with previous observations[1,2]. Low frequency of anaphase, telophase and prophase and high frequency of metaphase indicate the occurrence of metaphase arrest. This metaphase arrest is a C-mitotic effect which may indicate that the leaf extracts studied here possess narcotic effect similar to that of colchicine. Colchicine causes an increase in the mitotic index because of its property of metaphase arrest which tallies with the previous observations[3,4].

A reduction in the mitotic index has been observed in the roots treated for long periods in different concentrations of the leaf extract. But the mitotic stages have been low in some cases. Thus the reduction in the mitotic index may be due to the inhibitory effect of the extract at the onset of mitosis in spite of the existence of metaphase arrest. The effect of this leaf extract differs to some extent, from that of colchicine, which is corroborated by the previous data.[2,5]

Though the effects of leaf extract reveal a similarity with that of colchicine, the decrease in mitotic index may indicate its mitotoxic effect. This toxicity of the leaf extract may serve to protect the grains from insect attacks. The narcotic effect resulting into metaphase arrest may also harm the reproductive potentiality of the insects, thereby influencing the production of insect progenies. Therefore, the mitotoxic effect as well as C-mitotic effect of the leaf extract may act simultaneously in protecting grains from insect attacks.

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NEW ADDITIONAL HOSTS OF *PENTALONIA NIGRONERVOSA* COQ.

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THE banana aphid, *Pentalonia nigronervosa* Coq., was first reported[1] as a vector of the "bunchy top" disease of banana. Wardlaw[2] reported that the banana aphis is host-specific, that it is not known to live and flourish on hosts other than *Musa* species. The report also states that the aphid colonizes only on banana plants. Banana aphid colonies were occasionally observed[1] on plants of *Ravenala* and *Strelitiza* spp. growing in the proximity of banana stools in the Royal Botanic Garden, Brisbane. Urich[3] observed these aphids on wild banana, on balisier (*Heliconia bihai*) and on other monocotyledonous plants in Trinidad. Wolcott[4] recorded the presence of *P. nigronervosa* on Tannia in Puerto Rico and Ocfemia and Buhay[5] observed them on imported *Calla* flowers and on *Hedychium coronarium* Koling (Zingiberaceae) in the Phillipines. Uppal *et al.*[6] and Varma and Capoor[7] observed that this aphid colonizes in nature on *Chhoti elaychi (Elettaria cardamomum)* and Vasudeva[8] reported it on large cardamom *(Amomum subulatum).* Siddappaji and Reddy[9] observed *P. nigronervosa* var. *caladii* v.d. Groot occurrring on *Colocasia* plants. But so far, there is no record on *P. nigronervosa* colonizing on *Colocasia* and other allied species.

During the survey of some banana plantations in the Vasai (Bassein) Taluka of Thane District in Maharashtra State, it was observed that *Colocasia* with purple stalk was often grown by banana growers as a mixed crop in banana fields. It was interesting to note that some aphids, appearing like *Pentalonia*, were present at or near the leaf bases of these plants. The present study was carried out to ascertain whether *P. nigronervosa* could colonize on *Colocasia* and other allied species of the family Araceae.

Pentalonia aphids were collected from banana plants growing at the College of Agriculture, Pune and were identified as *Pentalonia nigronervosa* Coq. These aphids were released on healthy seedlings of *Colocasia antiquorum* Schott. having purple/black or green stalks and also on stalk of *Alocasia* sp. The plants were enclosed in muslin cages. It was found that the aphids preferred colonizing on these hosts; the multiplication rate was faster and higher on these plants during the period January to March 1981 when the maximum temperature was in the range of 24 to 30° C. From April 1981 onwards, however, there was a reduction in the aphid population on the plants. It appeared that the aphid preferred leaf base and also stalks of these plants. Both winged and apterous forms were noticed on the same stalk.

The colonization of *P. nigronervosa* Coq. on *Colocasia* and *Alocasia* spp. reported here constitutes the first record from India.

Further studies on the biology and on the behavioural and epidemiological aspects of this aphid species on these hosts and on allied plant species are under way. Studies are also in progress to ascertain whether these additional hosts of *P. nigronervosa* serve as reservoirs of the banana 'bunchy top' disease in nature and if so, whether these plant species play a role in the spread of this disease in banana plantations.

The authors are grateful to Dr. A. N. Basu, IARI, New Delhi, for conforming the identification of this aphid.

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ON BIFURCATION RATIO IN *SCHIMA* SPECIES

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THE bifurcation or branching ratio (*Rb*) which was first used by geomorphologists to quantify the drainage patterns of stream basins is based on Horton's[1] suggestion that in a drainage network the number of segments (streams) of each order forms an inverse geometric series with order number, which is constant throughout a river system. More recently the concept has been used to characterize the branching networks of biological systems, such as trees[2–7]. This paper attemps to relate this concept to *Schima khasiana* and *S. wallichii* two closely related tree species. These trees have a monopodial trunk which grows rhythmically and develops tiers of branches (Rauh's model).[8] The leader axis as well as branches are sylleptically borne. Flowers are axillary with no direct impact on the geometry of the tree crown.

For the present study 10 replicates of 'open' grown and 'forest' grown trees of *S. wallichii* from lower (Burnihat, 100 m) and higher (Shillong, 1,600 m) altitude; and *S. khasiana* from Upper Shillong (1,900 m) in Meghalaya (89° 45′ - 92° 50′ E and 25° - 26° 10′ N) were randomly chosen. The branch systems of the trees were ordered according to the centripetal ordering system using Horton's[1] method as modified by Strahler[9]. The bifurcation ratio was calculated by Motomura's[10,6] formula : $N\text{-}N_{max}/N\text{-}N_1$, where N is the total number of the branches of all orders, N_{max} is the number of branches of the highest order; and N_1 is the number of the branches of first order.

The bifurcation ratio values (table 1) were not significantly different (at 5% level) between the open and forest grown trees of *S. wallichii* but in *S. khasiana* significant differences (at 1% level) occurred. The altitude did not affect *Rb* values significantly for the two species/populations.

Oohata and Shidei[3] and Whitney[4] analysed bifurcation ratio and considered it to be a measure of morphological adaptation of the crown structure to a particular niche. Further, that may be a species-specific constant, suggesting that a given species has limited ability to modify the crown structure under different environments. On the other hand, Steingraeber *et al.*[6] and Pickett and Kempf[7] suggested that this is variable under different light environments. We tend to support the latter viewpoint only partially as the open and forest grown trees of *S. khasiana* alone differ significantly with respect to Rb values. The branch ordering system[9] and the subsequent calculation of *Rb* values completely ignores the information pertaining to architectural development of trees[8], according to which the main axis would represent the lowest order followed by increase in

TABLE 1

Bifurcation ratio (Rb) values(±S.E.) for Schima Reinw. ex Blume, species

	Open grown		t-value	Forest grown	
	Mean ± S.E.	Range		Mean ± S.E.	Range
S. wallichii (DC) Korth (Lower altitude)	3·99±0·49	3·31 – 4·76	0·76 N.S.	3·44±0·19	3·00 – 4·14
S. wallichii (DC) Korth (Higher altitude)	3·85±0·20	3·00 – 4·20	1·81 N.S.	3·40±0·14	3·00 – 3·95
S. khasiana Dyer	3·91±0·14	3·38 – 4·75	4·06*	3·24±0·09	3·00 – 3·59

*Significant at 1% level; N.S. = not significant.