Gregarious flowering of a long-lived tropical semelparous bamboo *Schizostachyum dullooa* in Assam

Schizostachyum dullooa (Gamble) Majumder (dolu bamboo) is a thin-walled sympodial moderate size to large tufted bamboo. The species is distributed in the moist semi-evergreen forests of northeast India (Assam, Sikkim, Meghalaya, Tripura and Mizoram) to Sylhet, Chittagong and Chittagong hill tracts of Bangladesh[1]. This is a dominant bamboo species in the successional fallows of northeast India[2] and forms the overriding vegetation in tropical and subtropical hill slopes in which it grows. This is one of the important bamboo species after *Melocanna baccifera* in the hill tracts of Cachar District, Assam and has been harvested by human populations for subsistence and commercial needs since time immemorial. Internodes of the green culm are used for preparation of a traditional food during the religious harvest festival in addition to its wide range of uses in house construction, fencing and craft making[3]. Young shoots of the species is also a food item of Phayre's leaf monkey during the rainy season (Figure 1). The importance of the species as the provider of ecosystem services[4] is clear from the numerous ways through which it generates services.

Gregarious flowering occurs almost over the entire area and flowering is followed by the death of the clump[5]. Some bamboos are perennial monocarps with long flowering intervals[6]. During variable cycle periods, bamboos die over a large area after mass synchronous flowering and setting of seeds[7]. Flowering happens after many years of vegetative growth, varying from 20 to 60 or even 120 years[5]. Bamboo die-off events have severe ecological and economic impacts on the ecosystem, viz. exposed forest soil, food crisis for dependent animals, unsuitability of dried culms for pulp and paper, and cottage industries[8]. Therefore, knowledge of exact flowering cycle of each species is necessary for the effective management of bamboo stands to make adequate arrangement for proper utilization of culms and the storage of seeds[8].

S. dullooa is a semelparous species that has a long period of vegetative growth followed by mass flowering. Recently, the species was flowering in the entire forest range of Innerline Reserve Forest of Cachar district (Figure 2). Flowering was observed in all the culm ages present in the clump. The flowering began in mid-October after the rainy season and continued till December. Young inflorescences within few weeks turned into huge inflorescences. Leaves in the culm gradually turned brown and culm became leafless. In Cachar, gregarious flowering was reported during 1962 (ref. 9). There is no available report of gregarious flowering of the species after 1962, revealing the flowering cycle of the species as 48 years. The flowering cycle of 47 years (1880–1927) was reported from Rangamati, Chittagong hill tract, Bangladesh[10,11]. Reports from Kassalong Reserve, Bangladesh revealed the flowering cycle of 47 years (1927–1974)[12]. Flowering cycle of 37 years (1962–1999) was reported from Hazarikhil, Chittagong hill tract, Bangladesh[13]. Moreover, sporadic nature of flowering was also reported during 1951 and 1967–1968 from Assam[14], and during 1990 from Chittagong hill tract, Bangladesh[1]. Therefore, the flowering nature of the species is mostly gregarious (37–48 years) and occasionally sporadic type.

The growing commercial trade of the species from its natural habitat has

Figure 1. Phayre's leaf monkey (*Trachypithecus phayrei*) in the bamboo dominated stand.

Figure 2. Profusely flowered *Schizostachyum dullooa* stand.

resulted in excessive harvest and therefore generated concern about overexploitation[3]. The present flowering phenomenon of the species may be an opportunity in disguise to study the gregarious flowering of the species in relation to biotic interferences. Further study is essential after die-off event to evaluate how the rural people convene their alternate requirements that otherwise are dependent on the species for their rural subsistence. It is also important at this stage to strengthen research to determine the effect of die-off event on the vegetational structure and functional aspect of the forest. It would also be interesting to explore the response of herbs, shrubs and tree seedlings to formation of exposed patches subsequent to the gregarious flowering of the species. Moreover, factors affecting recovery of original population size required detailed study. Certain management considerations like seed collection, protection of natural regeneration, and creation of seed and seedling bank are also required.

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Western Arunachal Pradesh offering prime home to the endangered red panda

Arunachal Pradesh, an abode of biodiversity and one among the 200 globally important ecoregions in the world, is fortunately situated in the north-eastern part of India. With the Eastern Himalaya extending into its western part, the state harbours an elegant range of endangered and endemic flora and fauna together with the most striking creature of the north-eastern forests, i.e. the red panda (*Ailurus fulgens*). Posing a taxonomic dilemma since a long time, the red or lesser panda has been placed in the order Carnivora and is the monotypic member of the family Ailuridae and the only representative species of the genus *Ailurus* (Eisenberg 1981). Adapted to a bamboo diet despite being a carnivore, the animal occupies a highly specialized niche and is protected under Schedule I of the Indian Wildlife (Protection) Act, 1972 and listed in Appendix I of Convention on International Trade in Endangered Species (CITES) and as 'endangered' by the International Union for Conservation of Nature (IUCN). The geographical range of the red panda extends from Nepal in the west to a few provinces of China in the east with its distribution in India along the Eastern Himalaya including Arunachal Pradesh, Sikkim and Darjeeling. However, according to IUCN, more than 90% of its approximate total habitat in the country is contributed by Arunachal Pradesh.

However, the population remained undocumented until the WWF-India in western Arunachal Pradesh initiated a baseline survey on the population status and distribution of red panda along with the threats faced by the species in the area. Intensive field and questionnaire surveys have been conducted at the Pangchen valley and the Mandla area occupying remote locations in the state and falling under the Tawang and West Kameng districts respectively. Both the sites have been declared as IBAs under the Important Bird Area Programme by Birdlife International, United States being the Zemithang–Nelya IBA and Mandla–Phudung IBA in the Pangchen valley and Mandla respectively. Furthermore, the sites exhibit prolific habitats mostly decked with temperate conifer and temperate broadleaf forests inhabiting some of the most fascinating wild flora and fauna.

During the field surveys in these conferred sites, the red panda presence has been confirmed through various direct (sightings, kills and carcasses) and indirect (scats, pug mark, scratch mark, pelts and secondary information from the local communities) evidences. Scats and a number of skins of the animal have been found in Mandla. However, the presence of the elusive red panda from the Pangchen valley has been revealed through a number of direct animal sightings mostly in November together with an appreciable number of scats found at an average elevation of 3200 m in different parts of the valley. Since a long time, frequent red panda sightings were reported on the *Sorbus* sp. (Laju) tree by the local communities, which have now been confirmed by more than 85% of the evidences. However, the *Sorbus* sp. and the most commonly known food of the animal almost all over its distribution range, i.e. the *Thamnocalamus* sp. (Bamboo) have been found to be the most preferred among the available plant species. In