January–March; it was significantly higher during January-March; when compared to the other periods except July–September. The pest population was also high in the field during the period January–March. However during July-September the pest population was low and was seen on young trees only; the fecundity of females was also high. The incubation period of eggs ranged between 6–10 days and was maximum (7.9±1.28 days) during July-September (mean temperature 27.6°C; RH 92.8%) which was significantly higher than other periods. The nymphal period ranged between 8–13 days and was maximum (11.5±0.80 days) during October–December (mean temperature 29.0°C; RH – 95.8%) which was significantly higher than other periods. The longer duration of the egg and nymphal stages during July–December may probably be due to the lower temperatures and the high relative humidities in the laboratory during that period.

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# A Case of Reversible Plagiotropy in Nutmeg *Myristica fragrans* (Houtt.)*

Nutmeg (*Myristica fragrans* Houtt.), an important tree spice is characterised by branch dimorphism exhibiting orthotropy in the trunk and plagiotropy in the branches (Fig 1). The stability of this morphogenetic change in nutmeg appears to be permanent as evidenced by the growth pattern of approach

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grafts made out of plagiotropic scions and planted at the Horticultural Research Stations, Kallar and Burliar, Tamil Nadu, India during 1952 where even after 30 years no tendency towards orthotropy in the scions was noticeable and whatever orthotropic shoots that have emerged from these grafts were traced to be rootstock sprouts (personal observation). According to Halle, Oldmann and Tomlinson, (1978) irreversible plagiotropy is most pronounced when spiral phyllotaxy is retained on orthotropic shoots in contrast to the distichous leaves of plagiotropic shoots. This condition is applicable in nutmeg. Thus the general experience indicates a non-reversible nature of plagiotropy in nutmeg. Similar cases have been reported in coffee (Carvalho, Krug and Mendes, 1959), cocoa (Greathouse and Laetsch, 1969), *Hydnocarpus* (Mendes, 1950) and *Araucaria excelsa* (Vochting, 1904). However, inspection of aged nutmeg trees over 50 years old showed the formation of orthotropic shoots from plagiotropic axes located at levels at or below the horizontal plane on lower branches farther from the trunk though such shoots were few. The lessening influence of apical control coupled with the advanced age conditioning the morphogenetic change to orthotropy might be involved in these cases as exemplified in *Trema occidentalis* and *Xylopia* (Halle et al. 1978). Greathouse and Laetsch (1969) also made similar observations in cocoa. The author has noticed orthotropic response in plagiotropic shoots of four year old nutmeg seedlings kept in the nursery that exhibited vigorous growth and also the development of erect growing shoots at the proximal end of plagiotropic branches close to the trunk, after beheading of female trees when the branches were cut retaining a stub of about 30 cm long (10 year old trees). Occasionally, innovative cultivators who planted grafts made with plagiotropic scions, have reported that they could induce orthotropy in the grafts by severe pruning of old plagiotropic branches. A case of such differentiation of plagiotropy to orthotropy during budding trials in nutmeg is presented in this note. Orthotropy has great significance in nutmeg as only such scions can develop into an erect growing graft.

Experiments on budding of nutmeg were carried out at the Research Farm of Central Plantation Crops Research Institute, Calicut during the years 1979 to 1981, using twenty five rootstock seedlings each of *Myristica fragrans* and *M. beddomei* all aged two years adopting the Forkhert method. The scions consisted mainly of plagiotropic shoots having the same thickness as that of the stock from female nutmeg trees since the availability of orthotropic scions were limited. The age of the scion trees in the 1979 and 1980 budding was 10 years and 5 years for the 1981 buddings. Though budding is highly successful, the growth pattern of the sprouted buds was plagiotropic with plagiotropic scions and orthotropic with orthotropic scions. In the first two years, the major problem encountered was the failure of successful 'Bud-takes' to sprout out. Treatments



Fig. 1. Nutmeg seedling showing orthotropic mainstem and plagiotropic branches
Fig. 2. Orthotropic shoot developing from plagiotropic scion after bending treatment

such as defoliation, decapitation, notching and stimulation with liquid manure did not help though spontaneous sprouting also occurred. The bending of the rootstocks at the budded portion was attempted in the third year of trial and in 30 days after the treatment all the buds sprouted exhibiting plagiotropic growth pattern akin to the nature of the scion. However, after a period of 10 months of scion growth, orthotropic shoots were seen arising from the base of the previous plagiotropic growth in many cases where the bending treatment was given (Fig. 2). Table I gives the survival of the budlings that have been forced to sprout and the number of cases wherein change to orthotropy occurred after 19 months. The observations were seen in 1979 and 1980 buddings only. All the buddings were kept under shade of coir mats. At the time of last observation the 1981 budlings have not exhibited any orthotropy.

First it was suspected that these erect shoots might be arising from the rootstocks but closer examination with wild stocks have confirmed that these erect shoots arose from the budded patch close to the previous sprout. No such pattern of shoot growth was observed in those budlings that have sprouted either spontaneously or without the bending treatment even

Table I. *Survival of budlings in nutmeg (upto 31st May, 1983)*

| Month | Rootstocks (25 No. each) | | | | | |
|---|---|---|---|---|---|---|
| | *M. fragrans* | | | *M. beddomei* | | |
| | 1979 | 1980 | 1981 | 1979 | 1980 | 1981 |
| January | 0.0 | 9.0(3)* | — | 0.0 | 16.0(6) | — |
| February | 0.0 | 11.0(2) | — | 0.0 | 9.0(3) | — |
| March | 0.0 | 1.0 | — | 0.0 | 0.0 | — |
| April | 0.0 | 0.0 | — | 0.0 | 0.0 | — |
| May | 0.0 | 12.0(1) | — | 0.0 | 18.0(4) | — |
| June | 0.0 | 3.0(1) | 0.0 | 0.0 | 4.0 | 0.0 |
| July | 0.0 | 0.0 | 92.0 | 0.0 | 4.0 | 76.0 |
| August | 0.0 | 0.0 | 44.0 | 2.0(1) | 0.0 | 8.0 |
| September | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 20.0 |
| October | 0.0 | 0.0 | 20.0 | 0.0 | 0.0 | 12.0 |
| November | 0.0 | 0.0 | 8.0 | 0.0 | 0.0 | 8.0 |
| December | 0.0 | 0.0 | — | 1.0 | 0.0 | — |
| Total | 0.0 | 36.0(7) | 184.0 | 3 (1) | 51 (13) | 124.0 |

* Figures in brackets show the number of cases wherein orthotropy was observed

— No buddings were done in these months during the year

after 3 years. Though the total number of orthotropic shoots initially recorded was ten, gradually other budlings of this group started putting out orthotropic shoots and after a period of 19 months, 21 cases were recorded. It may be possible that eventually all the 90 budlings may put out erect shoots and develop into erect growing scions.

Since the bending of the stem interferes with hormone transport, it may be contested that threshold levels of particular hormones at the bent might have induced the dedifferentiation of the plagiotropic meristem. Halle et al. (1978) mentioned that 'apical control' through hormones are involved in branch dimorphism in trees. Since native auxins move downward in the stem, accumulation of high levels at the bent might have been contributory to a conducive physiological state for the meristem to revert to orthotropy. Greathouse and Laetsch (1969) suggested that an aging orthotropic meristem may promote plagiotropic shoots by alteration in the balance of growth regulators which probably involves a reduction in auxin levels. Hence, high levels of auxins may be responsible for orthotropy of plagiotropic meristem. The role of plant hormones in the phenomenon of orthotropy and plagiotropy if resolved, can be a boon in the vegetative propagation of many tropical species characterised by rythmic branching. A perusal of the Table I shows that the buds have remained dormant for more than one year before sprouting. Hence these buds developed proleptically in which case orthotropic shoot development is indicated (Halle et al. 1978). The first shoot emerged invariably was plagiotropic in all the cases because the budpatch contained the already differentiated plagiotropic meristematic bud at the time of budding. The buds subsequently developed were influenced by factors both external and internal during the successive stages of making a bud graft. The conditioning effect of age in the reversion of plagiotropy is not tenable here as the trees used as scion source are young. Factors such as vigour of the scion tree, the physiological condition of the scion, the relative position of the scion in the tree crown or the multiple nature of auxillary buds giving rise to different types of shoots (Greathouse and Laetsch, 1969) or the variability of rootstocks may be involved in this phenomenon.

The above observation is significant in the vegetative propagation of nutmeg necessitated by the dioecious nature and variability of the crop, where, to get erect growing clones budding or grafting has to be confined to the use of orthotropic scions which are limited. The possibility of physiological manipulation of the plagiotropy in nutmeg is also indicated here.

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# A Simple Pressure Injection Device for the Application of Antibiotics on Coconut Palms

In the light of the reported association of mycoplasma like organisms (MLOs) with the coconut root (wilt) disease (Solomon, Govindankutty and Neinhaus, 1983), treatment with tetracycline antibiotics was attempted for its possible remission effect against the disease. Studies