

# PHENOLOGY OF SHOOT GROWTH IN CERTAIN EVER-GREEN AND DECIDUOUS TREES OF KUMAUN HIMALAYA

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In the present study the shoot growth and diameter growth pattern in leader shoot as well as in lateral shoots were analysed in evergreen and deciduous species (*Abies pindrow*, *Quercus floribunda* and *Fraxinus micrantha*) and shoot growth was noted throughout the study period in semi-evergreen species while it was confined to April-September in evergreen and deciduous species. Diameter growth mostly confined to the period of April to October in all the species and it was more rapid in contrast to the height growth.

**Keywords :** Shoot growth; *Abies pindrow*; *Quercus floribunda*; *Fraxinus micrantha*;  
Diameter growth.

## Introduction

Shoot growth of trees is affected by various environmental components, temperature, mineral supply, composition of the atmosphere above and below ground, soil chemical and physical properties, insects, other plants and various animals. Under natural conditions shoot growth is influenced much more by light intensity and photoperiod than by light quality (Kramer and Kozlowski, 1960; Gothreau et al., 1963).

In the present study the seasonality of height and diameter growth

is studied to understand that how evergreen species differ from deciduous species.

## Materials and Methods

For the analysis of growth pattern in shoot growth and diameter growth, a total of 9 saplings, 5 of each species viz. *Abies pindrow* (evergreen species), *Quercus floribunda* (semi-evergreen species) and *Fraxinus micrantha* (deciduous species) ranging 200 and 325 cm in length were marked by metal identification tags, in the undisturbed forest located at Government House site. The saplings



chosen had single dominant leader, the grazed saplings having no distinct dominant leader, were avoided. The parameters measured in each sapling were growth in one dominant leader shoot and lateral shoots (lower, middle and upper strata) and diameter 5 cm above ground level (dgl) and at breast height (dbh) and diameter of lateral shoots were measured near the point of their attachment to the main shoot. Three lateral branches from each stratum were marked with an oil-paint. The growth in leader shoot and lateral shoot were measured by a sealed tape. The diameter was measured by a screw-gauze. The values were averaged separately for each species. All the measurements were taken for the total 12 months on the 1st date of each month.

### Results and Discussion

*Leader shoot height growth*—Cumulative height growth of main shoot for different species are given in Fig. 1 (a,b,c). The height growth was noted throughout the period of study in semi-evergreen species while in other two species, it was mostly confined to April–September period. However, a sizeable portion of the semi-evergreen species during one month period between February and March was noted. In deciduous species about 87% growth occurred from April to August and in evergreen species about 60% growth occurred in the period of May July and 26%

during the period of August–September.

*Lateral shoot growth*—In all the species the growth in length was found more for the upper stratum and middle stratum. In evergreen species a period of the rapid growth accounting during May–June accounts for about 65% of the total growth. In semi-evergreen species about 50% of the total growth was recorded during May–July in each stratum, while in deciduous species the growth was comparatively more in May in middle stratum (77.44%) and the rapid growth period was recorded from May–June for other strata.

*Diameter growth of stem*—Diameter increment was mostly confined to the period of April–October in all three species. Total diameter increment was found more in evergreen species followed by deciduous species and semi-evergreen species. In evergreen species diameter increment was more rapid during June–August (58.84% and 67.25% of the total growth respectively for dbh and dgl). In semi-evergreen species and dbh increased rapidly during May–August (80.13% of the total growth) and dgl increased rapidly once during May–June accounting 58.6% of the total growth and then during July–September accounting 36.6% of the total growth (Fig. 2 a, b, c).



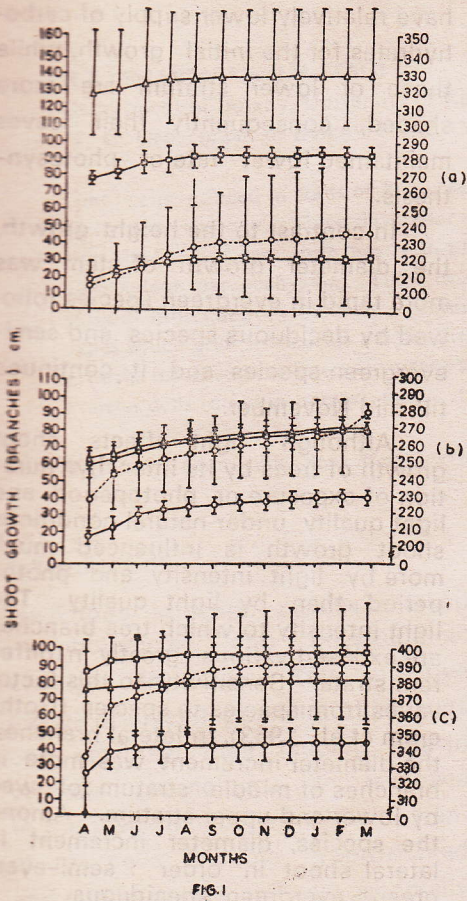


FIG. 1

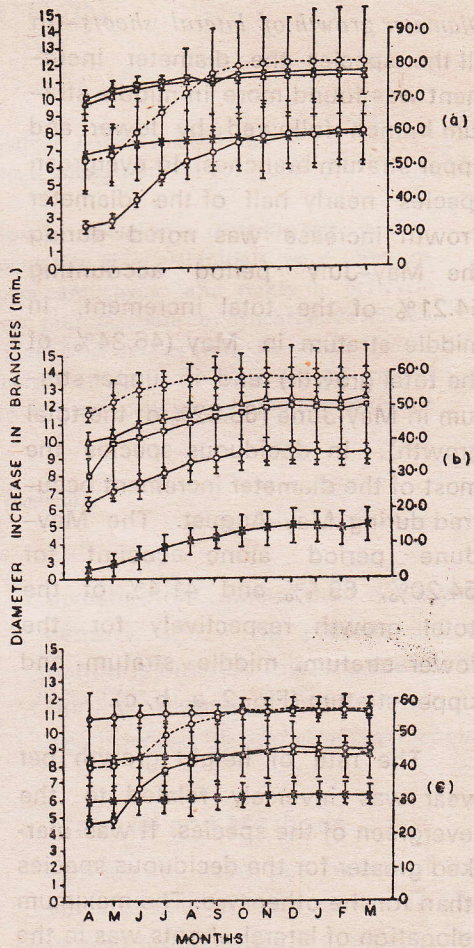


FIG. 2

Fig. 1—Cumulative shoot growth (cm) a-*Abies pindrow*, b-*Quercus floribunda* c-*Fraxinus micrantha* (closed circle with dotted lines—leader shoot, triangle with smooth lines—lower stratum branch, quadrangle with smooth lines—middle stratum branch and closed circle with smooth lines—upper stratum branch).

Fig. 2—cumulative diameter increment (mm) a-*Abies pindrow*, b-*Quercus floribunda*, c-*Fraxinus micrantha* (closed circle with dotted lines—leader shoot, triangle with smooth lines—lower stratum branch, quadrangle with smooth lines—middle stratum branch and closed circle with smooth lines—upper stratum branch).



*Diameter growth of lateral shoots*—In all the species the diameter increment was found more in middle stratum branch followed by lower and upper stratum branches. In evergreen species nearly half of the diameter growth increase was noted during the May–July period accounting 54.21% of the total increment, in middle stratum in May (46.34% of the total growth) and in upper stratum in May–June (68.82% of the total growth). In deciduous species the most of the diameter increment occurred during May–August. The May–June period alone account for 54.20%, 69.4% and 41.4% of the total growth respectively for the lower stratum, middle stratum and upper stratum (Fig. 2 a, b, c).

The rate of height growth per year was inversely related to the evergreen of the species. It was marked greater for the deciduous species than for the other two. The maximum elongation of lateral shoots was in the branch of middle stratum of the species followed by upper and lower stratum. It indicates that all the three species tend to form similar shape of crown sheet growth, till the leaves are not able to produce photosynthate in addition to their own requirement, occurs at the expense of previous year's nutrition reserves. The subsequent shoot growth depends on photosynthetic activity of the leaves

possibly, the shoots of upper stratum have relatively lower supply of carbohydrates for the initial growth, while those of lower stratum are more shaded, consequently their leaves maintained lower rate of photosynthesis.

In contrast to the height growth, the diameter growth of stem was more rapid in evergreen species followed by deciduous species and semi-evergreen species and it continued till mid November.

Although light affects shoot growth of trees by its intensity, duration of exposure or photoperiod and light quality, under natural conditions shoot growth is influenced much more by light intensity and photoperiod than by light quality. The light intensity to which tree branches are exposed varies greatly in different strata. Sensitivity to this factor varies from species to species (Gotherum et al., 1963). In lateral branches, the diameter increment was more in branches of middle stratum followed by lower and upper stratum. Among the species, diameter increment in lateral shoot is in order : semi-evergreen > evergreen > deciduous.

#### Acknowledgement

Financial support from Department of Environment, Govt. of India is gratefully acknowledged.

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Accepted October, 1989

#### References

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