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Cover: Mugger Crocodile basking on the banks of Savitri River at Mahad in Maharashtra, India. © Utkarsha M. Chavan.

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SHORT COMMUNICATION

The new addition of Blue Pimpernel of Primulaceae to the state flora of Assam, India

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Abstract: *Lysimachia arvensis* var. *caerulea* (L.) Turland & Bergmeier, a variety belonging to the family Primulaceae is reported as new to the state flora of Assam, northeastern India. The authors encountered the specimen during field survey at Kamrup Rural District of Assam in 2020. This manuscript describes taxonomy and morphology details along with pictorial illustration of the specimen.

Keywords: Assam, diversity, floristic, *Lysimachia arvensis* var. *caerulea*, new addition, palynology.

The genus *Lysimachia* Tourn. ex L., of Primulaceae, has approximately 180 species of plants with an almost cosmopolitan distribution (Hu & Kelso 1996; Liu et al. 2014). Assam, also known as the floristic gateway of northeastern India, consists of two species of this genus. Several floristic works have been done on this rich biodiversity of Assam, among which contributions of Kanjilal et al. (1934–1940), Chowdhury (2005), and Barooah & Ahmed (2014) are noteworthy.

During a floristic survey of Kamrup (R) District of Assam in 2018–2021, a distinct plant population was observed. All the petals of the flowers were covered with marginal hairs and were bright blue in colour. After referring to taxonomic literatures and critically investigating and examining of herbarium samples, a variety, *Lysimachia arvensis* var. *caerulea* (L.) Turland & Bergmeier, was identified as new addition to the flora of Assam. For easy identification of the species, detailed taxonomic description and other pertinent information along with clear photographs have been provided here. Additionally, palynological data have also been incorporated along with scanning electron microscope (SEM) images of pollen grains to assist in future palyno-taxonomic research.

Materials And Methods

Study Area

Kamrup is one of Assam's oldest districts, with a 1,000-year history dating back to the ancient age. It is a one-of-a-kind administrative unit, with jurisdiction on both sides of the great Brahmaputra. The district is presently an administrative district in western Assam, with its headquarters in Amingaon. According to 2011 Census of India report, the district covers a total geographical area of 3,105 km^2 and is situated in between 25.46–26.49 ^{0}N and 90.48–91.50 ^{0}E (Figure 1).

Methods

Several field visits were conducted throughout the

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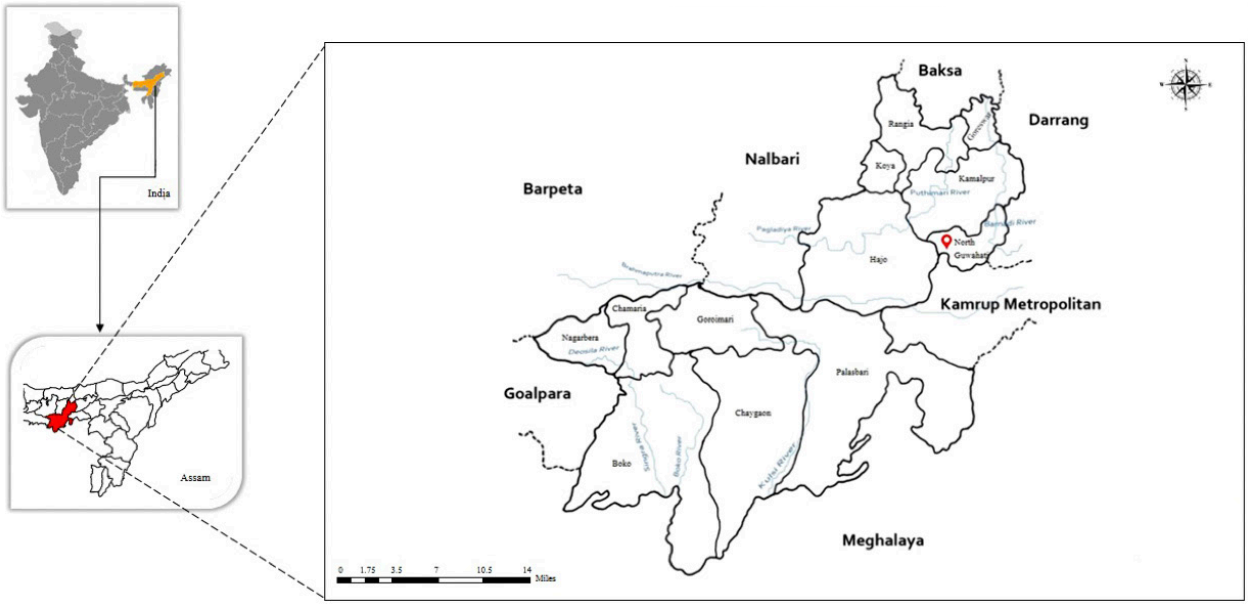

Figure 1. Kamrup (R) District showing study area.

Kamrup (R) District during 2018–2021. The specimens were gathered from the fields for comprehensive morphological analysis and mounted onto standard herbarium sheets according to the procedure of Jain & Rao (1977). Multiple copies of the plant species were collected preferably in flowering and fruiting condition. The plant specimens were identified consulting various relevant taxonomic literatures. They were also compared with herbarium microfilms available online at the virtual sites provided by Royal Botanic Gardens- Kew Herbarium Catalogue & New York Botanical Garden, ;also with the digital photographs provided by Central National Herbarium (CNH), Howrah. The voucher specimen has been deposited at the Gauhati University Botanical Herbarium (GUBH), Gauhati University for future reference. Photographs were taken in the field and after dissection as well. Fresh pollen samples were collected and dried with the help of silica gel and images were captured using the SEM.

Results And Discussion

***Lysimachia arvensis* var. *caerulea* (L.) Turland & Bergmeier, Willdenowia 41: 185 (2011).**

Anagallis caerulea L., Amoen. Acad. 4: 479 (1759); *Anagallis arvensis* var. *caerulea* (L.) Gouan, Fl. Monsp.: 30 (1764); Parmar, Nelumbo 54: 131 (2012); Patel & Bihola, Life Sciences Leaflets 59: 150 (2015). *Anagallis arvensis* f. *azurea* Hyl., Uppsala Univ. Årsskr. 7: 256 (1945).

Taxonomic description

Description: Annual creeping herb, 10–30 cm in height. Stem quadrangular, branched from base, nodes often swollen. Leaves simple, opposite, each pair equal in size, sessile; lamina narrowly ovate to ovate, 0.7–1.8 × 0.3–1.2 cm with entire margin, apex obtuse to acute. Inflorescence racemose or solitary. Flowers axilary, actinomorphic, bisexual, hypogynous, pentamerous, attractive blue, pedicellate, pedicel recurved in fruit, ca 1.6 cm long. Sepals 5, gamosepalous, 3.7 × 0.8 mm, connate at the base, segments linear-lanceolate, margins hyaline, persistent. Petals 5, united, rotate, blue, 4.5 × 3.1 mm, margin minutely glandular-ciliate. Stamens 5, epipetalous arranged opposite to the petals, almost of same length, basally connate, filaments purplish, with long glandular articulate trichomes; anthers bithecous, sagittate shaped, dorsifixed, oblong. Gynoecium ca 2.8 mm, carpels 5, syncarpous, ovary superior, stigma slightly capitate, style linear, lower part hairy, ovary superior, 5 lobed; placentation free central; bitegmic. Fruit capsule 1–3 cm long, 5-ridged, many-seeded, angular, subglobose, 4–5 mm across, glabrous, tuberculate- rugose (Image 1& 2).

English name: Blue Pimpernel.

Native to: Mainly distributed in European countries as well as middle eastern region and western Himalaya.

Distribution status in the State: Distributed sporadically (Altitudinal Range: 64–48 m approx.)

Flowering and Fruiting: January to August

Habitat: It is found along roadsides with lightly

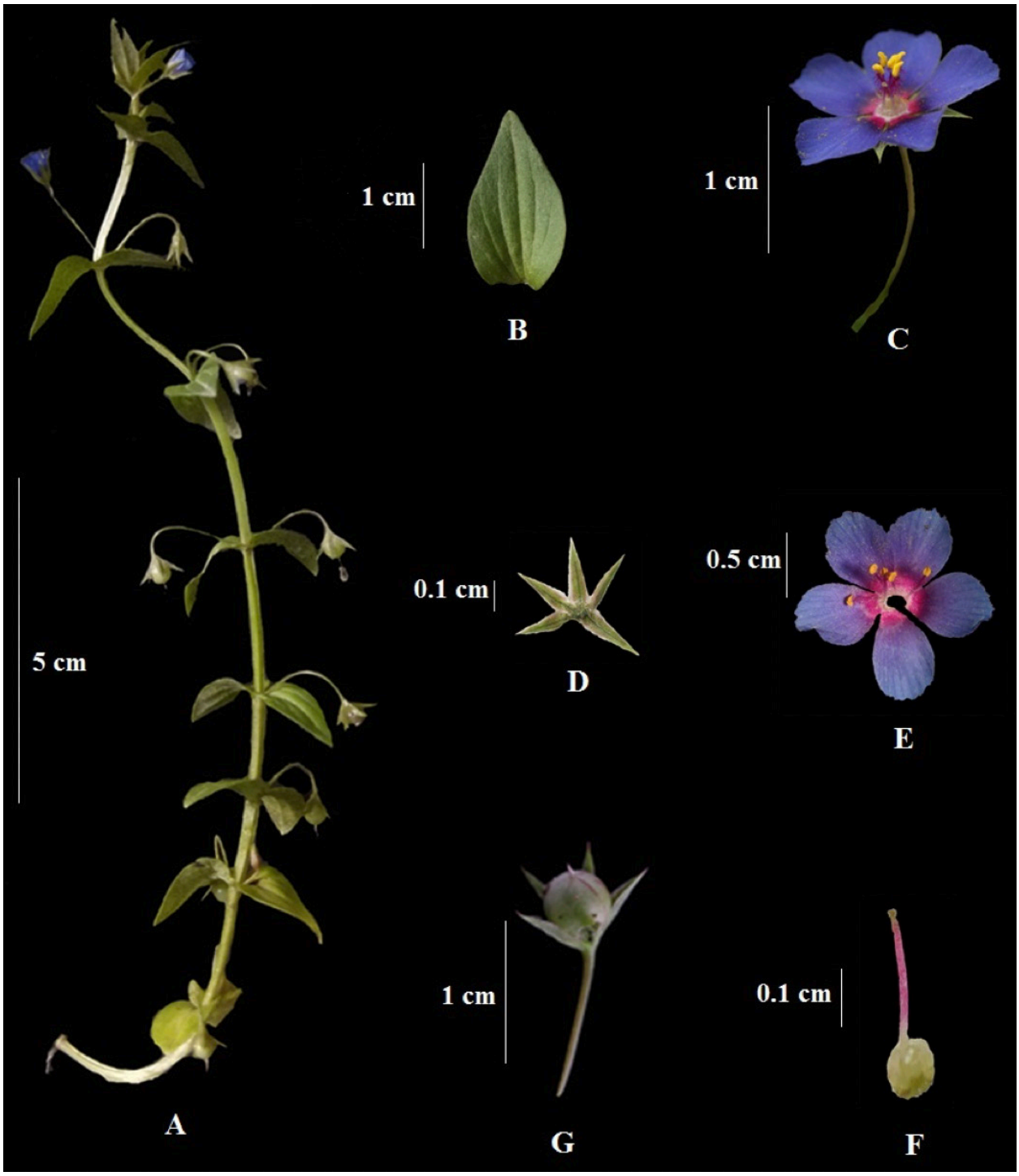

Image 1. ***Lysimachia arvensis*** **var.** ***caerulea*****: A—Habit | B—Leaf (dorsal) | C—Complete flower | D—Calyx | E—Corolla with epipetalous stamens | F—Gynoecium | G—Fruit (capsule). © Barnali Das.**

shaded habitats and in crop fields like that of *Brassica*. Associated with *Vicia sativa*, *Vicia hirsuta*, *Fumaria indica*, *Orobanche aegyptiaca*, *Solanum nigrum*, *Brassica nigra*, and *Cannabis sativa*.

Availability status (at the study area): It is found in some localities seasonally; particularly in crop fields or along roadsides.

Specimen examined: Srinagar, Kashmir, 1891, G.A. Gammie, CAL0000031110, image!; Barni village, Rajasthan, 1973, B.V. Shetty, CAL0000052632, image!;

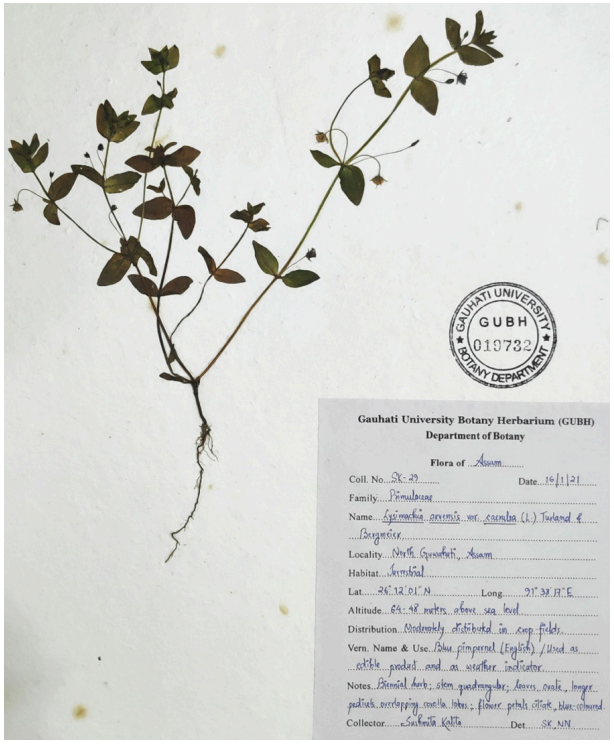

Image 2. Herbarium of *Lysimachia arvensis* var. *caerulea* deposited at GUBH.

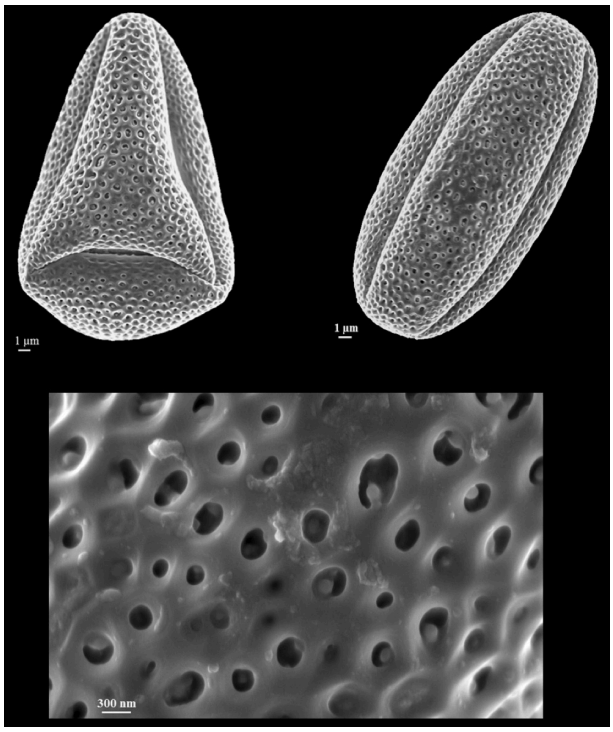

Image 3. *Lysimachia arvensis* var. *caerulea*: A—proximal | B—distal surface view of pollen | C—exine ornamentation.

Ranchi, Bihar, 1981, K.C. Mallick & R.N. Banerjee, CAL0000009231, image!; Tikamgarh, 1990, MP, M. Kishore & M. Prasad, CAL0000013112, image!; Hajo, Kamrup (R), 2021, S. Kalita & B. Das, SK-29, 26.2004^{0}N, 91.6346^{0}E (GUBH!).

Pollen characters: Pollen unit monad, tricolporate, and prolate in shape. The polar axis (P) length is 34.76 µm and the equatorial axis (E) is 17.56 µm; P/E ratio is 1.98. Pollen class is mediae. The exine sculpturing (tectum ornamentation) is reticulate (Image 3).

Note: It is noteworthy mentioning that *L. arvensis* is sometimes mistaken with *L. foemina*, although the species differ in the morphology of petal margins. *L. arvensis* has numerous marginal hairs, whereas, *L. foemina* has glabrous petals with very few or without marginal hairs (Haines 2011). Furthermore, whereas, *L. arvensis* has ovate leaves, longer pedicels and overlapping corolla lobes, *L. foemina* has narrowly lanceolate leaves, shorter pedicels and non-overlapping corolla lobes (Manns & Anderberg 2007). According to our findings, the new variety has blue-coloured, ciliate petals, confirming the specimen's unique identification.

Significance: The present record of a new variety is significant in taxonomy since it might lead to the development of a new species. The findings of the present investigation with flower colour polymorphism are significant, since flower colour serves as a characteristic in diversity of angiosperms and plays a critical role in evolution (Narbona et al. 2021). The present work therefore will embellish the floristic diversity of the entire state that is yet to be documented completely. This will further enrich the floristic composition of Assam and will aid in the conservation of native, rare and threatened species that are struggling to survive owing to habitat degradation caused by anthropogenic interference. Furthermore, the ability of *L. arvensis* var. *caerulea* to

Key to the species

1a. Pedicels longer than subtending leaves, petals with marginal hairs ..... *Lysimachia arvensis*
1b. Pedicels shorter or equal to subtending leaves, petals with few or no marginal hairs ..... *Lysimachia foemina*

Key to the variety

1a. Flower colour orange or reddish ..... *Lysimachia arvensis* var. *arvensis*
1b. Flower colour dark blue or purplish ..... *Lysimachia arvensis* var. *caerulea*

indicate the weather as well as the time of day is widely recognized which can aid in revealing the mechanisms of developing folk botanical awareness. Besides, it is also a source of scientific data concerning plant physiology and phenology. Farmers frequently employ such indicator plants in crop planning, particularly when no other signs are accessible (Gibbs & Talavera 2001; Acharya 2011). Thus, realization and conservation of such weather indicator plants are crucial at the time when there is increasing global concern about climate change and its impact on life.

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