STUDY ON THE *FEJERVARYA* (ANURA: DICROGLOSSIDAE) SPECIES OF ASSAM

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plus web supplement of 2 pages

ABSTRACT

Species of *Fejervarya* were described under the nomen *Rana / Limnonectes / Fejervarya limnocharis* from northeast India. Based on morphological description provided by Schleich and Kästle (2002) we recognized four species of *Fejervarya* namely, *F. nepalensis*, *F. pierrei*, *F. syhadrensis* and *F. teraiensis* from Assam. All these species are sympatric and except *F. syhadrensis* are restricted to Eastern Himalaya and adjacent flood plains.

KEYWORDS

Amphibia, Assam, Dicroglossidae, *Fejervarya*, morphometrics, PCA, true frogs

The genus *Fejervarya* is characterized by presence of 'Fejervarya line' on both sides of the belly and absence of rictal gland at the mouth commissure. In early publications most of these frogs of wetlands were known under the name *Rana limnocharis* with a wide range of distribution from Pakistan to China, Japan to Indonesia. Dubois & Ohler (2000) and Veith *et al.* (2001) opined that the nomen *Fejervarya limnocharis* is applied to a species whose distribution covers Indonesia and Malaysia. Many records of this species in other parts of its distribution probably applied to other species of *Fejervarya*.

Dubois (1975, 1984) described three distinct species of *Fejervarya* which were previously described under the name *Rana limnocharis*. He further stated that still other species were present in India. Dutta & Singh (1996) reported that *Fejervarya* species group represents a complex comprising 13 nominal species distributed in South Asia. Based on the descriptions provided by Schleich & Kastle (2002) for the species of Nepal we report the occurrence of the four species of genus *Fejervarya* in Assam. The genus *Fejervarya* is classified in the family Dicroglossidae, and subfamily Dicroglossinae (Frost, 2007).

MATERIALS AND METHODS

The amphibian fauna of Assam is being continuously surveyed, and during the trips since 2002, we have collected and studied the *Fejervarya* species along with other amphibians. The specimens of *Fejervarya* were fixed and preserved in 8% buffered formalin. Natural history notes for all the specimens were recorded. Voucher specimens were preserved, assigned museum number and were deposited in the Arya Vidyapeeth College Museum (AVCM). Selected morphometric measurements were taken with a Mitutoyo dial vernier caliper with an accuracy of 0.1mm. Measurements taken were: SVL - Snout vent length (from the tip of the snout to vent); HL - Head length (from the tip of the snout to the angle of the jaw); HW - Head width (width of head at level of angle of jaw); A-G - Axilla to groin distance (distance between posterior edge of forelimbs at its insertion to body to anterior edge of hind limb at its insertion to body); SntL - Snout Length (distance between anterior corner of the eye to snout tip); EL - Eye length (from the anterior corner of the eye to the posterior corner of the eye); EN - Eye to nostril distance (distance between anterior point of eye and nostril);NS - Nostril to snout distance (distance between nostril to tip of snout); IO - Interorbital space (minimum distance between upper eyelids) IN - Inter nasal space (distance between two nostrils); UEW - Width of upper eyelid (greatest transverse width of upper eyelid); HTYD - Horizontal tympanum diameter (maximum distance from the anterior corner to the posterior corner of the tympanum); VTYD - Vertical tympanum diameter (greatest tympanum diameter along vertical plane); ET - Eye to tympanum distance (distance between posterior corner of eye and anterior corner of tympanum); FLL - Forelimb length (distance from posterior edge of forelimbs at its insertion to tip of longest finger); F_1 - First finger length (from the base of the palm to the tip of the 1st finger); F_2 - Second finger length (from the base of the palm to the tip of the 2nd finger); F_3 - Third finger length (from the base of the palm to the tip of the 3rd finger); F_4 - Fourth finger length (from the base of the palm to the tip of the 4th finger); TL - Tibia length (from the knee joint to the tibio tarsal joint); HLL - Hind limb length (from the vent to the tip of the 4th toe); TTA - Tibio tarsal articulation Toe length : From base of digit to tip; T_1 - 1st toe length; T_2 - 2nd toe length; T_3 - 3rd toe length; T_4 - 4th toe length; T_5 - 5th toe length; IMC - Inner metacarpal tubercle; MMC - Middle metacarpal tubercle; OMC - Outer metacarpal tubercle; IMT - Inner metatarsal tubercle; OMT - Outer metatarsal tubercle

Web formula has been expressed following Schleich and Kästle (2002). PCA and cluster analysis were performed through Biodiversity Professional Version 2 software programme

Study sites (Image 1[w])

Garbhanga Reserve Forest (26°07'-26°09'N & 90°33'-91°55'E; area: 114km²). The main block of the forest is situated on an stretched out portion of the Shillong plateau and is separated from the later by alluvial tract. The vegetation is moist deciduous with occasional patches of evergreen complexes. The reserve forest is drained by numerous streams criss-crossings the whole area.

Pobitora Wildlife Sanctury (26°12'-26°15'N & 92°02'-92°05'E; area: 39km²) is situated in the flood plain of the river Brahmaputra with 68% grassland and 30% wetlands.

[w] see Images in the web supplement at www.zoosprint.org

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Deepor Beel (26°05'-26°09'N & 91°36'-91°45'E; area: 4km²) is a permanent fresh water lake with abundant aquatic vegetation.

Mayang Hill Reserve Forest (25°43'-25°55'N & 90°32'-91°21'E; area: 21km²) is located in the hilly tract of extended Khasi hills. The major forest types are eastern hill sal forest, moist plain sal forest, moist mixed deciduous forest, secondary moist bamboo brakes and wet miscellaneous formation.

Bherjan Forest (27°28'-27°35;N & 95°29'-95°36'E) encompasses about 2km² and is situated in Tinsukia district. The forest type is composition of Hollong-Nahar forest and mixed deciduous forest. The forest has a dense canopy cover. The terrain is almost flat and intersected by drains and seasonal water logged areas.

Results

In the present study we observed four distinct species of *Fejervarya* in all the study sites.

1. *Fejervarya nepalensis* (Dubois, 1975) (Image 2[w])

Material examined: (measurements in mm) 10 examples (SVL: 23-42.3, HL: 9.5-13.5, HW: 5.5-13.5, TL:12-20.4), Mus no: AVCM/R/0091 (20.vi.03, Deeporbeel), AVCM/R/0102 (17.vii.04, Deeporbeel), AVCM/R/0100 (10.viii.04, Deeporbeel), AVCM/CND/797/25 (10.vii.02, Mayeng Hill R.F.), AVCM/A/0275 (4.iv.02, Garbhanga RF), ZSIS/V/A/ERS/592 (5.iv.03, Dihing Patkai WLS), AVCM/A/0105 (4.vi.05, Garbhanga R.F.), ZSIS/V/A/ERS/591(14.vi.00, Pobitara WLS), AVCM/CND/398/16 (5.v.02, Chandubi), ZSIS/V/A/ERS/593 (12.vii.05, Borjan R.F.).

Head is pointed in dorsal view. Relative finger length is 2<1<4<3. IMC is elongated, MMC and OMC are oval. IMC is well separated from MMC. MMC and OMC are separated by a groove at the base of 3rd and 4th finger. IMT is flattened; OMT is oval. A weak and indistinct fringe of skin on the outer side of the 5th toe. TTA reaches between nares and the anterior corner of the eyes. Toe web formula is I_{0-1} $II_{½-1½}$ III_{1-2} $IV_{1½-½}$ V. Inter orbital space is almost equal to the internasal space [IO:IN = 0.93] and more than three fourth of the upper eyelid width [IO:UEW = 0.87]; inter orbital space is little more than half of the eye length [IO:EL = 0.61]. SVL of adult female ranges from 30.0-42.3mm and the ratio between SVL/HLL = 0.55 and HL/HTYD = 4.9

A dark inter orbital band and a distinct mid dorsal line often with red patches are present. The thigh is distinctly barred.

The species is found frequently in open land with moist grasses and herbs near water source.

2. *Fejervarya pierrei* (Dubois, 1975) (Image 3[w])

Material examined: (measurements in mm) 10 examples (SVL: 24.7-41.2, HL: 7.0-15.3, HW: 7.7-13.5, TL: 11.6-20.8), Mus No.: AVCM/R/0129 (3.viii.04, Garbhanga R.F.), AVCM/CND/797/40 (3.iv.01, Mayeng Hill R.F.), AVCM/R/0183 (5.vii.02, Nameri NP), AVCM/A/091 (5.vii.02, Nameri NP), AVCM/CND/797-18 (2.iv.02, Mayeng Hill R.F.), ZSIS/V/A/ERS/598 (3.xi.02,Guwahati), AVCM/R/0107 (12.viii.04, Deeporbeel), AVCM/CND/398/20 (2.v.01, Chandubi), ZSIS/V/A/ERS/596 (10.viii.04, Guwahati), ZSIS/V/A/ERS/597 (27.ix.02, Dibru-Saikhowa NP).

Body is oblong, oval and the hind limbs are short. Head is pointed. Long longitudinal folds on the dorsum are prominent. Relative finger length is 2=4<1<3. IMC is long, MMC transeverse and globular and OMC is small and oblong. IMC is separated from MMC by a narrow groove, and MMC and OMC are fused at the base. IMT is laterally flattened, OMT is very small. No skin fringe on 5th toe. TTA reaches at the posterior corner of the eye. Toe web formula is I_{0-1} II_{0-1} $III_{½-1½}$

Table 1. Measurements of* Fejervarya nepalensis *(Dubois, 1975)

	R0091 F	R0102 F	R0100 M	CND79725 F	A0275 M	A334 F	R0105 F	A0272 M	CND39816 F
SVL	40.6	32.75	23.0	34.7	31.0	42.3	31.2	37.8	33.6
HL	13.0	10.5	9.5	9.9	10.4	13.5	10.8	12.0	11.0
HW	12.2	10.4	9.6	11.5	10.2	13.5	10.6	12.0	5.5
AG	18.1	16.1	10.7	14.3	14.6	11.6	12.2	17.2	15.8
SntL	6.8	5.8	5.0	5.75	5.4	7.5	5.6	6.5	6.3
EL	5.2	4.6	4.0	4.3	4.8	5.3	4.0	4.8	4.4
EN	3.3	3.0	2.1	3.0	2.5	3.7	2.1	3.1	2.65
NS	3.3	2.8	2.5	3.0	2.8	3.7	2.6	3.0	2.9
IN	3.5	2.7	2.5	2.9	3.0	3.3	2.75	2.7	2.5
UEW	3.7	3.2	2.8	2.9	2.9	4.0	2.8	3.0	3.0
HTYD	2.5	2.0	2.0	1.8	2.1	2.3	2.9	2.35	2.2
VTYD	2.5	2.0	2.1	2.3	2.3	2.9	2.9	2.35	2.3
ET	1.4	1.1	1.2	1.8	1.0	1.4	1.2	1.4	1.4
FLL	20.5	18.0	15.3	19.9	16.5	22.6	16.5	20.0	17.8
F_1	7.1	6.1	5.5	6.7	5.2	7.8	7.3	7.35	6.4
F_2	6.7	5.7	5.0	6.1	5.2	7.0	6.4	6.4	5.6
F_3	9.1	9.0	7.0	6.8	7.1	8.5	7.4	8.65	7.6
F_4	5.9	6.3	4.7	6.0	4.9	5.9	4.1	5.5	6.0
HLL	64.0	51.0	48.5	58.5	49.0	73.2	51.6	62.0	56.9
TL	18.0	16.0	12.0	15.8	14.2	20.4	15.5	19.5	16.4
TW	6.6	4.4	4.4	4.7	4.6	6.1	4.6	6.0	5.5
T_1	5.5	4.3	5.3	6.9	4.8	6.9	5.3	7.1	5.5
T_2	9.4	9.8	7.	10.3	8.0	11.8	9.0	11.2	8.7
T_3	15.0	14.5	11.3	15.8	11.9	12.4	12.7	14.7	13.0
T_4	21.0	19.8	16.8	19.8	17.2	23.6	17.5	21.4	18.4
T_5	5.2	13.7	11.9	14.3	12.1	6.4	12.25	14.1	13.3

Table 2. Measurements of* Fejervarya pierrei *(Dubois, 1975)

	R0129 M	CND79740 F	A0183 M	A0191 F	CND79718 F	R0084 M	R0107 M	CND39820 M	R0104 F
SVL	41.2	35.6	29.0	37.9	33.1	41.0	35.0	24.7	34.3
HL	15.3	10.4	10.5	7.0	9.8	12.5	11.0	7.5	11.0
HW	13.5	8.0	8.7	11.0	10.6	8.0	12.0	7.7	12.1
AG	17.3	13.0	11.1	14.3	13.2	16.6	15.0	9.0	14.8
SntL	7.3	12.0	5.4	6.4	10.5	7.0	6.0	8.4	10.5
EL	5.9	5.0	3.6	5.4	4.2	4.4	5.1	3.8	5.0
EN	3.4	3.0	2.5	3.4	3.1	4.0	2.8	2.1	3.3
NS	3.6	3.2	2.3	3.5	3.0	3.2	2.8	2.0	3.1
IN	2.7	3.4	2.3	2.5	3.0	2.8	3.1	2.5	3.1
UEW	3.5	3.4	2.3	3.0	2.8	3.0	3.5	2.5	3.5
HTYD	2.7	1.8	1.7	2.0	1.8	2.5	1.7	1.6	2.0
VTYD	2.5	2.1	2.0	2.1	1.8	2.5	1.6	1.5	2.0
ET	2.0	1.5	0.70	1.2	1.2	1.5	1.2	0.80	1.2
FLL	19.7	18.0	14.3	20.3	17.0	19.7	18.0	13.8	19.0
F_1	8.0	6.2	5.3	7.0	3.8	8.0	6.9	4.3	6.7
F_2	7.2	5.3	4.3	6.5	3.8	6.4	7.05	3.7	7.05
F_3	9.2	7.5	6.3	9.0	5.8	9.0	9.0	5.1	9.0
F_4	7.2	5.0	4.2	6.5	4.0	6.4	7.0	3.6	7.1
HLL	58.6	54.6	45.3	45.6	44.0	58.9	55.0	37.5	66.6
TL	17.0	15.6	13.7	20.8	15.0	17.1	20.0	11.6	20.0
TW	6.4	4.7	12.0	6.0	4.0	7.0	4.2	3.4	5.8
T_1	5.8	5.5	3.7	6.0	4.7	6.3	4.8	3.2	6.1
T_2	9.8	9.1	7.5	10.0	7.5	10.4	9.8	6.5	10.0
T_3	15.0	13.00	10.4	14.8	10.9	15.3	13.5	8.7	14.8
T_4	20.3	16.4	14.7	21.1	17.5	20.0	18.5	12.5	21.0
T_5	14.0	12.5	10.3	14.6	10.7	14.0	12.5	9.4	14.1

$IV_{1½-0}$ V. Hind limbs weakly barred. Inter orbital space is almost equal to the internasal space [IO:IN = 0.91] and more than three fourth of the upper eyelid width [IO:UEW = 0.84]; inter orbital space is slightly more than half of the eye length [IO:EL = 0.57]. SVL of adult female ranges from 33.1-41.2mm and the ratio between SVL/HLL = 0.61, and HL/HYTD = 5.0.

A broad mid dorsal line, interrupting the interorbital band, from snout tip to the vent is usually distinct. The thigh is distinctly barred.

Found among moist leaf litters of woodland as well as in moist grassland and open field including cultivated land.

3. *Fejervarya syhadrensis* (Annandale, 1919) (Image 4[w])

Material examined: (measurements in mm) 9 examples (SVL:4.8-37.0, HL: 8.3-11.5, HW: 8.2-11.9, TL:11.5-17.4) Mus. No: AVCM/A/O408 (04.vi.03, Deeporbeel), ZSIS/V/A/ERS/589 (24.iv.03, Garbhanga RF), AVCM/A/409 (4.vi.02, Nameri NP), AVCM/A/274 (4.iii.01, NameriNP), AVCM/CND/797/28 (12.v.01, Mayeng Hill RF), AVCM/R/0037 (15.vi.02, Deeporbeel), ZSIS/V/A/ERS/590(3.vi.03, Guwahati), ZSIS/V/A/ERS/588 (7.vii.98, Nameri NP), AVCM CND/699/17 (13.vii.02, Mayeng Hill RF).

Small spindle shaped body with pointed head. Relative finger length is 1=2 <4<3. IMC elongated and flat, MMC is oval and present at the base of the third finger while MMC is small and circular. IMC, OMC and MMC are widely separated. IMT is elongated and laterally compressed and OMT is minute. A vestige of skin fringe on the outer side of the 5th toe is present. TTA reaches anterior corner of the eye to snout. Toe web formula is I_{0-1} $II_{½-1½}$ $III_{½-2}$ $IV_{1½-0}$ V. Hind leg is banded. Inter orbital space is almost equal to the internasal space [IO:IN = 0.91] and more than three fourth of the upper eyelid width [IO:UEW = 0.89]; inter orbital space is little more than half of the eye length [IO:EL = 0.55]. SVL of adult female ranges from 20.5-35.7mm and the ratio between SVL/HLL = 0.68and HL/HTYD = 5.07.

A very narrow dull white mid dorsal line is usually present and interrupts the inter orbital band. The thigh is blotched on dorsal side.

Found in wide range of habitat from thick forest to human habitat. It is found frequently near water but also in moist areas away from water source. Normally lay eggs in shallow water with grasses or other aquatic emergent vegetation.

4. *Fejervarya teraiensis* (Dubois, 1984) (Image 5[w])

Material examined: (measurements in mm) 10 examples (SVL:19.5-49.2, HL:7.1-14.8, HW:7.5-16,TL:8.2-29.2.). Mus. No: V/A/ERS/595 (29.iii.05, Garbhanga R.F.), AVCM/R/133 (16.v.04, Deeporbeel), AVCM/R/131 (16.v.04, Deeporbeel), AVCM/R/006 (Garbhanga 7.v.02), AVCM/R/139 (16.v.04, Deeporbeel), AVCM/R0027 (14.v.02, Deeporbeel), AVCMR/0020 (10.v.02, Guwahati), AVCM/R/0043 (21.v.02, Deeporbeel), ZSISV/A/ERS/594 (25.ix.02, Guwahati).

Body is large, oval and stout; head is pointed at dorsal view. The relative finger length is 2=4<1<3 with 1st finger distinctly longer than 2nd and 4th IMC, MMC and OMC are globular. IMC is separated from MMC by a narrow groove, and MMC and OMC are fused at the base. IMT is large, elongated and raised; OMT is minute and globular. A distinct skin fringe on the outer side of the 5th toe. TTA reaches between the posterior corner of the eyes and the eye center. Toe web formula is I_{0-1} II_{0-1} $III_{½-1½}$ $IV_{1½-0}$ V. Inter orbital space is slightly larger than the internasal [IO:IN = 1.03] and more than half of the upper eyelid width [IO:UEW = 0.64]; inter orbital space is equal to half of the eye length [IO:EL = 0.51]. SVL of adult female ranges from 34.3-59.6mm and the ratio

Table 3. Measurements of* Fejervarya syhadrensis *(Annandale, 1919)

	A0408 M	R0076 F	A409 M	A274 F	CND79728 M	R0037 M	R0087 F	A0184 F	CND 69917 M
SVL	26.6	34.0	24.8	37.0	23.3	27.5	26.8	32.9	28.0
HL	9.4	11.5	9.3	11.5	9.0	8.5	9.3	10.3	8.3
HW	9.6	11.3	8.7	11.9	8.5	9.4	9.0	8.5	8.2
AG	10.6	12.9	9.9	14.4	13.0	12.0	8.4	15.9	13.8
SntL	4.8	11.8	9.7	12.0	4.6	9.0	9.3	10.5	4.7
EL	4.2	4.8	4.6	5.2	4.0	4.3	3.5	4.0	3.0
EN	2.5	3.2	2.5	3.0	2.5	2.25	2.3	3.0	2.3
NS	2.3	2.7	2.0	3.1	2.1	2.25	2.65	2.4	2.1
IN	2.2	3.0	3.0	3.0	2.2	2.6	2.5	3.6	2.0
UEW	2.3	3.0	3.0	3.2	2.3	2.4	2.8	2.8	2.5
HTYD	2.0	2.2	2.5	1.9	1.8	1.4	1.9	1.8	1.9
VTYD	1.9	1.9	2.2	2.0	1.6	1.3	2.0	1.7	1.9
ET	0.4	1.3	1.0	1.2	0.80	0.90	1.0	0.90	1.15
FLL	16.0	17.5	13.0	19.5	13.8	13.5	8.8	17.8	12.9
F_1	4.8	5.2	6.6	6.5	3.65	5.0	5.2	5.8	4.25
F_2	4.7	5.7	6.6	6.5	3.7	4.5	4.7	4.3	4.1
F_3	6.2	7.5	8.6	8.1	5.4	6.0	6.5	7.1	5.5
F_4	4.6	6.5	6.8	5.7	4.1	4.2	5.1	4.2	4.1
HLL	45.5	47.5	44.3	60.3	44.1	42.3	40.0	51.6	41.5
TL	13.1	15.0	17.4	17.0	13.25	11.7	11.5	15.0	12.0
TW	4.3	5.1	4.0	5.8	3.6	3.0	3.0	4.2	4.3
T_1	3.9	6.2	4.3	5.5	4.0	4.5	4.5	5.7	3.7
T_2	7.1	8.5	9.0	8.8	6.4	6.9	7.4	8.2	5.9
T_3	11.3	13.3	11.2	14.0	9.3	10.3	9.8	12.0	9.1
T_4	15.3	18.6	10.6	19.1	13.0	14.3	14.6	18.4	13.0
T_5	10.4	13.3	11.0	13.8	9.4	8.5	10.5	11.0	9.2

Table 4. Measurements of* Fejervarya teraiensis *(Dubois, 1984)

	R204 M	R133 F	R0047 M	R131 F	R006 M	R139 F	R0027 M	R0020 F	R0043 M
SVL	49.2	33.8	27.5	40.6	19.5	34.8	21.5	25.5	20.0
HL	7.1	12.4	9.6	14.8	7.5	12.1	8.3	9.3	8.0
HW	16.0	11.1	9.7	13.2	7.5	11.3	8.1	9.0	7.6
AG	23.4	14.8	12.0	18.6	8.0	12.5	9.6	10.0	8.0
SntL	8.1	6.5	5.0	7.3	4.0	6.1	4.1	4.7	4.0
EL	7.1	5.5	3.06	5.4	3.2	5.1	3.5	3.6	3.4
EN	4.2	3.4	3.0	4.0	2.8	3.0	2.4	2.5	1.8
NS	3.7	2.9	2.5	3.3	1.9	2.9	2.4	2.3	1.8
IN	3.3	2.4	1.8	2.65	1.7	2.5	2.0	2.0	2.0
UEW	4.0	3.3	3.0	3.9	3.0	3.5	3.5	4.0	3.0
HTYD	3.5	2.3	2.0	2.5	1.5	2.5	1.6	1.7	1.7
VTYD	3.5	1.9	2.0	2.5	1.6	2.4	1.6	1.8	1.6
ET	1.6	1.5	1.5	1.5	1.2	1.25	1.0	1.0	1.0
FLL	25.3	19.4	13.2	22.4	5.8	17.6	10.0	12.1	9.6
F_1	8.4	6.5	5.7	2.8	3.5	7.0	4.7	4.06	4.0
F_2	7.7	6.1	5.0	7.4	3.3	6.3	3.3	4.07	3.2
F_3	10.6	7.8	6.7	10.1	4.0	8.5	10.0	6.4	9.6
F_4	7.7	6.1	5.1	2.6	3.3	6.3	3.8	5.0	3.6
HLL	67.5	52.3	50.1	63.8	42.2	53.3	44.7	49.2	44.1
TL	20.5	16.0	11.1	29.2	9.0	16.2	9.5	1.25	8.2
TW	9.2	6.2	2.5	5.6	2.5	4.6	2.5	3.05	2.3
T_1	7.1	5.9	4.6	6.9	3.8	6.0	3.6	5.0	3.5
T_2	10.35	9.1	7.0	11.0	5.5	9.0	4.8	7.0	5.5
T_3	16.5	13.0	10.5	13.0	6.8	13.2	7.5	10.3	7.5
T_4	23.4	16.5	15.2	21.0	10.0	17.9	10.3	14.3	10.5
T_5	15.9	11.7	10.7	12.4	6.5	11.6	6.7	8.6	7.0

between SVL/HLL = 0.68 and HL/HTYD = 5.5

The pineal organ is present as a small dot. The mid dorsal line may or may not be present. The dorsum frequently has red or green patches. Males have typical W-shaped dark marking on throat.

Found in open lowland often in flooded paddy fields. Prefers vicinity of temporary or permanent water bodies.

PCA and cluster analysis of the four species of *Fejervarya* reveals that *F. pierrei* and *F. nepalensis* are closely related with similarity of about 96% while least similarity of 91.5% exists between *F. nepalensis* and *F. syhadrensis* (Table 1; Fig. 1 & 2).

Discussion

The genus *Fejervarya* is not monophyletic (Ohler, 2002), represented in India by at least 14 species (Frost, 2004), most of which were previously known under the nomen *Rana (Limnonectes/Fejervarya) limnocharis*. During the present study four species of the genus *Fejervarya*: *F. nepalensis*, *F. pierrei*, *F. syhadrensis* and *F. teraiensis* were recorded from Assam. All these species were more or less sympatric.

Sengupta *et al.* (2000) first reported *Fejervarya syhadrensis* from Garbhanga Reserve Forest along with *F. limnocharis*. However, Dubois and Ohler (2000), Veith *et al.* (2001) opined that the *F. limnocharis* is restricted to Indonesia and Malaysia, the species earlier described as *F. limnocharis* from India, Pakistan, China, Japan, Myanmar, Vietnam, Laos, Thailand are some allied species of *Fejervarya limnocharis*. Choudhury *et al.* (2001) and Pathak *et al.* (2001) suspected the presence of allied species of *Fejervarya limnocharis* and described four morphs of this species complex.

Prakash (1995) detected wide genetic variation in the population of *Rana limnocharis* from Meghalaya which suggests presence of a few species in the state. Dubois (1975, 1984) described three species of *Fejervarya limnocharis* complex namely *F. nepalensis*, *F. pierrei* and *F. teraiensis* based on vocalization from Nepal. Recently Ao *et al.* (2003) recorded *F. nepalensis* and *F. teraiensis* from Nagaland. The Global Amphibian Assessment (IUCN *et al.*, 2006) assesses *Fejervarya pierrei* as occuring only in Nepal, with a possibility of its occurrence in India. From the available records it is found that *F. syhadrensis* has a wide range of distribution from western India to Assam; while the other three species are restricted to eastern Himalaya and foothills from Nepal to northeastern India, and Brahmaputra flood plain.

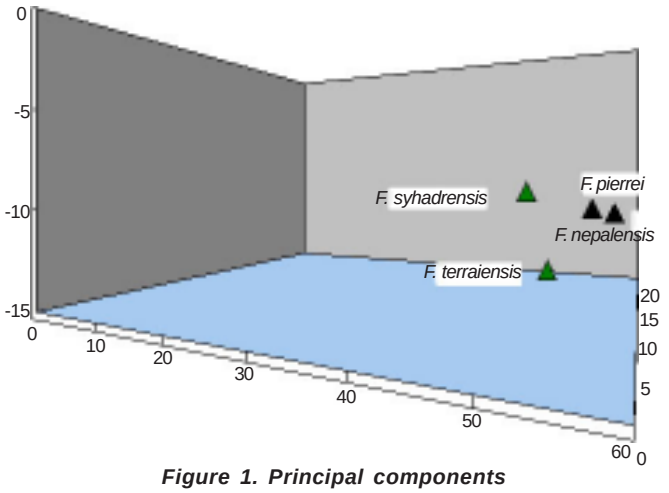

Figure 1. Principal components

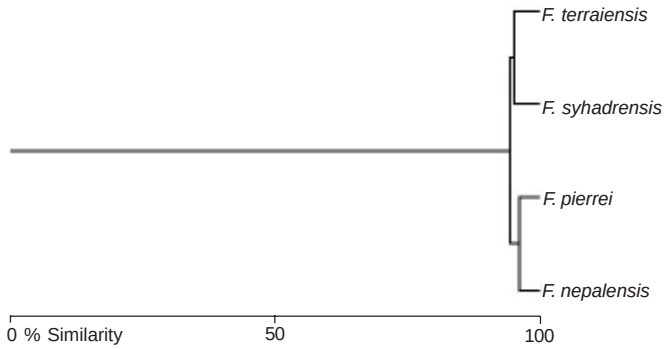

Figure 2. Bray-Curtis cluster analysis of* Fejervariya *species

Cluster analysis similarity matrix

	F. nepalensis	*F. pierrei*	*F. syhadrensis*	*F. teraiensis*
F. nepalensis	1.00	96.1859	91.52	92.52
F. pierrei		1.00	93.6372	94.51
F. syhadrensis			1.00	95.32
F. teraiensis				1.00

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