

## NOTES

### 1. Insect Pollination of Bamboos

On 26 February 1980 I was driving between Samoeng and Ban Mae Lam in Chiang Mai Province, when I noticed two or three clumps of the 'mai rai' bamboo, [*Gigantochloa albociliata* (Munro) Kurz], in flower. On closer examination the flowers were found to be fragrant, and were being visited by large numbers of small bees, probably Meliponidae, many of which had full *corbiculae* (pollen-baskets). It seemed reasonable to assume that the bees were pollinating the bamboos.

On discussing this with Dr. Tem Smitinand, he informed me that he had observed insects visiting the flowers of this species on a number of occasions, so this species of bamboo appears to be, at least partially, insect-pollinated.

It has generally been assumed that bamboos, being of the grass family, are wind-pollinated. JANZEN (1976) while writing that bamboos "are apparently wind-pollinated" quotes two records of possible insect pollination. These are from BODEKAR (1930) recording bees hovering round the flowers of *Bambusa polymorpha* Munro, which is the phai hom, 'fragrant bamboo', in Thailand; and a suggestion from GUNCKEL (1948) that a species of *Chusquea* was pollinated by wind "and by some small insects" in Chile. Janzen also gives a reference to insect pollination of some other forest grasses (SODERSTROM & CALDERON, 1971).

That some species of bamboo may be insect-pollinated is interesting for a number of reasons. The bamboos (Bambuseae) are considered by many botanists to be a primitive tribe of grasses, as shown by a number of species having from 6 to many stamens (as opposed to the 3 or fewer stamens of most grasses) and 3 large lodicules which are probably analogous to the perianth of other monocotyledons, and which in other grasses are smaller and often reduced in number (BOR, 1973). CORNER (1965) considers that all living wind-pollinated angiosperms have been derived from insect-pollinated ancestors. Thus insect pollination in bamboos would also be a primitive character, as compared with most other grasses which are wind-pollinated.

There may also be some connection with the much-discussed question of why some bamboos flower gregariously. Such species of bamboo tend to flower at very long intervals of time, from 7 to over 100 years (JANZEN, 1976), but when they flower, every bamboo clump of the species in a given area flowers within a period of about 3 years. The time of flowering is controlled genetically, rather than by the environment, as is shown by records of cuttings of bamboos planted many thousands of km from their parent stands, which in quite different climatic conditions flower at the same time as the parent plants from which the cutting were taken.

JANZEN (1976 and other papers) considers that this gregarious flowering has been evolved in response to the activities of seed predators. Bamboo seeds are so attractive to a number of animals – rats, porcupines, jungle fowl and other birds – that if only relatively small quantities of seed are produced in any year, predation will be so severe that reproduction of the parent plants will be gravely endangered. So the parent plants flower simultaneously and produce such a large quantity of seed that, despite the predators, not all can be eaten, and some seed survives to produce plants of the next generation.

An alternative explanation (WHITMORE, 1975; JACKSON, 1978) is that gregarious flowering is a device to ensure cross-pollination. Since DARWIN (1876) it has been shown that in general more viable seeds are produced from cross-pollinated plants than from self-pollinated ones. Bamboos are essentially forest undergrowth plants, though in many cases they persist and even increase when the overstorey of forest trees has been removed. In the forest understorey wind speeds are generally low, and wind-pollination must therefore be rather hazardous. Thus gregarious flowering of wind-pollinated plants in these conditions could appreciably increase the possibility of cross-pollination.

The conditions of the forest understorey do not hinder insect pollination, however, and in addition insects can transport pollen for considerable distances between plants. Thus in insect-pollinated species of bamboos the pressure towards gregarious flowering might be expected to be less.

The bamboos which I saw flowering were in isolated clumps, and did not form part of a gregarious flowering group. The species, *Gigantochloa albociliata*, is not included in Janzen's table of mast-seeding bamboos, but is included in BRANDIS's (1921) group of "irregularly flowering species" in which "one or a few culms in one clump, or a few clumps in one locality, are in flower at any one time, while at other times all culms of one clump and all clumps in one district are simultaneously covered with flowers". TROUP (1921) writes that it often flowers sporadically, but cites six occasions of gregarious flowering.

On the other hand *Bambusa polymorpha*, referred to above, is a gregariously flowering species, with a period between flowering, according to Janzen, of over 50 years. Troup estimates a flowering cycle of about 60 years or a little more; however, he does also mention occasional sporadic flowering. Brandis also describes it as a gregariously flowering species.

It would be most interesting if further records of insect pollination of bamboos could be obtained, particularly to find out which species are pollinated by insects, and whether these tend to flower sporadically or gregariously. It would also be useful to collect the insects visiting bamboo flowers, to identify them and also the pollen being transported by them.

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