grades of 6 mm and less). The plants are fed with a top dressing of Nutricote and regular liquid dressings of Aquasol The bulk of the plants are sold in the spring some 9 to 10 months after the cuttings were first taken.

EFFECT OF AUXIN COMBINATIONS ON ROOTING *PERSOONIA CHAMAEPITYS* AND *P. PINIFOLIA* CUTTINGS

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Abstract. The effect of indolebutyric acid (IBA) alone and in combination with naphthaleneacetic acid (NAA) and/or 2, 4 dichlorophenoxyacetic acid (2,4-D) on the rooting of *P chamaepitys* and *P pinifolia* was investigated The highest percentage rooting was obtained following treatment with a combination of all three auxins Retreatment of the cuttings with auxin after a period of time under mist further stimulated rooting A possible explanation for the findings is presented

A basic system for root initiation and development was proposed more than 25 years ago (1). In the intervening 25 years much evidence has been gathered in its support and it is on the verge of being proved correct. The endogenous auxin indoleacetic acid (IAA) was identified in 1934 and was soon being added exogenously to promote the rooting of cutting. Synthetic auxins, notably indolebutyric acid (IBA) and naphthaleneacetic acid (NAA), were soon developed and because of their greater stability and mobility were found to be of greater commercial use. Generally IBA has proved the more effective auxin. With some species, however, NAA has proven superior to IBA in promoting rooting while with a few species a combination of IBA and NAA has been shown to be superior to either auxin alone These findings suggest that the two hormones may not have the same site of action.

Furthermore, 3-methyleneoxindole, formed by the oxidation of IAA (6) has been shown to be at least 10-fold more effective than IAA as a plant auxin (9). Subsequently Haissig (4) suggested 3 methyleneoxindole rather than IAA to be the compound that conjugates with a phenolic cofactor to form an auxin cofactor complex responsible for triggering root initiation (Figure 1). However, 3-methyleneoxindole can be inactivated by reduction to 3-methyloxindole by a group of enzymes, 3 methyleneoxindole reductases, which show differential sensitivity to the synthetic auxins NAA and 2,4-dichlorophenoxyacetic acid (2,4-D) (8). With two of the reductases, which could be separated completely by column chromatography, one was found to be strongly inhibited by NAA, and the other by 2,4-D Since NAA cannot be oxidized to methyleneoxindole, it was postulated that its mode of action as an auxin might be in maintaining elevated levels of endogenous 3 methyleneoxindole by inhibition of 3-methyleneoxindole reductase (9); 2,4-D might be expected to act similarly. Furthermore, if several of these reductases are active in tissue then the use of a combination of both NAA and 2,4-D might be superior in initiating an auxin response.

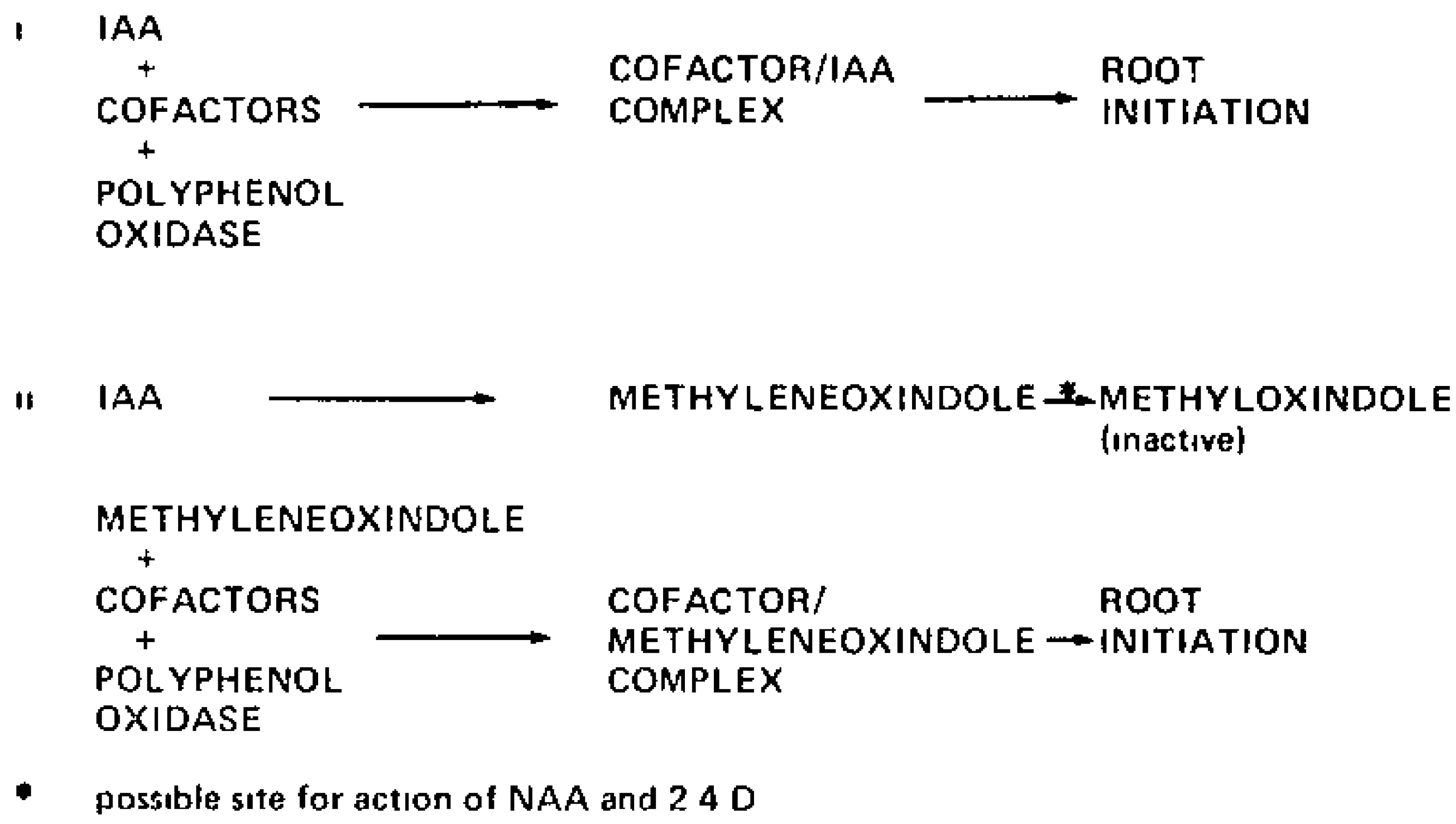

Figure 1. Two possible schemes for root initiation

The genus *Persoonia* contains a number of species of considerable horticultural merit. *P. chamaepitys* is a beautiful prostrate plant with bright, light-green foliage, and yellow flowers. *P. pinifolia* is a pendulous shrub growing to 4 metres which bears yellow flowers followed by bunches of succulent fruits. In cultivation they are generally hardy in sunny, well-drained positions. Unfortunately most have proved very difficult to propagate from either seed or cuttings. At the National Botanic Gardens, A C.T. a small number of *P. pinifolia* seed have been germinated following treatment with gibberellic acid (unpub. data). Propagation from cuttings has generally been unreliable Ellyard (2) reported a 50% strike rate with cuttings of *P. chamaepitys* taken in May and treated with a 500 ppm IBA/500 ppm NAA liquid quick-dip formulation. This strike rate, however, has not been achieved in subsequent work

In this paper the results of a study on the effect of IBA, NAA, and 2,4-D on the rooting of *P. chamaepitys* and *P. pinifolia* cuttings are reported.

MATERIALS AND METHODS

Tip cuttings, 100 to 120 mm in length, were taken from cultivated plants and the leaves removed from the basal two-thirds. The effect of six hormone treatments on rooting was investigated. All hormone treatments were applied as a five-second dip to the basal surface of the cutting and excess solvent (ethanol, water 1.1) allowed to evaporate. The cuttings were then placed to a depth of 50 mm in 100 mm square plastic pots, 15 per pot, containing a medium of equal parts washed sand, perlite, and sieved German peat moss. All cuttings were watered and placed under mist on a sand bed heated to maintain a temperature of 25° ± 2°C in the cutting medium The pots were re-randomised and treated with fungicide, alternately benomyl and Captan, weekly.

Fourteen weeks after placing on the bench the cuttings were harvested and the number of rooted cuttings per treatment recorded.

Following the first evaluation the live unrooted cuttings in each treatment were divided into two groups. The base of each cutting in the first group was recut to expose live wood and the cuttings inserted in fresh cutting medium Cuttings in the second group were recut and retreated with the relevant auxin and inserted in fresh cutting medium. The cuttings were returned to the mist bench and re-evaluated after a further eleven weeks

RESULTS

The rooting of both *P. chamaepitys* and *P. pinifolia* cut-

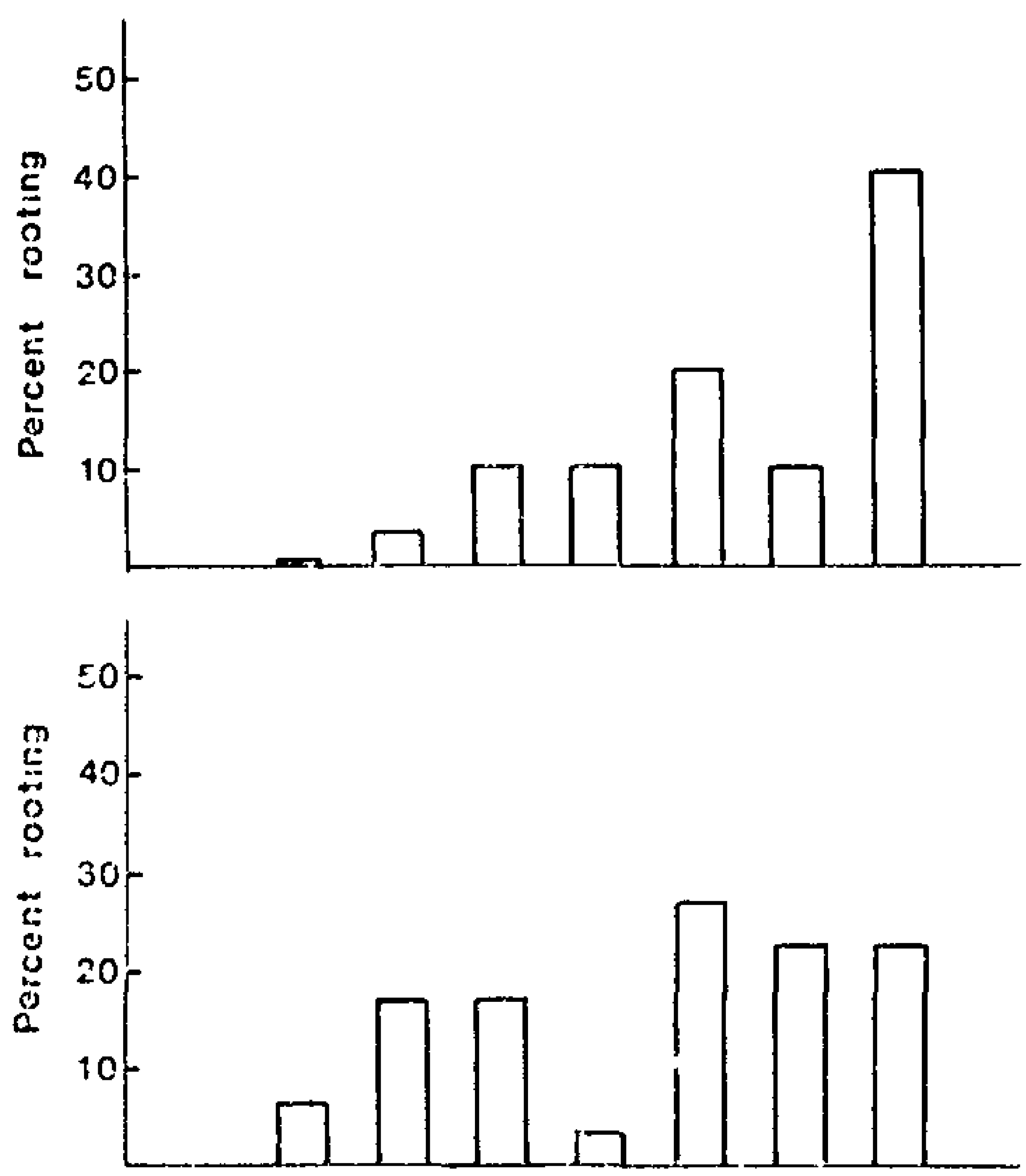

Figure 2. Effect of auxin on the rooting percentage of *P chamaepitys* (above) and *P pinifolia* (below) All treatments contained 30 cuttings and were harvested after 14 weeks Left to right no auxin, 1200 ppm IBA, 1000 ppm IBA/200 ppm NAA, 1000 ppm IBA/200 ppm 2,4-D, 600 ppm IBA/600 ppm NAA, 600 ppm IBA/600 ppm 2,4-D, 1000 ppm IBA/200 ppm NAA/200 ppm 2,4-D

tings was influenced by hormone type. After 14 weeks on the cutting bench *P. chamaepitys* had rooted best following treatment with a mixture of IBA/NAA/2,4-D (Figure 2a). Combinations of IBA/NAA and IBA/2,4-D were less effective, and IBA alone was ineffective. When the unrooted cuttings were retreated and returned to the mist bench for 11 weeks the combination of all three hormones, and the 600 ppm IBA/600 ppm NAA gave excellent rooting (Figure 3a) IBA was once again ineffective while the IBA/2,4-D combinations and the 1000 ppm IBA/200 ppm NAA were intermediate in their effect. Recutting the base only was also ineffective.

With *P. pinifolia* cuttings hormone type had less effect on the initial rooting response (Figure 2b) The highest percentage rooting was obtained with the two 600 ppm/600 ppm preparations and with the IBA/NAA/2,4-D combination. When the unrooted cuttings in each treatment were retreated and placed back on the misting bench the IBA/NAA/2,4-D combination was superior in stimulating rooting (Figure 3b)

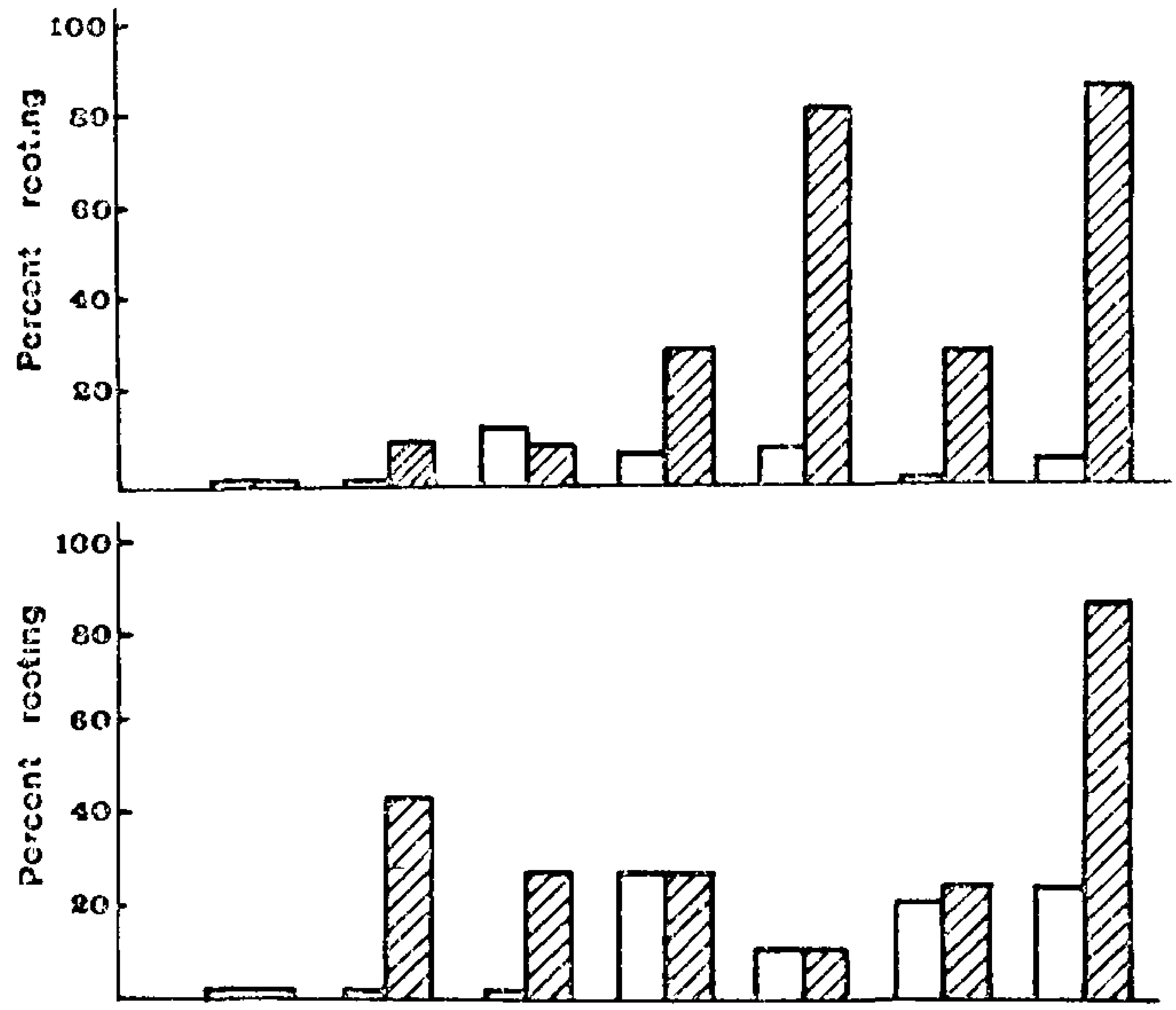

Figure 3. Effect of recutting the base (open bars) and recutting plus auxin treatment (shaded bars) on the rooting percentage of *P. chamaepitys* (above) *P pinifolia* (below) cuttings The number of replicates per treatment was dependent on the percentage rooting obtained following the initial auxin treatment The cuttings were harvested after 11 weeks Left to right no auxin, 1200 ppm IBA, 1000 ppm IBA/200 ppm NAA, 1000 ppm IBA/200 ppm 2,4-D, 600 ppm IBA/600 ppm NAA, 600 ppm IBA/600 ppm 2,4-D, 1000 ppm IBA/ 200 ppm NAA/200 ppm 2,4-D

DISCUSSION

The results clearly indicate that *P. chamaepitys* and *P. pinifolia* may be rooted successfully by the use of a combination of IBA/NAA/2,4-D. The superiority of this combination is evidence consistent with the proposition that the site of action of NAA and 2,4-D is the 3-methyleneoxindole reductase complex. Further studies are required, however, to establish whether all three auxins are required or whether the response is due solely to the NAA/2,4-D combination.

Although the number of replicates were small the results also indicate a beneficial response to auxin treatment after a period of time on the cutting bench Phenolic cofactors have been implicated in root initiation (5) and the production of such phenolic cofactors have been shown to be stimulated by misting (7). It has been suggested that these phenolic compounds, which are produced in buds and are translocated to the cutting base (3) are capable of conjugating with auxins to form compounds capable of stimulating rooting (3,4) (Figure 1). The present observations with *Persoonia* may reflect the slow accumulation of such a phenolic compound under mist and that this is necessary before applied auxin is effective in inducing a rooting response At this stage, however, the possibility that the leaching of inhibitors under mist is responsible, cannot be ruled out.

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