** Arm thin, force - arm (FLL 9.14 – 11.36 mm) shorter than hand (HAL 12.06 – 14.44 mm; TFL 6.52-7.86 mm); relative length of fingers: II < I < IV < III ; tips of finger rounded enlarged; discs present on fingers I – II – III – IV, with distinct latero-ventral grooves: fingers without dermal fringe; webbing absent; subarticular tubercles prominent, oval, single, all present; prepollex oval, and prominent, palmar tubercles: 2, oval and prominent; supernumerary tubercles absent.

**Hindlimbs:** Tibiotarsal articulation reaching between nostril and eye, heels strongly overlapping when hindlimbs folded at right angles to the body; tibia nearly 4.5 times longer (TL 24.06 – 30.24 mm) than wide (TW 5.5 – 7.34 mm), longer than thigh (FL 21 – 25.44 mm) and the distance from base of inner metatarsal tubercle to tip of toe IV (FOL 22.86 – 29.26 mm); toes long and thin, length of toe IV (FTL 12.9 – 16.26 mm) 2.4 times in distance from base of tarsus to tip of toe IV (TFOL 31.3 – 39.86 mm); relative length of toes : I < II < III < V < IV; tips of toes rounded, enlarged; discs present on toes I – II – III – IV – V, with distinct latero-ventral grooves; webbing present, moderate, webbing formula: I 0 – 1 II $\frac{1}{2}$ – 1$\frac{1}{2}$ III $\frac{1}{2}$ – 2 IV 1 $\frac{1}{2}$ – $\frac{1}{2}$ V, two phalanges of fourth toe free; subarticular tubercles prominent, oval, simple, all present; inner metatarsal tubercle distinct, oval and its length (IMT 1.84 – 2.24 mm) 2.5
times in length of toe I (ITL 4.58 - 6.8 mm); outer metatarsal tubercle small but well developed; supernumerary tubercles absent.

**Skin:** Skin granular on snout, between eyes, dorsum and upper part of flank, lower part of flank, from line from insertion of arm to groin smooth; latero-dorsal folds present, prominent and wide, from back of eye to vent; white along with black colour; dorsal parts of forelimbs tarsus smooth; dorsal part of thigh and legs granular; ventral parts of head, body and limbs smooth; brachial gland present.

**Coloration in life:** Dorsal parts of head and dorsum light brown with chocolate spotting; upper and lower part of the flank light brown with irregular dark markings; loreal region creamy white and brown; tympanic region white and brown; tympanic region white inner circle surrounded by brown; tympanum brown; upper lip creamy white with brown spotting; latero-dorsal folds white and blank; dorsal part of forelimb creamy white with brown spotting; dorsal part of thigh with transverse banding; dorsal part of leg light brown with chocolate cross banding; dorsal part of foot creamy white with spotting; posterior part of thigh creamy white with irregular chocolate markings; throat creamy white marbled with brown; margin of throat dark brown; vocal sacs black.
Secondary Sexual Characters (Male): Nuptial pad present and oval shaped. The males have a pair of large external subgular vocal sacs. Other male secondary sexual characters are absent.

DESCRIPTION OF ADULT FEMALE (*H. leptoglossa*)

The description (all measurements in mm) is based on 10 adult females. Measurements are given in Table 8.

Size and general aspect: Rather moderate sized frog (SVL 49.9 - 59.16 mm), body rather elongate.

Head: Head moderate, longer than wide (HW 16.24-19.06, HL 19.06-22.46 mm), flat above; snout rounded protruding beyond the mouth, its length (SL 7.44-9.3 mm) longer than the horizontal diameter of eye (EL 4.5-6.34 mm); Canthus rostralis sharp, loreal region concave; interorbital space flat, less (IUE 3.72-4.22 mm) than upper eyelid (UEW 4.42-5.7 mm) and internasal distance (IN 4.46-5.44 mm); distance between front of eyes (IFE 8.56-9.62 mm) 1.5 times in distance between back of eyes (IBE 12.36-14.22 mm); nostrils rounded without flap of skin laterally, as close to lip of snout (NS 2.6-3.34 mm) than to eye (EN .4.88-5.34 mm); pupil oval horizontal; tympanum very distinct, oval, horizontal, its diameter (TYD 3.7-4.46 mm) more than half the diameter of the eye, larger than distance from tympanum to eye (TYE 0.6-1.36 mm); pineal ocellus absent; vomerine ridge present, bearing few small teeth between
choanae with an angle of 45° relative to body axis, less close to choanae than from each other, as long as distance between them; tongue moderate notched, median lingual projection absent; tooth–like projections on maxilla absent; supratympanic fold absent; parotid glands absent; cephalic ridges absent; co-ossified skin absent.

**Forelimbs:** Arm thin, force–arm (FLL 10.4-11.82 mm) shorter than hand (HAL 12.8-15.58 mm; TFL 6.44-8.26 mm); relative length of fingers: II < I < IV < III; tips of finger rounded enlarged; discs present on fingers I–II–III–IV, with distinct latero-ventral grooves; fingers without dermal fringe; webbing absent; subarticular tubercles prominent, oval, single, all present; palmar tubercles: 2, oval and prominent; supernumerary tubercles absent.

**Hindlimbs:** Tibiotarsal articulation reaching between nostril and eye, heels strongly overlapping when hindlimbs folded at right angles to the body; tibia nearly 4.5 times longer (TL 29.1-32.14 mm) than wide (TW 5.26-7.66 mm), longer than thigh (FL 24.1-27.64 mm) and the distance from base of inner metatarsal tubercle to tip of toe IV (FOL 25.9-30.46 mm); toes long and thin, length of toe IV (FTL 14.7-18.4 mm) 2.4 times in distance from base of tarsus to tip of toe IV (TFOL 36.74-42.8 mm); relative length of toes: I < II < III < V < IV; tips of toes rounded, enlarged; discs present on toes I–II–III–IV–V, with distinct latero-ventral grooves; webbing present, moderate, webbing formula: I 0 – 1 II
½ - 1½ III ½ - 2 IV ½ - ½ V, two phalanges of fourth toe free; subarticular tubercles prominent, oval, simple, all present; inner metatarsal tubercle distinct, oval and its length (IMT 2.08-2.64 mm) 2.5 times in length of toe I (ITL 5.52-6.74 mm); outer metatarsal tubercle small but well developed; supernumerary tubercles absent.

**Skin:** Skin granular on snout, between eyes, dorsum and upper part of flank, lower part of flank, from line from insertion of arm to groin smooth; latero-dorsal folds present, prominent and wide, from back of eye to vent; white along with black colour; dorsal parts of forelimbs tarsus smooth; dorsal part of thigh and legs granular; ventral parts of head, body and limbs smooth; brachial gland present.

**Coloration in life:** Dorsal parts of head and dorsum light brown with chocolate spotting; upper and lower part of the flank light brown with irregular dark markings; loreal region creamy white and brown; tympanic region white and brown; tympanic region white inner circle surrounded by brown; tympanum brown; upper lip creamy white with brown spotting; latero-dorsal folds white and blank; dorsal part of forelimb creamy white with brown spotting; dorsal part of thigh with transverse banding; dorsal part of leg light brown with chocolate cross banding; dorsal part of foot creamy white with spotting; posterior part of thigh creamy white with irregular chocolate markings; throat creamy white marbled with brown; margin of throat dark brown.
Secondary sexual characters (Female): Oviduct zigzag, translucent, ovary with oocytes small pigmented, black and whitish; other female secondary sexual characters are absent.

SEXUAL DIMORPHISM

Sexual dimorphism is much prominent in *H.leptoglossa*. The body size is comparatively smaller in adult male (SVL 45.64 –54.56 mm.) than in adult female (SVL 49.9 –59.16 mm.). The size of tympanum is almost same both in male and female. The tympanum eye distance is greater in female than in male. Otherwise no marked differences are observed between male and female except the external vocal sacs in males.
Table 8: Measurements of males and females of *Hylarana leptoglossa*

<table>
<thead>
<tr>
<th>Measurement (in mm)</th>
<th>Range Male</th>
<th>Mean ± standard deviation (Male)</th>
<th>Range Female</th>
<th>Mean ± standard deviation (Female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVL</td>
<td>45.64 - 54.56</td>
<td>50.46 ± 2.83</td>
<td>49.9 - 59.16</td>
<td>55.62 ± 2.74</td>
</tr>
<tr>
<td>HW</td>
<td>14.7 - 17.28</td>
<td>15.89 ± 0.80</td>
<td>16.24 - 19.06</td>
<td>17.56 ± 0.92</td>
</tr>
<tr>
<td>HL</td>
<td>17.28 - 20.64</td>
<td>19.26 ± 0.96</td>
<td>19.06 - 22.46</td>
<td>21.05 ± 1.03</td>
</tr>
<tr>
<td>MN</td>
<td>14.74 - 17.88</td>
<td>16.28 ± 0.78</td>
<td>16.62 - 19.64</td>
<td>18.11 ± 0.97</td>
</tr>
<tr>
<td>MFE</td>
<td>10.36 - 13.6</td>
<td>11.99 ± 0.78</td>
<td>12.4 - 14.34</td>
<td>13.44 ± 0.60</td>
</tr>
<tr>
<td>MBE</td>
<td>6.14 - 7.82</td>
<td>6.97 ± 0.49</td>
<td>6.96 - 8.34</td>
<td>7.76 ± 0.44</td>
</tr>
<tr>
<td>IFE</td>
<td>7.38 - 9.5</td>
<td>8.55 ± 0.70</td>
<td>8.56 - 9.62</td>
<td>9.17 ± 0.32</td>
</tr>
<tr>
<td>IBE</td>
<td>11.04 - 13.34</td>
<td>12.38 ± 0.72</td>
<td>12.36 - 14.22</td>
<td>13.62 ± 0.69</td>
</tr>
<tr>
<td>FLL</td>
<td>9.14 - 11.36</td>
<td>10.24 ± 0.65</td>
<td>10.4 - 11.82</td>
<td>11.07 ± 0.47</td>
</tr>
<tr>
<td>HAL</td>
<td>12.06 - 14.44</td>
<td>13.38 ± 0.75</td>
<td>12.8 - 15.58</td>
<td>14.15 ± 0.72</td>
</tr>
<tr>
<td>TFL</td>
<td>6.52 - 7.86</td>
<td>7.25 ± 0.45</td>
<td>6.44 - 8.26</td>
<td>7.65 ± 0.61</td>
</tr>
<tr>
<td>TL</td>
<td>24.06 - 30.24</td>
<td>27.76 ± 1.81</td>
<td>29.1 - 32.14</td>
<td>30.47 ± 0.98</td>
</tr>
<tr>
<td>FOL</td>
<td>22.86 - 29.26</td>
<td>26.50 ± 1.79</td>
<td>25.9 - 30.46</td>
<td>28.73 ± 1.37</td>
</tr>
<tr>
<td>FTL</td>
<td>12.9 - 16.26</td>
<td>15.14 ± 0.99</td>
<td>14.7 - 18.4</td>
<td>16.41 ± 1.04</td>
</tr>
<tr>
<td>IN</td>
<td>3.9 - 5.5</td>
<td>4.79 ± 0.47</td>
<td>4.46 - 5.44</td>
<td>5.09 ± 0.26</td>
</tr>
<tr>
<td>EN</td>
<td>4.18 - 4.88</td>
<td>4.54 ± 0.23</td>
<td>4.88 - 5.34</td>
<td>5.10 ± 0.13</td>
</tr>
<tr>
<td>EL</td>
<td>4.86 - 5.98</td>
<td>5.41 ± 0.31</td>
<td>4.5 - 6.34</td>
<td>5.74 ± 0.55</td>
</tr>
<tr>
<td>TYD</td>
<td>3.78 - 4.5</td>
<td>4.07 ± 0.24</td>
<td>3.7 - 4.46</td>
<td>4.10 ± 0.25</td>
</tr>
<tr>
<td>TYE</td>
<td>0.4 - 0.84</td>
<td>0.62 ± 0.12</td>
<td>0.6 - 1.36</td>
<td>0.99 ± 0.18</td>
</tr>
<tr>
<td>IUE</td>
<td>3.06 - 4.3</td>
<td>3.58 ± 0.44</td>
<td>3.72 - 4.22</td>
<td>3.91 ± 0.16</td>
</tr>
<tr>
<td>UEW</td>
<td>4.3 - 5.48</td>
<td>4.73 ± 0.38</td>
<td>4.4 - 5.7</td>
<td>5.23 ± 0.35</td>
</tr>
<tr>
<td>IMT</td>
<td>1.84 - 2.24</td>
<td>2.10 ± 0.11</td>
<td>2.08 - 2.64</td>
<td>2.30 ± 0.15</td>
</tr>
<tr>
<td>ITL</td>
<td>4.58 - 6.8</td>
<td>5.92 ± 0.56</td>
<td>5.52 - 6.74</td>
<td>6.05 ± 0.40</td>
</tr>
<tr>
<td>FL</td>
<td>21 - 25.44</td>
<td>23.41 ± 1.35</td>
<td>24.1 - 27.64</td>
<td>25.74 ± 1.23</td>
</tr>
<tr>
<td>SL</td>
<td>6.82 - 8.82</td>
<td>7.98 ± 0.58</td>
<td>7.44 - 9.3</td>
<td>8.54 ± 0.47</td>
</tr>
<tr>
<td>NS</td>
<td>2.38 - 3.16</td>
<td>2.84 ± 0.24</td>
<td>2.6 - 3.34</td>
<td>2.93 ± 0.26</td>
</tr>
<tr>
<td>TW</td>
<td>5.5 - 7.34</td>
<td>6.42 ± 0.54</td>
<td>5.26 - 7.66</td>
<td>6.77 ± 0.71</td>
</tr>
<tr>
<td>TFOL</td>
<td>31.3 - 39.86</td>
<td>36.51 ± 2.28</td>
<td>36.74 - 42.8</td>
<td>39.86 ± 1.89</td>
</tr>
</tbody>
</table>
Hylarana nigrovittata (Blyth, 1856)

Plate –I (Fig 4)

Material examined: One male.

Distribution: This species is known from Southern Yunnan, China and Southern Myanmar through Thailand, Lao People’s Democratic Republic, Viet Nam and Cambodia to the northern half of Peninsular Malaysia and Phuket. It has also been reported from Sumatra, Indonesia and India (Assam, Meghalaya and Nagaland). It usually occurs from 200 – 600 m asl.

Description:

Head: Moderate, longer than wide, snout pointed, protruding beyond lower jaw, Canthus rostralis sharp loreal region concave; nostrils closer to tip of snout than to eyes; tympanum distinct rounded, vomerine teeth present, supratympanic fold absent.

Fore limbs: Short, fingers free, tips of fingers dilated into small discs having circum ventral grooves; subarticular tubercles present and rounded in shape.

Hind limbs: Moderately long, tibiotarsal articulation reaching anterior corner of eyes, toes with discs having circum ventral grooves, subarticular tubercles oval, inner metatarsal tubercle oval and distinct; outer metatarsal tubercle absent.
**Skin:** Dorsal surface of body granular, dorso-lateral fold present from eyes to groin, ventral surface smooth.

**Colouration:** Live colouration of the specimen brown dorsally, upper part of flank greenish, lower part of flank white lined with black stripe; ventral surface white.

**Morphometric measurement (in mm):** Medium sized frog, snout vent length (SVL) 45.48 (male); length of head (HL) 19.24; width of head (HW) 14.84; length of snout (SL) 8.16; length of eye (EL) 5.54; interorbital space (IUE) 3.5; length of arm (FLL) 8.8; length of tympanum (TYD) 3.0; relative length of fingers III>IV>I>II; length of tibia (TL) 25.8; relative length of toes IV>V>III>II>I.

**Status:** IUCN Red List Category: Least Concern (LC).

*Hylarana tytleri* (Theobald, 1868)

Plate –III (Fig. 13)

**Material examined:** 2 males and 2 females.

**Distribution:** This species ranges through Southern Nepal, much of north-eastern India (Nagaland) and throughout Bangladesh.

**Description:**

**Head:** Longer than wide, snout pointed, loreal region concave, tympanum distinct, vomerine teeth oblique in position.
Forelimbs: Thin and long fingers free, tips of fingers dilated into discs having circum-marginal grooves; subarticular tubercles present and oval in shape.

Hindlimbs: Moderately long and slender tibiotarsal articulation reaching eyes. Toes moderately webbed, tips of toes with disc having circum-marginal grooves; inner metatarsal tubercle round and very small.

Skin: Head, dorsal surface of body, limbs smooth. Dorso-lateral fold present from eyes to groin, ventral surface smooth.

Colouration: Live colouration of the specimen green dorsally, wide whitish lateral stripe present from eye to groin, dark brown stripe from eye to snout, dorsolateral fold blackish in colour. Black longitudinal stripes present on hind legs.

Morphometric measurement (in mm): Rather small sized frog; snout vent length (SVL) 26.1 – 27.1 (male); 32.5 – 33.4 (female); length of head (HL) 10.96 – 13.4; width of head (HW) 8.2 – 10.3; length of snout 4.56 – 5.7; length of eye (EL) 2.98 – 3.6; inter orbital space (IUE) 2.1 – 3.94; length of arm (FLL) 4.0 - 5.92; length of tympanum (TYD) 2.1 – 2.5, relative length of fingers III>I>IV>V>II, length of tibia (TL) 12.1 – 16.78; relative length of toes IV>V>III>II>I.

Status: IUCN Red List Category: Least Concern (LC).
3.5 DISCUSSION

The global conservation crisis facing amphibians requires regional taxonomic-based assessments of conservation status (Molur, 2008). In view of the present global scenario the present work assumes significance as the study has been carried out in an area where extensive exploration was not taken up.

The Sivasagar district is situated in the north - eastern part of Assam and lies between 26°45' N to 27°15' N latitude and 94°25' E to 95°20' E longitude. It is bordered in the north by Dibrugarh district and on the west by Jorhat district of Assam. It is bounded in the south and east respectively by the state of Nagaland and Arunachal Pradesh. It is bordered on north-west by the river Brahmaputra. The geographical location of the district indicates that it is a part of the mega diversity hotspot area the Eastern Himalayan region. In the recent past many amphibian species has been documented from Nagaland and Arunachal Pradesh which are new records for the country. Intensive survey was carried out in Charaideo subdivision during the four years (2004-2008) study period.

The climate of the district is tropical monsoon type with high humidity. Therefore the different habitats which support mostly tropical vegetation are favourable habitats for different species of amphibians.
Chanda (1994) recorded five species from erstwhile Sivasagar district of Assam. These are *Xenophrys parva*, *Hyla annectans*, *Microhyla rubra*, *Rhacophorus tuberculatus* and *Limnonectes laticeps*. In the present survey these species could not be validated with fresh record. A total of 19 amphibian species belonging to 4 families and 8 genera could be recorded. Species recorded from Sivasagar district has been raised to 24.

An important achievement of this biodiversity study is the addition of a new species *Rhacophorus suffry* (Bordoloi, Bortamuli and Ohler) to the global list of Amphibia. Remaining 18 species of frogs recorded are more common in Northeast India and has been recorded by various authors from different parts of this region.

It is revealed from the study that the species belonging to the genus *Hylarana* are more common in the wetlands of the Charaideu subdivision and is represented by 5 species. The genus *Fejervarya* is represented by at least 20 species in India (Dinesh et al., 2009), most of which were previously known under the nomen *Rana*. During the present study four species of *Fejervarya* namely *Fejervarya nepalensis*, *Fejervarya pierrei*, *Fejervarya syhadrensis* and *Fejervarya teraiensis* has been recorded. All these four species has been previously recorded from different forest areas of Assam by Borthakur et al. (2007).

Most of the fauna so far recorded either have distribution in Myanmar or in India. A link to the fauna of Himalayan terrain region can
be shown by the presence of species like *Fejervarya nepalensis*, *Fejervarya pierrei*, *Fejervarya teraiensis*, *Rhacophorus maximus* and *Polypedates teraiensis (P.leucomystax)*.

Due to various reasons exploration work at night has not been possible. Amphibian being nocturnal intensive survey work in the evening may lead to many more record in the inaccessible as well as in accessible areas.
Fig. 1 - *Hoplobatrachus crassus*  
(Jerdon, 1853)

Fig. 2 - *Hoplobatrachus tigerinus*  
(Daudin, 1802)

Fig. 3 - *Microhyla ornata*  
(Dumeril & Bibron, 1841)

Fig. 4 - *Hylarana nigrovitatta*  
(Blyth, 1856)

Fig. 5 - *Polypedates teraiensis*  
(Dubois, 1987)

Fig. 6 - *Bufo melanostictus*  
(Schneider, 1799)

PLATE – I  Anuran species of Sivasagar district (Fig 1- Fig 6)
Fig. 7  *Euphlyctis cyanophlyctis*  
(Schneider, 1799)

Fig. 8  *Rhacophorus suffry*  
Bordoloi, Bortamuli & Ohler, 2007

Fig. 9  *Rhacophorus maximus*  
Gunther, 1858

Fig. 10  *Fejervarya teraiensis*  
(Dubois, 1984)

Fig. 11  *Fejervarya pierrei*  
(Dubois, 1975)

Fig. 12  *Fejervarya nepalensis*  
(Dubois, 1975)

**PLATE – II  Anuran species of Sivasagar district (Fig 7 - Fig 12)**
Fig. 13  *Hylarana tytleri* (Theobald, 1868)

Fig. 14  *Hylarana humeralis* (Boulenger, 1887)

Fig. 15  *Hylarana leptoglossa* (Cope, 1868)

PLATE - III  Anuran species of Sivasagar district (Fig 13- Fig 15)