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SOME FACTORS WHICH MAY INFLUENCE

ROOT FORMATION IN CONIFER

CUTTINGS

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the Requirements for the Degree of
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ABSTRACT

Seasonal fluctuations in adventitious root formation capacity of cuttings of Juniperus virginiana L. 'Skyrocket' ("easy-to-root") and J. scopulorum Sarg. 'Pathfinder' ("difficult-to-root"), as indicated by three parameters, was determined over a nine month period from late summer (February) until spring (October). Rootability rose from a low or moderate level in late summer to an optimum in mid winter after an intervening period of low potential and diminished again in spring. A less comprehensive study of Cupressus sempervirens L. 'Swane's Golden' ("easy-to-root") revealed that rootability was high in February and June but low in March. The most marked difference in the pattern of seasonal changes between the two juniper cultivars occurred in the percentage of cuttings rooted, which increased dramatically in J. virginiana 'Skyrocket' in April and remained at high levels before declining sharply in October but remained low in cuttings of J. scopulorum 'Pathfinder' until the optimum was attained suddenly in June and diminished thereafter. Generally more gradual changes occurred in the other parameters.

Air temperature treatments of the stock plants and cuttings induced significant differences in level of rooting achieved in cuttings taken in mid winter. Material of J. virginiana 'Skyrocket' and J. scopulorum 'Pathfinder' from stock plants which had received normal winter chilling had a greater root regeneration potential than

that from plants maintained in a heated glasshouse since autumn. The converse was true for cuttings of J. scopulorum 'Blue Haven' ("very difficult-to-root") and C. sempervirens 'Swane's Golden'. The effect of cutting environment was rather more variable but material which had been exposed to the most favourable parent environment tended to root in greatest numbers in an unheated compared with a heated air environment. Responses of J. scopulorum 'Pathfinder' and C. sempervirens 'Swane's Golden' under controlled environment growth cabinet conditions confirmed these results. The attainment of a high rooting percentage in cuttings of J. scopulorum 'Pathfinder' in mid winter appeared to be dependent to a large extent on exposure of the stock plants to low temperatures. Results from the seasonal study generally coincided with the commonly held opinion that phase of growth may be an important determinant of root formation potential in narrow-leaved evergreens. It was suggested that the promotion of rooting in chilled material of J. virginiana 'Skyrocket' and J. scopulorum 'Pathfinder' may have been associated with the stimulation of shoot activity brought about by that treatment but there was no conclusive evidence to support this.

Analysis of endogenous growth regulator content was conducted in material from different cultivars, temperature treatments and harvest dates. Level of an IAA-like growth promoter seemed to be the least related to differences in rootability. Estimated ABA and total cytokinin content appeared to be inversely related to rootability in several instances.

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Abbreviations

Mid Winter Study

Parent Material Treatments

- WP = "warm parent" = parent plant held in a heated glasshouse (18°C) from autumn
- WCP = "warm+cold parent" = as for WP plus two weeks winter chilling prior to excision
- CP = "cold parent" = parent plant exposed to normal winter chilling
- CCP = "cold+cold parent" = as for CP plus two weeks cool-storage (5°C) of cutting material

Cutting Treatments

- WH = "warm propagation house" = cuttings propagated in a heated glasshouse (18°C) over basal heat
- CH = "cold propagation house" = cuttings propagated in an unheated glasshouse (approx. 13°C) over basal heat

Growth Cabinet Study

Parent Material Treatments

- WP = "warm parent" = parent plants maintained in a warm environment (20°C)
- CP = "cold parent" = parent plants maintained in a cold environment (10°C)

Cutting Treatments

- WH = "warm propagation house" = cuttings propagated in a warm environment (18°C) over basal heat
- CH = "cold propagation house" = cuttings propagated in a cold environment (12°C) over basal heat

CHAPTER 1

INTRODUCTION

1.1 Introduction to the Present Investigation

A vegetative means of propagating certain plants is frequently desirable or necessary and for this purpose the use of stem cuttings is normally the preferred and certainly the most extensively applied method. The utilization of this important means of propagation is often seriously hampered however by a low ability of cuttings of many species to form adventitious roots or by large variations in this ability.

Most species exhibit a degree of seasonal variation in their capacity to root from cuttings and root initiation potential of conifers is often greatly influenced by factors associated with season or state of growth. Adventitious root formation is a complex phenomenon involving interactions of many environmental and endogenous factors not yet clearly understood although such an understanding could be of great assistance in overcoming some of the difficulties encountered in practice. Research conducted at the New Zealand Nursery Research Centre, Palmerston North, indicated that air temperature at both the stock plant and cutting stages may significantly affect rooting of certain conifer species. The present study was therefore undertaken to investigate:

- i) seasonal fluctuations in root formation ability,

ii) the effects of air temperature at the parent material and cutting stages on rooting of the cuttings,
 iii) levels of certain endogenous growth regulators in relation to capacity to form roots

in easy- and difficult-to-root conifers and to determine possible relationships between these.

1.2 Description of the Cultivars

Four cultivars were used in the study: Juniperus virginiana L. 'Skyrocket' syn J. scopulorum Sarg. 'Skyrocket' ("easy-to-root"); J. scopulorum Sarg. 'Pathfinder' syn J. virginiana L. 'Pathfinder' ("difficult-to-root"); J. scopulorum Sarg. 'Blue Haven' syn 'Blue Heaven' ("very difficult-to-root"); Cupressus sempervirens L. 'Swane's Golden' ("easy-to-root").

The junipers form a very large and important genus from which which a great many cultivars are derived. J. virginiana (eastern red cedar or pencil cedar) and J. scopulorum (Rocky Mountain juniper) are native to eastern and western North America respectively. Identification of these genetically diverse species is difficult and many hybrids occur between these and other species. The two species are closely allied and some authors believe that J. scopulorum may be only a subspecies of J. virginiana. Although both have given rise to many highly valued ornamental cultivars, these hardy species

are of commercial value in other respects. J. virginiana for instance is used in its country of origin for timber, essential oils and windbreaks, and ultimately forms a large tree. (Bailey, 1928; Haverbeke and Read, 1976).

J. virginiana 'Skyrocket' is of a very narrow, columnar growth habit, with grey-green foliage and has a rather fast rate of growth in comparison with most junipers.

J. scopulorum 'Pathfinder' and J. scopulorum 'Blue Haven' have blue-grey foliage and are of upright, pyramidal growth habit. All have predominantly scale-like leaves although foliage of juvenile, more open appearance is commonly found scattered throughout the plant. A height of approximately 2 - 2.5 m is reached after ten years. Propagation is normally from cuttings except in J. scopulorum 'Blue Haven' which is reported to be grafted in most instances (Harrison, 1975; Bloom, 1972; Proudley, 1977).

The cypresses are valued ornamentals in mild climates and C. sempervirens (Italian cypress), as the common name indicates, originates from southern Europe. C. sempervirens 'Swane's Golden' is a slow growing yellow-gold form of narrow, columnar growth habit and is normally propagated by cuttings. (Harrison, 1975; Proudley, 1977).