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SOME OBSERVATIONS ON THE FLOWERING OF BAMBOOS IN MIZORAM

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ABSTRACT

Bambusa tulda, *Dendrocalamus longispathus*, *D. sikkimensis*, *Melocalamus compactiflorus*, *Melocanna bambusoides* and *Pseudostachyum polymorphum* were observed in flower during 1977-79. The nature and consequences of bamboo flowering are discussed.

INTRODUCTION

ONE of the most puzzling features which has evaded understanding is flowering of certain bamboos after the lapse of several years. Although it is known that bamboos derived originally from the same clump would flower simultaneously, irrespective of where they have been planted, the nature of the factors leading to their 'once flowering' is far from clear. The death of all the clumps with a single act of flowering and fruiting in these monocarpic plants has been attributed to reproductive exhaustion, caused by the movement of reserve food materials from the vegetative parts. It is also likely that developing seeds may be sites of synthesis of certain inhibitors.

The flowering of certain bamboos is accompanied by large scale increase in the population of 'bamboo rats' in Mizoram and other north-eastern hill regions of India. The rats are reported to consume the bamboo seeds and with the exhaustion of this bountiful supply of bamboo food, they attack the standing crops, causing severe devastation resulting in famine.

During a study under the research scheme 'Biology of bamboo rats and their relation to bamboo flowering', supported by the Indian Council of Agricultural Research (1977-79), the authors noted several instances of gregarious as well as sporadic flowering of bamboos

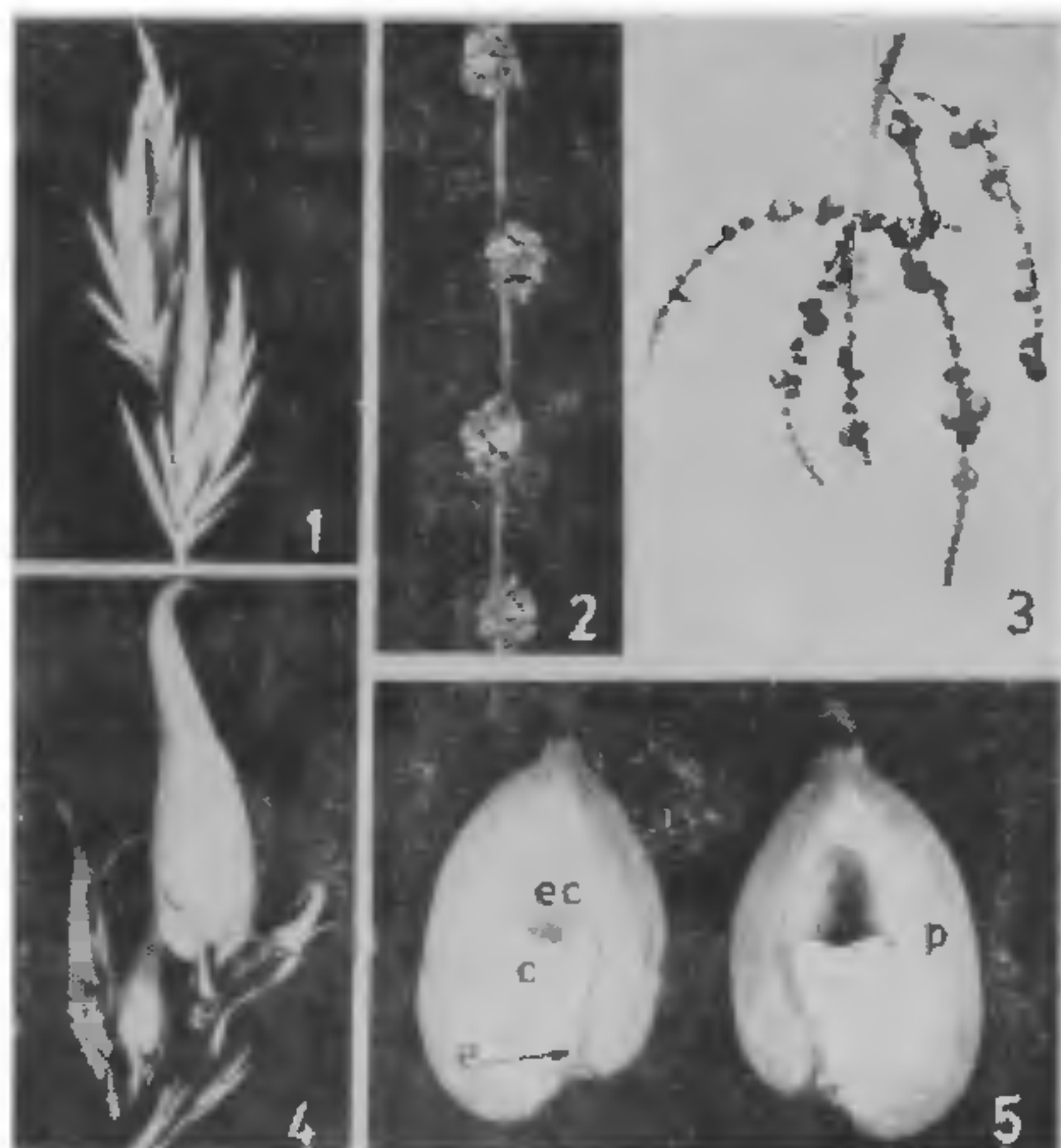
in Mizoram. Observations made on the nature and extent of flowering and consequences of flowering have been summarized below. The flowering material and seedlings have been collected and photographed. A detailed account of the biology of certain bamboos is being investigated. A species-wise account follows:

OBSERVATIONS AND DISCUSSION

1. *Bambusa tulda* Roxb. (Mizo name: *Rawthing*)

Flowering in this bamboo has been associated with the 'Thingam' famine. According to the local people this bamboo flowers gregariously once in 48 years. A survey of the forest records and reports by naturalists indicates that flowering had been observed in 1880 through 1884 and in 1928 through 1929. Recently a few clumps began flowering in 1976 and gregarious flowering occurred and lasted until 1979. Flowering was first observed in the southern parts of Mizoram and it later spread to the northern parts and progressed further into the Assam plains.

The plants stop producing new shoots before the commencement of flowering and shed their leaves completely. The inflorescence is an immense radical leafless panicle, bearing interrupted clusters of fertile long spikelets (1 to 8 cm) (Fig. 1). When the culms are



FIGS. 1-5. Fig. 1. A portion of inflorescence of *Bambusa tulda*. Fig. 2. A portion of inflorescence of *Melocalamus compactiflorus*. Fig. 3. A twig bearing fruits of *M. compactiflorus*. Fig. 4. Developing fruits of *Melocanna bambusoides*. Fig. 5. Fruit of *M. bambusoides* cut in half (lengthwise) to show the enlarged cotyledon (c), embryonal axis (e), endosperm cavity (ec) and pericarp (p).

cut and burnt (for jhum cultivation) before the onset of flowering, the underground rhizomes produce thin shoots, which bear spikelets instead of leaves. This indicates that the stimulus for flowering probably lies in the underground rhizome.

All the plants, irrespective of the gregarious or sporadic nature of flowering, die and their rhizomes fail to form any new shoots. Regeneration of the new thickets is through the germination of seeds and the establishment of seedlings, which takes 5-6 years. The seeds have no dormancy but their viability is lost within 2-3 months.

The amount of seed formed is very low, although the plants produce enormous quantities of flowers. This may be due to the damage caused by insects, large scale shedding of flowers prior to seed development and also insufficient pollination or self-incompatibility.

During the survey it was found that the rodent population increases during bamboo flowering but the general belief about the bamboo seeds increasing the fecundity of rats is debatable. Six species of rodents namely, *Rattus rattus*; *Rattus rattus brunneusculus*; *Rattus bowersi mackenziei*; *Cannomys badius badius*; *Mus musculus* and *Vandeleuria oleracea dumitricola* were collected from Mizoram. Among the above rodents *Rattus rattus brunneusculus* is dominant and is responsible for the crop damage.

The records maintained by the Directorate of Agriculture of Mizoram and Rodent Control Cell in the Deputy Commissioner's establishment at Aizawl put the number of rats killed at 4,92,926 during 1976 (flowering had just started) and at 26,00,000 during 1978 (flowering had reached the peak). This enormous increase in rat population could be attributed to reduction in cannibalism, shortening of the time gap between pregnancies (due to highly nutritious food) and disturbed prey-predator balance (snakes and birds have been indiscriminately killed in this state).

Dendrocalamus longispathus Kurz. (Mizo name: *Rawnal*)

Gregarious flowering was observed during the years 1976 and 1977. The distribution of this bamboo is more towards the plains in Mizoram and only small populations were observed in the hills. Seed production in the hills, where only isolated clumps were found in flower, was very low as compared to that in the plains with numerous flowering clumps. It may be presumed that non-availability or insufficiency of pollen for cross-pollination in the hills could be an important factor.

This bamboo is more commonly known for its sporadic flowering than gregarious but is reported to have flowered during all the 'Thingam' famines along with *B. tulda*.

Dendrocalamus sikkimensis Gamble (Mizo name: *Rawmi*)

This bamboo occurs at higher altitudes than *D. longispathus*. Flowering was observed in the isolated clumps near 'Sangau' (Lunglei District) in the Blue Mountain range (highest peak 2168 m above mean sea level). A large quantity of viable seeds was collected even from the isolated clumps (15-20 kg of seeds per clump) where no other flowering clump was observed in a radius of 2-3 miles. Seeds germinated readily in the laboratory but viability was lost within 3-4 months even when stored under dry conditions. A few albino seedlings were also observed. The flowering under report was of sporadic nature which resulted in the death of the clumps and practically no records exist of the previous flowerings in Mizoram.

Melocalamus compactiflorus (Mizo name: *Sairil*)

Distribution of this bamboo in Mizoram is restricted to valleys, undisturbed forests with tall trees and river banks. Gregarious flowering was observed during the years 1977-79. A large amount of fruits was collected by the authors. The inflorescence is a large compound panicle of small sub-globose heads (Fig. 2). The fruits are non-typical of the bamboos, being large, sub-globular, the summit depressed, 1.0-2.0 cm across and are supported by persistent glumes, palae and

lodicules (Fig. 3). The pericarp is crustaceous and separates easily from the seed. Each clump produces 30–35 kg of mature fruits. Vivipary is common and the fruits also germinate readily when shed. The young seedlings show multiple shoots and adventitious roots (instead of a single primary root as seen in other bamboos). These roots may emerge either before or after shoot emergence.

Flowering in this bamboo is preceded by leaf fall and results in the death of the entire plant. Fruits of this bamboo are rarely eaten by animals. The previous flowering dates of this species in Mizoram have not been recorded.

A detailed study of the structure of the ovule, endosperm and fruit development is being conducted to solve the existing disputes on its taxonomic status.

Melocanna bambusoides Trin. (Mizo name: *Mautak*)

The Mizos predict that flowering of this species is invariably followed by famine 'Mautam' which occurs recurrently every 48 ± 2 years. Various flowering dates of this bamboo have been reported in Mizoram, by earlier workers, but the nature of flowering has not been mentioned. Chatterjee¹ had reported flowering in 1863–1866; 1892–1893; 1900–1902; 1933 and 1960, and Parry² had recorded flowering during 1864, 1911–1912. A survey of the forest records indicates that gregarious flowering had occurred in Mizoram during 1910–1912 and 1958–1959 and the Government had set up relief measures to help the people because the rodent population had increased by leaps and bounds and had caused extensive damage to the crops. This bamboo is expected to come to gregarious flowering around 2007.

This bamboo is a dominant species and is capable of producing large amount of fruits (20–25 kg of fruits per clump) which are large, pear-shaped, with a massive embryo, thick fleshy pericarp and liquid endosperm during the early stages of embryo development (Fig. 5). The fruits are rich in protein (11.5%), and starch (50.29%) (unpublished data) and are eaten by the local people after boiling with salt. The Mizos collect these fruits and raise clumps from them in their neighbourhood. As these clumps do not come to bloom along with others during gregarious flowering, they provide a ready supply of raw material even at times of scarcity caused by synchronous senescence following flowering.

An enormous increase in rodent population was recorded during the previous occasions of gregarious flowering (1911–1912 and 1958–1959) of this species. During 1958–59 the 'Mautam Relief Front' was set up by the young Mizos to deal with the problems arising from the bamboo famine,

In the years 1978–79 only a few clumps were observed in flower. These were found to be either partially uprooted during road construction or damaged by the burrowing rats. It may be presumed that stress resulting from damage could induce untimely flowering. Some field experiments are being conducted to determine whether or not stress leads to flowering in this bamboo. All the flowering culms shed their leaves prior to flowering.

Blatter³ in his article on the flowering of bamboos has commented upon several occasions of survival of plant parts and ultimate regeneration of thickets from the sporadically flowering clumps. However, in *M. bambusoides* the plants were observed to have died after sporadic flowering. The fruits germinate without dormancy and vivipary is not uncommon^{4–6}. The fleshy fruits are relished by rats and jungle fowl.

Pseudostachyum polymorphum Munro (Mizo name: *Chal*)

This species occurs predominantly near water sheds and valleys where the climate is cool, moist and shady. A thin-walled bamboo, with culms spaced at greater intervals than that of *Melocanna bambusoides*, gives an elegant appearance with its straight, smooth, shiny light-green surface. Flowering was sporadic and curiously no leaf shedding was noted even in the flowering culms. The seed set was poor. The inflorescence appeared to have been infected by a pathogen as a result of which the spikelets had become converted into round, soft, hairy masses. The fruits are globose-depressed, surmounted by the base of the long, rigid style. Flowering in this bamboo, though of sporadic nature, results in the death of the entire clump.

The cycle of the two famines 'Mautam' and 'Thingtam' is 48 years but the two do not coincide; the gap between 'Mautam' and 'Thingtam' is 18 years and that between 'Thingtam' and 'Mautam' is 30 years. Of the two famines 'Mautam' is more devastating as the amount of seed produced by *M. bambusoides* is enormous and can support a vast number of rodents which subsequently migrate to the crop fields and destroy the standing crops. Our observations indicate that *B. tulda* and *M. bambusoides* have a life cycle of 48 years.

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