Free e-journals on the Internet

It is indeed unfortunate that our university libraries are poorly maintained (Mariappan, P. and Balasundaram, C., *Curr. Sci.*, 2002, **82**, 491). The funding agencies of State and Union Governments must provide adequate funds to university libraries for subscribing to journals and books, which update the knowledge in this rapidly expanding information age. However, the current financial crisis experienced by many librarians may be partially alleviated by using the Internet. A large number of journals and journal articles can be accessed without any cost to the library, other than a computer and an uninterrupted Internet connection. Regular browsing of websites would update the number of journals available free from time to time. A few websites, which list free e-journals available on the Internet are:

http://e-jis.ncsi.iisc.ernet.in/freej.php
(Indian Institute of Science)

http://info.lib.uh.edu/wj/webjour.html
(University of Houston)

http://www.freemedicaljournals.com/
http://adswww.harvard.edu/
(The NASA Astrophysics Data System)

http://highwire.stanford.edu/lists/freeart.dtl
(HighWire Press).

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Flower structure and function in the classification of bamboos

This has reference to the article entitled 'Insect visits to some bamboos of the Western Ghats, India' by Koshy *et al.*[1]. Based on our studies on floral biology and breeding behaviour in bamboos[2–4], we proposed the division of bamboos into two major categories: (i) the species in which the androecium and gynoecium mature at the same time, lemma and palea open up, expose the reproductive structures to the pollinating agent (wind), as in *Bambusa arundinacea*, and (ii) the species in which the gynoecium matures earlier than the androecium, lemma and palea do not open up, but the stigma and anthers are exerted at different times when they mature, as in *Dendrocalamus strictus*[5]. In the first category the stigma and anthers remain at two different planes. As the filaments are slender and longer, the anthers remain at a much lower plane than the stigma. Thus there is a physical barrier to self-pollination (pollination of stigma by pollen from the anthers of the same flower). In the second category, the barrier to self-pollination is the maturation of pistil and stamen at different times[5] (Figure 1 *a*–*c*). Koshy *et al.*[1] have suggested a further grouping of the *Bambusa* type on the basis of floret opening: (1) Species in which the floral glumes (lemma and palea) are widely separated (as in *Bambusa bambos* and *Bambusa* sp. in their study), and (2) species in which floral glumes are not widely separated (as in *B. vulgaris*); (Figure 1 *d*). We feel this sub-division is premature and not justified. The reasons are: (i) as at present it is based on observation in only one species (or variety as we have referred to it in our earlier publication[6]), and (ii) the species/variety is known to be sterile[6,7–16]. The second point has much significance as the difference in the flower structure and function is for discouraging/preventing self-pollination. Most of the 250,000 species of flowering plants are known to have genetic self-incompatibility systems to prevent inbreeding or morphological mechanisms which favour out-crossing/discourage inbreeding. When no seed is produced, the morphological modification is of no use to the plant, and is not an adaptation. It may have to be considered as an abnormality. As the partial opening of lemma and palea is an intermediate character, one of the possibilities is that *B. vulgaris* (*B. vulgaris* var. '*vittata*') may have originated through hybridization between parents belonging to the two different categories. We have noticed concurrent flowering of *B. arundinacea* (belonging to the first category) and *D. strictus* (belonging to the second category) in Pune[17]. McClure[8] and Janzen[18] considered this species/variety as a sterile mutant, which does not set seed. It is possible that the species is a sterile hybrid. Koshy and Jee[15] have reported many meiotic abnormalities, such as various types and degrees of chromosome associations (almost all cells studied reportedly had at least six quadrivalents, and the rest trivalents, bivalents and univalents – anaphase-I cells showing high degree of variations in the number of chromosomes in the segregating groups – resulting in microspores with differently sized nuclei), frequent occurrence of lagging chromosomes in the anaphase cells, etc. and high degree of pollen sterility. Whether a sterile mutant or a sterile hybrid, this species (or variety) has an unstable genome.

From the copious visit of insects, the possibility that bamboos may be, at least in part, insect-pollinated, has been suggested/suspected by many earlier authors as well[18]. However, bamboos in their natural habitats grow either as monocultures, or as understorey plants in association with few other species, in large areas. The following points also may have to be considered while deciding whether bamboos are wind-pollinated or insect-pollinated. (i) Their relatively small pollen grains are produced in copious amounts, and are shed in a highly dehydrated condition (so that it can be easily carried by the wind). (ii) Their stigmas are feathery and have many papillae. (iii) Insects visit bamboo florets when the climate is good. (iv) In many bamboos, seed-set occurs even in the absence of insect visits. (v) Insects have very short life spans and bamboos flower at very long intervals (so that there

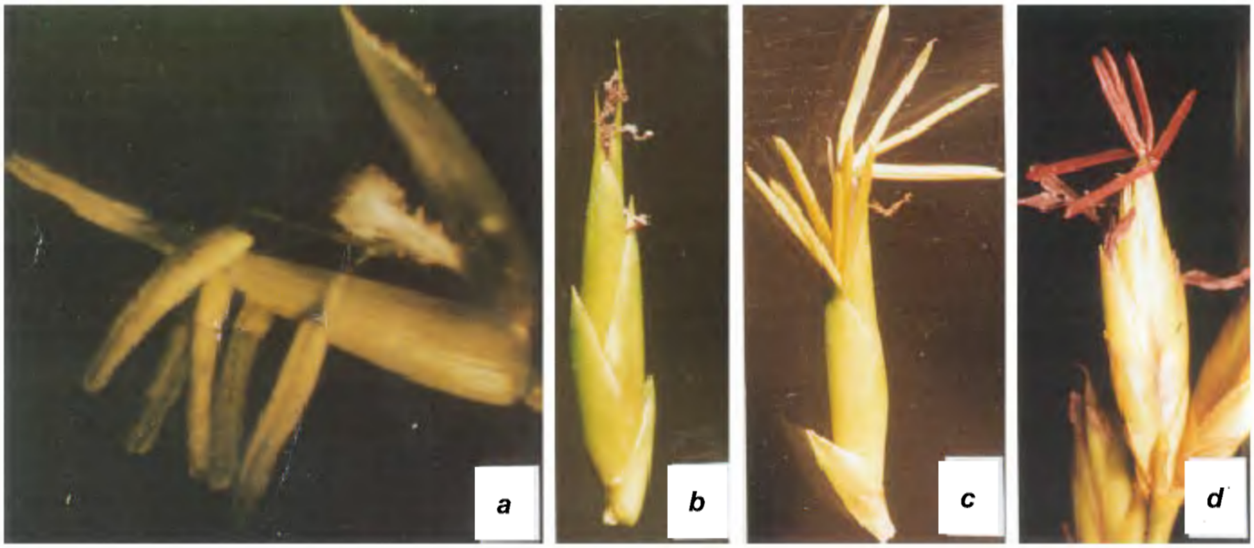

Figure 1. ***a***, One floret of *Bambusa arundinacea* in which the androecium and gynoecium mature at the same time, lemma and palea open up, expose the reproductive structures to the pollinating agent (wind); ***b***, ***c***, Florets of *Dendrocalamus strictus* in which the gynoecium matures earlier than the androecium, lemma and palea do not open up, but the stigma and anthers are exerted at different times when they mature (***b***, at female phase and ***c***, at male phase); ***d***, Florets of *Bambusa vulgaris* var. '*vittata*' (syn. *B. vulgaris*) in which the androecium and gynoecium mature at the same time, but lemma and palea open only partially, and the stigmas are not exposed to the pollinating agent (hence no seed-set).

Figure 2. One floret of *Melocanna bambusoides*. Anthers are not exerted, but insect visitors have collected pollen by cutting open the anther wall.

cannot be a co-evolution between the pollinator and the plant). (vi) Insects often collect pollen from immature anthers by cutting open the anther wall[19] (Figure 2). From our observations, we feel that the purpose of insect visits is collection of pollen (as food) and not pollination. In rare instances they may be affecting pollination, more as an accident than as a routine.

Lastly, *B. vulgaris* florets are referred to as 'monogamous' (p. 835, last paragraph). Possibly the authors mean 'homogamous'. But these two are very different.

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Response:

John *et al.*[1] proposed division of bamboos into two groups based on the timing of maturation of male and female organs: *Bambusa* type and *Dendrocalamus* type. Our studies[2] in six bamboo species are also in agreement with this division. Bamboos can also be divided, using the nature of opening of florets as a character, into two major groups: (1) species with floral glumes (lemma and palea) widely separated at an angle more than 40° (we proposed the term 'open florets'[2]) and (2) species with floral glumes separated at an angle less than 10° ('tubular florets'[2]). Using this trait, we further grouped the three species of *Bambusa* into (i) species having open florets (*B. bambos* and *Bambusa* sp.) and (ii) species with tubular florets (*B. vulgaris*). *B. vulgaris*, thus, undoubtedly represents another group under *Bambusa* type. The descriptions and figures provided by John and Nadgauda are also in favour of this grouping. Sterility and adaptations are different aspects which are not relevant, at least here.

The statement that the positioning of stigma and anthers at two different levels acts as a physical barrier to self-pollination in *B. arundinaceae*, has to be reviewed in the light of the works of Kondas *et al.*[3] and Indira[4], who have inferred self-pollination in the species.

The cytological evidences[5] in *B. vulgaris* surely raise questions on the status of the taxa. It could be a sterile hybrid or a sterile mutant, as suggested by John and Nadgauda. However, further studies may be necessary to throw more light on this aspect.

The florets in *Bambusa* sp.[2] are similar to those of other species of *Bambusa* studied, except that floret opening and bee visitation were observed twice daily. We do not have any conclusive evidences to categorize it under 'heterodichogamy'.

With reference to co-evolution and point (v) that 'insects have very short life spans and bamboo flower at very long intervals', we feel that the comparison of life span of bees should be made with that of bamboo flowers, and not with the long interval of bamboo flowering.

Insect-pollination in bamboos was first suspected by Soderstrom and Calderon[6]. Chris Stapleton[7], a field botanist who worked extensively on bamboos in the Siwalik Hills of Nepal and West Bengal writes, 'I was puzzled as to how *Dendrocalamus hamiltonii* sometimes produced large quantities of seed when only one clump was flowering in the local area, and I put this down to pollination by bees rather than the wind'. After explaining the floral biology and the chances of probable insect pollination, we suspected the co-existence of autophily, anemophily and hymenopterophily in *Bambusa*[2]. The works of Kondas *et al.*[3], Indira[4] (autophily), Soderstrom and Calderon[6] and Stapleton[7] (hymenopterophily) also support this view.

It is true that the florets in *B. vulgaris* are homogamous. Though John and Nadgauda (legend to Figure 1 *d*, this issue) recognize the variety of *vittata* of *Bambusa vulgaris*, their assumption of *B. vulgaris* as synonym is taxonomically incorrect. *B. bambos* (L.) Voss is the correct name for *B. arundinacea* (Retz.) Willd (see Dransfield and Widjaja[8]).

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NEWS

Could the Basmati rice on your plate be an imposter? Call in the 'rice detectives'

There is quite a hullabaloo about the good old Basmati rice. A rice, which has traditionally adorned the plates of a repast fit for kings. In this day and age we know not what we eat, as a result of adulteration and spurious food doing the rounds. In the case of Basmati, it is of paramount importance to distinguish the valued 'traditional' variety from others, considering the high cost of the raw material. For this, and of vital significance to trade, comes a solution with the latest in gene technology to decipher the truth about Basmati rice varieties that we may encounter in the market-place. This is where efficient DNA molecular markers can authenticate traditional Basmati (TB) from evolved Basmati (EB) and the semi-dwarf non-Basmati (NB) rice varieties.

TB variety has special characteristics 'culminated by centuries of selection and cultivation by farmers'. The TB variety is characterized by 'extra-long, slender grain, pleasant and distinct aroma, and soft and fluffy texture'. However, TB has also not so good characteristics, for example, 'tall stature, low yield, etc.'. To rectify this, and in order to develop better 'elite' strains, rice breeders have resorted to combinations with high-yielding NB resulting in the EB variety. The EB variety however, does not turn out to be quite the best. This is due to difficulties involved in getting the best match, while crossing the most desirable qualities. A recent publication by J. Nagaraju *et al.*[1], titled 'Genetic analysis of traditional and evolved Basmati and non-Basmati rice varieties by using fluorescence-based