Range extension of *Epiophlebia laidlawi*, Tillyard (1927) (Odonata, Epiophlebiidae) eastward and southward in Bhutan

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Introduction

- *Epiophlebia laidlawi* belongs to order Odonata, family Epiophlebiidae.
- One of four extant species.
- *E. superstes* in Japan, *E. sinensis* (Li *et al.*, 2011) & *E. diana* (Carle 2012) in Heilongjiang and Sichuan provinces respectively in China.
- *E. laidlawi* recorded from Nepal, India (Sikkim) and Bhutan (2006).

- IUCN assessed it as vulnerable in 1986, 1988, 1990, 1994 & 1996.
- Assessed as Near Threatened in 2006 and remains so.
  - restricted range, insufficient data on its distribution and population size, and being a relict species.

In Bhutan:

- *E. laidlawi* first recorded in 2006 (Brockhaus & Hartmann, 2009)
- From three districts: Haa and Thimphu in Western Bhutan, and Trongsa in Central Bhutan from larval studies.
- Adult dragonfly studies in Eastern Bhutan, South Eastern Bhutan, Western and Central Bhutan failed to record adult *E. laidlawi.*

Research need

- Scanty larval development studies
- Difficulty to collect F0 or ultimate instar larva due to probably unique behaviour like that of *E. superstes* larva
- Difficulty to record adults due to short flight period
- Larval distribution studies within its possible ranges will help understand population trend and distribution range.

Aims

- Thus, the current study aimed to:
  - –study larval distribution in Western and Central Bhutan
  - –describe the larval development stage

Materials & method

- Opportunistic survey carried out within five districts in Western and Central Bhutan from 2012 to 2104.
- D-frame net (25cm x 25cm) used for sampling.
- Different number of subsamples in each site/reach in different districts.
- 13 streams within Punakha, 3 within Bumthang, 2 within Trongsa, 9 along Thimphu-Phuntsholing highway.

Image 1. Sampling and sorting for macroinvertebrates.

Result

21 larvae were collected from the whole study area.

Image 2. *E. laidlawi* larvae from Bumthang.

Table 1. Streams and reaches with sampling dates, coordinates, altitude, temperature and number of *E. laidlawi* larvae recorded.

Stream and reach	Sampling date	Latitude	Longitude	Altitude	Temperature	No. of larvae
Stream 1(S1)	11.V.2012	273239.0	904316.9	2922	12	3
Stream 2(S2)	11.V.2012	273228.8	904322.9	2916	12	3
Nikachhu (N1)	01.XII.2012	272654.0	902223.9	2251	7	2
N2	01.XII.2012	272655.5	902226.3	2177	7	1
Dorokna (D1)	19.X.2013	273017.2	894725.6	2067	12.5	1
D2	10.III.2014	273021.3	894724.3	2047	6.9	1
D7	10.III.2014	273069.4	894760.2	1956	9.8	1
D8	10.III.2014	273075.7	894772.4	1889	9	1
Jichulum (J1)	03.X.2013	273102.3	894951.8	1653	15	3
J2	03.X.2013	273105.2	894954.7	1647	16	1
J3	03.X.2013	273114.9	894957.0	1602	11	1
J4	03.X.2013	273120.1	894957.5	1568	12	1
Drechhu(Dr1)	02.II.2014	272116.2	893427.5	2201	4	1
Lobnekha(Lo1)	02.II.2014	270937.4	893303.3	2170	6	1

Image 3. *E. laidlawi* larva in Lobnekha stream (a) dorsal view and (b) ventral view (ovipositor encircled).

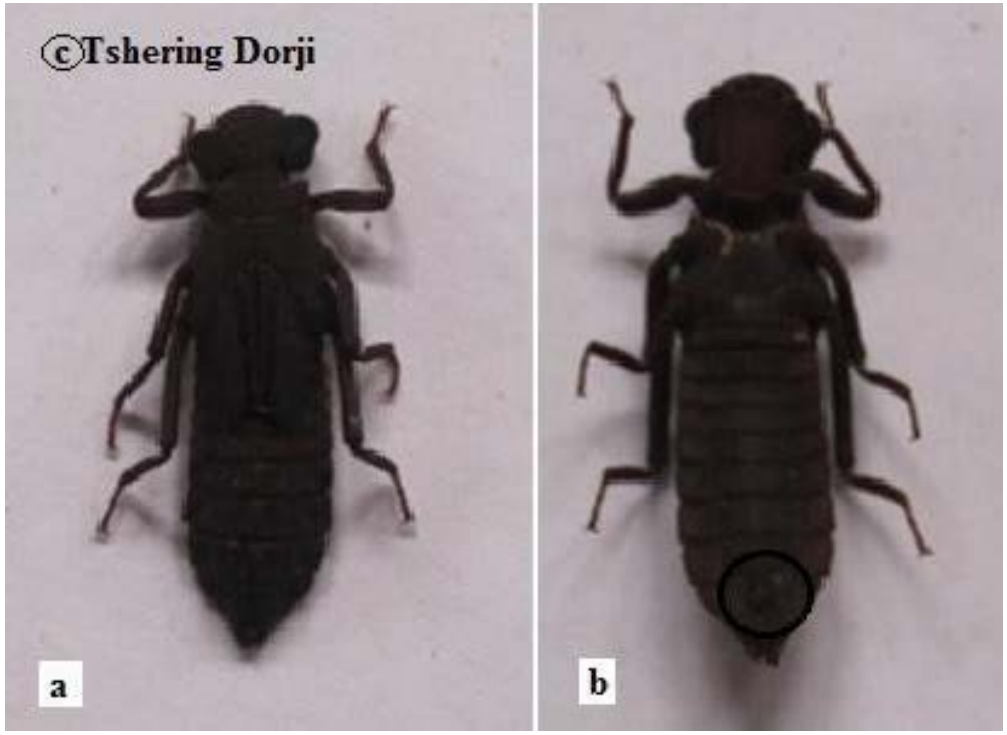

Image 4. *E. laidlawi* larvae from (a) Drechhu (Wangsisina), (b) Dorokna (D2), (c) Jichulum (J2), (d) Nikachhu (N1), (e) Nikachhu (N1), and (f) Nikachhu (N2).

Table 2. Larval development stage with descriptions and sex.

Larvae	Body length (mm)	Head capsule width (mm)	Wing pad	Instars	Sex
Bumthang 1	15.2	4.2	Touching 1st abdominal segment	F2	F
2	15.1	4.2	-//-	F2	F
3	15.1	4.2	-//-	F2	F
4	8.8	2.9	Reaching anterior margin of abdomen	F4	M
5	5.2	1.8	Not developed	F6	ND
6	3	0.6	Not developed	F8	ND
Drechhu	11	3.5	Touching first abdominal segment	F3	F
Lobnekha	25.4	6.2	Reaches posterior margins of 4th abdominal segment	F0	F

Discussion & conclusion:

- Record from:
  - Bumthang district extends the distribution range within Bhutan and Himalayas to the eastern most part.
  - Chukha district extends to the southern most part in Bhutan.
  - Nikachhu adds to previous record from its tributary.

  - Thimphu extends range within district southward.
  - Toebirongchhu sub-watershed in Punakha increases districts with *E. laidlawi* to six districts.
  - Makes Punatshangchhu the third basin afters Wangchhu and Drangmechhu basins with *E. laidlawi*.
- Confirms the presence of F0 larva from October through, December and February till March.
- F3 and F8 instars described first time from Bhutan.

Image 6. Current distribution range of *E. laidlawi* in Bhutan. © Google Earth

Conservation concerns:

- Being restricted in its range:
  - Water abstraction for irrigation & domestic use.
  - Water pollution
  - Climate change
- Data deficiency for its population trend and distribution range.
- Lack of studies of its larval stages (unique and long-time residence within streams).

Image 7. Water abstraction from Dorokna stream

Image 8. Solid waste from roadside amenities in Jichulum & unnatural turbidity in Toebirongchhu.

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THANK YOU ALL

WELCOME FOR DISCUSSION