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Rooting *Acacia mangium* Cuttings of Different Physiological Age with Reference to Leaf Morphology as a Phase Change Marker

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Summary

Capacity for adventitious rooting of *Acacia mangium* was assessed for shoot terminal cuttings originating from: (A) the crown and (B) sprouting stumps of 4-year-old trees growing outdoors, (C) 4-year-old hedged stock plants and (D) 1-year-old seedlings kept cultivated in containers. All these cuttings exhibited the mature phyllode morphology. For the stump sprout origin, rootabilities of juvenile-like composed leaf (B1), intermediate leaf (B2) and mature-like phyllode (B3) cuttings were also compared.

Rooting potential was found to be greatly influenced by the cutting source and to lesser extent, although still significantly, by the different types of cutting morphology. In both cases, the highest average rooting rate score of 85% was obtained for the mature-like phyllodes cuttings derived from mature sprouting stumps, whereas the same origin cuttings with juvenile-like leaves were less prone to root. Exogenous auxin treatment was shown to improve noticeably the number of roots formed per rooted cutting, but had overall no effect on rooting rate with marked differences depending on the date of the experiment.

These results are discussed in terms of ageing influence on the potential for adventitious rooting of *Acacia mangium* cuttings, with reference to leaf morphology as a phase change marker.

Key words: Acacia mangium, age, auxin, cutting, maturation, morphological marker, phase change, rootability, vegetative propagation.

FDC: 161.4; 164.3; 164.5; 165.441; 232.11: 232.411.4; 176.1 *Acacia mangium*.

Introduction

Acacia mangium WILLD. has gained an increasing interest for reforestation programmes in the humid tropics over the last 2 decades mainly for pulpwood production. This is due to the remarkable growth potential of this pioneer tree legume, even on very acid and infertile soils it can rehabilitate thanks to its natural nitrogen fixing ability. For a few years, special efforts have been devoted on tree improvement of this fast-growing species. Progress in that field is just beginning and although simple breeding strategies based on sexual propagation seem objectively well adapted to the situation (MONTEUUIS and NASI, 1992), the vegetative propagation option is also worth particular consideration. First experiments tended to indicate that while desirable in theory (HAINES and GRIFFIN, 1992), the prospects for propagating vegetatively *A. mangium* through rooted cuttings are rather limited, mostly due to early negative effects of the maturation process on the potential for adventitious rooting of this species (DARUS, 1991; POUPARD *et al.*, 1994).

Decrease or even loss of ability for true-to-type cloning as trees become larger in size with increasing age has been already reported for many species (SCHAFFALITZKY DE MUCKADELL, 1959; BONGA, 1982; HACKETT, 1983, 1985), and the need to find simple markers of this so-called phase change phenomenon in various species to select within the donor plant the more juvenile shoots with greater potential for adventitious rooting, has called for special attention (HACKETT, 1985; MONTEUUIS, 1985). *A. mangium* is a species exhibiting salient differences in leaf morphology associated with the first phases of the ontogenetical process (DOORENBOS, 1965). The first leaves, or "composed leaves", are exclusively composed of pinnates, the number of which increase from one for the first leaf formed to 4 for the 6th or 7th leaf, before the appearance of an intermediate leaf type consisting of a phyllode with 4 and then 2 pinnates attached to its apex, to become a full phyllode from the 9th to 11th node position upward, that corresponds roughly to 12 weeks to 16 weeks after germination depending on the local conditions (RUFELDS, 1988; GAN and SIM, 1992). From that age onwards, *A. mangium* seedlings produce phyllodes exclusively, that characterizes the mature condition (DOORENBOS, 1965). It was the aim to find out to what extent juvenile foliage characteristics can be considered reliable markers of potential for adventitious rooting of cuttings in *A. mangium*. This has been further investigated examining rootability of samples of *A. mangium* shoots coming from different age donor plants or differing in ontogenetical age and leaf morphology, in relation to exogenous auxin treatment, the beneficial influence of which on rooting capacity has been already reported several times (DARUS, 1989; WONG, 1989; WONG and HAINES, 1992; POUPARD *et al.*, 1994).

Material and Methods

Terminal shoot cuttings with an apical bud of *A. mangium* used for rooting experiments were collected from 4 different types of donor plants all from the same Papua-New Guinea – "PNG" – seed provenance. Unless otherwise stated, they were softwood cuttings bearing only phyllodes:

A. lower part of the crown – about 4 m to 5 m above ground level – of 4 year-old *A. mangium* planted trees;

B. 60 cm to 80 cm tall stumps obtained by decapitating 1.5 month earlier some of the above mentioned trees, that resulted in the production of 3 week-old sprouting shoots, 30 cm as maximal length, collected to make cuttings and distinguishing between:

B1: cuttings with composed leaves exclusively;

B2: cuttings with intermediate phyllode-pinnate morphology;

B3: cuttings with phyllodes exclusively;

These 3 types of cuttings, more herbaceous than the other origins, are illustrated in *figure 1*;

C. 4 year-old stock plants kept extensively cultivated potted in 5 l plastic bag containers filled with local top soil and maintained at an height of 50 cm to 60 cm by hedging in the nursery;

D. main stem of 1 year-old seedlings potted in 1 l plastic bag containers filled with local top soil and kept cultivated in the nursery.

The average size of the cuttings was around 6 cm in length from the basal cut to the apical bud whatever the type, with

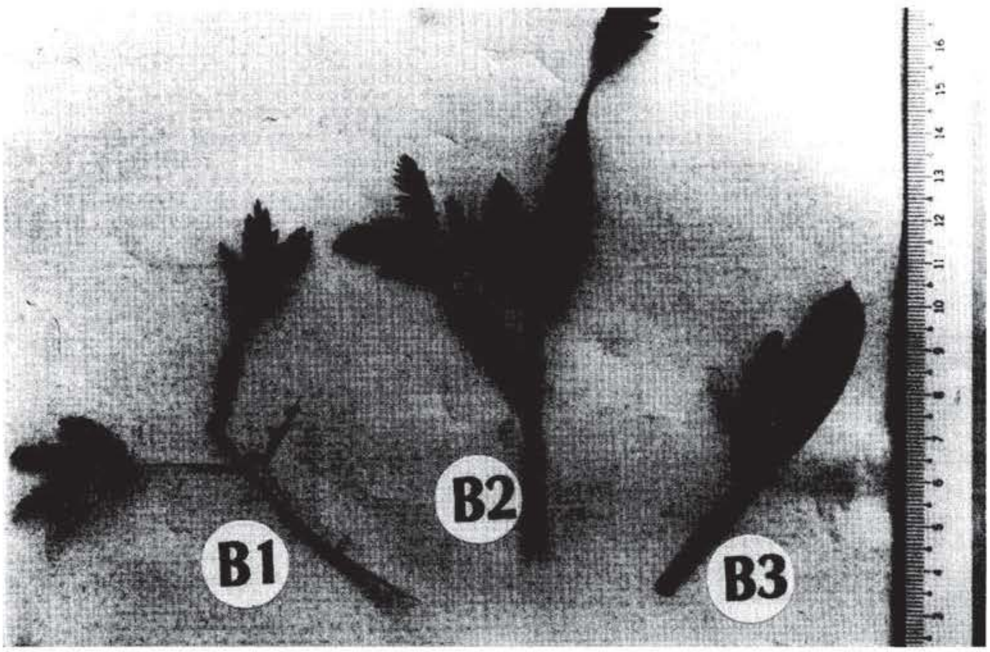

Figure 1. – Distinctive morphological features of composed leaf (B1), intermediate leaf (B2) and phyllode (B3) cuttings produced by the mature stumps and used for the experiments.

smaller diameter for the composed-leaf and intermediate morphology cuttings than for the mature-like ones exclusively with phyllodes, as shown in *figure 1*.

Half of the cuttings corresponding to each of the different categories used were treated with auxin by dipping their base into a SERADIX 3 commercial powder preparation (0.8% of 3-indolebutyric acid in talc), the remaining being treated as controls.

All the cuttings were finally inserted into rooting beds filled with wet sand used as rooting substrate after it had been boiled with a view of reducing disease risks.

The study consisted of 2 distinct sub-experiments – "exp.1" and "exp.2" – set up applying strictly the same procedure and under the same equatorial humid climatic conditions on 2 different dates:

- October 14, 1992 for exp.1;
- May 1, 1994 for exp.2.

The experimental design adopted for each sub-experiment corresponded to a full factorial of (i) the cutting category,

- from A to C, that is to say 5 classes for exp.1;
- and from A to D, that is to say 6 classes for exp.2;

and (ii) the auxin treatment (2 classes), resulting in a total of:

- 5 x 2 = 10 combinations for exp.1;
- and 6 x 2 = 12 combinations for exp.2.

For both sub-experiments, each combination was represented by 3 plots of 10 cuttings randomly distributed within 3 complete blocks.

To sum up, the whole experiment comprised:
(10 x 3 x 5 x 2) + (10 x 3 x 6 x 2) = 660 cuttings.

Once set into the rooting bed, the cuttings were maintained under a 50% shade with intermittent-mist water sprays provided by a mist system, the frequency of which was controlled by an "electronic leaf" system (HARTMANN *et al.*, 1990) to avoid any desiccation damage. Aqueous fungicide solutions – mainly Thyram 80, 5 g/l – were sprayed on the cuttings once a week.

After a rooting period of 2 months in these conditions, the cuttings were assessed by recording the following criteria:

1. *rooting rate for cuttings (RRC)*, based on the plots with 10 cuttings each;
2. *number of adventitious roots (NR)* per rooted cutting;
3. *length of the longest root* (in cm) per rooted cutting.

The data were analyzed using the SAS statistical package (SAS Institute Inc., 1988). Null hypotheses were rejected when the probability value was $P \leq 0.050$. Tests for homogeneity of variance were performed using BARTLETT's and LEVENE's tests (SNEDECOR and COCHRAN, 1980) which both established the need of replacing RRC by ASRRC = $\arcsin\sqrt{RRC}$, and NR by LNR = $\log_{10}$NR (SNEDECOR and COCHRAN, 1980).

The different analyses of variance for the 3 criteria considered were carried out according to the following general model:

$$Y_{ijkl} = \mu + E_i + B_{ij} + C_k + A_l + (EC)_{ik} + (EA)_{il} + (CA)_{kl} + \varepsilon_{ijkl}$$

where:

Y_{ijkl} = value of the plot submitted to the i^{th} level of factor *(sub) experiment*, j^{th} level of factor *block*, k^{th} level of factor *cutting category* and l^{th} level of factor *auxin;*

μ = overall mean of the trial;

E_i = effect of the factor *sub-experiment*, $1 \leq i \leq 2$;

B_{ij} = effect of the factor *block j within sub-experiment i*, $1 \leq j \leq 3$;

C_k = effect of the factor *cutting category*, $1 \leq k \leq 6$;

A_l = effect of the factor *auxin*, $1 \leq l \leq 2$;

$(EC)_{ik}$ = effect of the interaction of *sub-experiment* and *cutting category;*

$(EA)_{il}$ = effect of the interaction of *sub-experiment* and *auxin;*

$(CA)_{kl}$ = effect of the interaction of *cutting category* and *auxin;*

ε_{ijkl} = residual error.

Due to imbalance in the data between "exp.1" and "exp.2", cutting category *D* was discarded from the analyses of variance combining these 2 sub-experiments.

Treatment means were compared using the STUDENT-NEWMAN and KEULS test when in F-tests the null hypothesis was rejected ($P \leq 0.05$).

PEARSON's correlation coefficients between the 3 variables, RRC being replaced by ASRRC and NR by LNR, were calculated computing N = 47 elementary plot mean values with high enough rooting rates corresponding to cutting origins *B1, B2, B3* and *C*, treated and not treated with auxin, exp.1 and 2 combined, with at least 1 rooted cutting per elementary plot.

Results

General outlines

Mean values for the various criteria assessed corresponding to the different treatments are given in *table 1*. Similar overall rooting rates were obtained for exp.1 and exp.2 at the end of the 2 month rooting period, 58.0% (174/300) and 56.7% (204/360) respectively, notwithstanding the noticeable score variations between the 2 sub-experiments, and especially in terms of reactivity to exogenous auxin. Only very few cuttings remained alive without having formed roots (7 out of 300 for exp.1 and 12 out of 360 for exp.2). For both sub-experiments, cuttings with phyllodes originating from decapitated stumps *(B3)* rooted best, with overall rooting rates of 88.3% for exp.1 and 81.7% for exp.2. The 2 other criteria, namely number of roots and root length, showed differences in plant material responsiveness with higher overall scores for exp.1.

Correlations

Correlation coefficients between the 3 characters over both experiments were all highly significant establishing that the

Table 1. – Mean values, for "exp. 1", "exp. 2" and the combination ("Combi."), of the 3 criteria assessed – RRC: rate of rooted cuttings; NR: number of roots per rooted cutting; Lenght: length of the longest root per rooted cutting –, in relation to the experimental factors investigated. Means followed by letters only were submitted to the analysis of variance and compared (STUDENT-NEWMAN and KEULS test). Within each column, letters distinguish means which are significantly different at the 5% level.

CRITERIA / FACTORS	RRC (%)			No of plots	NR			Length (cm)			No of plots
	Exp.1	Exp.2	Combi.		Exp.1	Exp.2	Combi.	Exp.1	Exp.2	Combi.	
CUTTING CATEGORY											
A	8.3*c*	1.7*c*	5.0*d*	6+6	2.7	1.0*	2.3	8.7	6.0*	8.0	3+1
B1	46.7*b*	76.7*a*	61.7*bc*	6+6	3.7*a*	5.8*a*	4.7*a*	8.7*b*	9.9*a*	9.3*a*	6+6
B2	86.7*a*	63.3*a*	75.0*ab*	6+6	4.7*a*	3.5*b*	4.1*a*	12.2*a*	8.4*b*	10.3*a*	6+6
B3	88.3*a*	81.7*a*	85.0*a*	6+6	5.3*a*	2.6*bc*	4.0*a*	12.4*a*	7.1*bc*	9.8*a*	6+6
C	60.0*b*	38.3*b*	49.2*c*	6+6	4.6*a*	2.7*c*	3.7*a*	9.1*b*	6.0*c*	7.7*b*	6+5
D		78.3*a*	78.3	6		2.5*c*	2.5		5.3*c*	5.3	6
AUXIN											
Control	46.7*b*	64.4*a*	56.4*a*	15+18	2.7*b*	2.1*b*	2.3*b*	9.9*b*	7.9*a*	8.8*a*	13+16
Seradix 3	69.3*a*	48.9*b*	58.2*a*	15+18	5.9*a*	4.8*a*	5.4*a*	10.8*a*	6.7*b*	8.8*a*	14+14
OVERALL SCORES	58.0	56.7	57.3	30+36	4.4	3.4	3.8	10.4	7.4	8.8	27+30

*) Based on one observation since only one cutting not treated with auxin rooted.

higher the rooting rate, the more adventitious roots formed per rooted cutting and the longer these roots.

Analyses of variance and comparison of means

The general analyses of variance of data the mean values of which are reported in *table 1* established that:

1. The various categories of cuttings tested influenced markedly ($P < 0.0001$) the overall rooting rates and length of the newly formed roots. The analyses of variance carried out on the mature-like cuttings only (*Table 2*) demonstrated marked differences in terms of rooting rates and root length ($P < 0.0001$) depending on plant origin, whereas only rooting rate scores were found to be significantly ($0.01 < P < 0.05$, *Table 3*) influenced by the different morphology of the compared cutting classes (*B1, B2, B3*). In both cases, the STUDENT-NEWMAN and KEULS test established that the mature like cuttings produced by the stump (*B3*) rooted in greater amount than the other cutting categories. The interactions reported in *table 2* and *3* between the subexperiments and the different factors investigated are consistent with the score variations from one experiment to the other reported in *table 1*.

Table 2. – Analyses of variance for the rooting rate (expressed by ASRRC), the number of roots (expressed by LNR) and the lenght of the longest root per rooted cutting for the different origins of mature-like cuttings only, "exp. 1" and "exp. 2" combined (see text for more information).

	ASRRC			LNR			Length	
Source	DF1	MS2	F3	DF	MS	F	MS	F
Exp. (E)	1	0.188	4.5*	1	0.321	26.2***	96.625	73.0***
Block	4	0.041	1.0	4	0.007	0.6	0.856	0.6
Origin (O)	2	2.790	66.1***	1	0.014	1.2	26.709	20.2***
Auxin (A)	1	0.039	0.9	1	0.790	64.5***	0.444	0.3
E x O	2	0.028	0.7	1	0.002	0.2	6.227	4.7
E x A	1	0.632	15.0***	1	0.045	3.7	9.336	7.1*
O x A	2	0.076	1.8	1	0.081	6.6*	0.132	0.1
Error	22	0.042		12	0.012		1.324	

[1]) Degrees of freedom.
[2]) Mean square.
[3]) Value of FISCHER's statistical test with significance levels:
*) $p \leq 0.05$; **) $p \leq 0.01$; ***) $p \leq 0.001$.

Table 3. – Analyses of variance for the rooting rate (expressed by ASRRC), the number of roots and the lenght of the longest root per rooted cutting for the different morphological types of stump cuttings only, "exp. 1" and "exp. 2" combined (see text and *table 2* for more information).

	ASRRC			LNR			Length	
Source	DF	MS	F	DF	MS	F	MS	F
Exp. (E)	1	0.002	0.0	1	0.045	2.8	60.140	29.6***
Block	4	0.046	1.0	4	0.031	1.9	2.393	1.2
Morphology (M)	2	0.236	5.2*	2	0.021	1.3	3.281	1.6
Auxin (A)	1	0.001	0.0	1	0.702	43.2***	0.000	0.0
E x M	2	0.314	7.0**	2	0.125	7.7**	34.997	17.2***
E x A	1	0.434	9.6**	1	0.014	0.9	23.994	11.8**
M x A	2	0.011	0.2	2	0.002	0.1	0.034	0.0
Error	22	0.045		22	0.016		2.031	

2. Auxin treatment with Seradix 3 had no overall significant effect on rooting rate nor on root length, but it resulted in a remarkable increase ($P < 0.0001$) of the number of adventitious roots formed (see *Table 1* for accurate data). The pronounced "experiment x auxin" interactions pointed out in *tables 2* and *3* were caused by differences in response to Seradix 3 treatment for rooting rates and root length. It was promotive in exp.1 and inhibitive in exp.2.

Discussion

The inability of *Acacia mangium* cuttings to survive after 2 months in rooting conditions in the absence of adventitious roots has already been observed (POUPARD *et al.*, 1994) and can be associated with the very limited potential for callus formation in this species in contrast to others like *Sequoia sempervirens* (MONTEUUIS *et al.*, 1987) or *Tectona grandis* able to remain alive several months in similar rooting conditions providing a big basal callus has formed.

A previous investigation (POUPARD *et al.*, 1994) established the advantage of using terminal shoot cuttings as compared to nodal cuttings which were found less responsive to adventitious rooting. The present experiment shows however that the potential to form adventitious roots of such a plant material can vary greatly according to the age of the donor plant this type of cuttings were removed from, although all of them displayed similar mature-like morphological foliage features. The fact that cuttings coming from the crown of 4-year-old ortets, the oldest position from the ontogenetical ageing standpoint (FORTANIER and JONKERS, 1976), demonstrated the lowest very limited capacity for rooting is consistent with many observations (MONTEUUIS, 1985; BON *et al.*, 1994). More surprising is the remarkable rootability of shoots sprouting from stumps, chronologically as old as the ortets, which rooted better than their homologs from same age stock-plants, probably inappropriately managed in terms of feeding and hedging operations. The scores obtained for these terminal shoot cuttings issued from stump sprouts were higher than those observed in similar conditions by POUPARD *et al.* (1994), but the top cuttings in this latter case originated from longer sprouting shoots which were therefore ontogenetically older than the ones used in the present experiment. The same argumentation can be applied to terminal cuttings removed from the 1-year-old seedlings for which greater rooting potential than those observed for the sprouts could have been expected in the case of ontogenetically younger top cuttings produced by less-aged seedlings (DARUS, 1991).

By contrast with other species (MONTEUUIS, 1985), foliar, features as indicators of phase change do not appear to be reliable markers of rooting potential in *Acacia mangium* since for the stump sprout origin, mature-like cuttings rooted better than the juvenile-like ones. In fact, the juvenile phase corresponding to the production of the composed leaves is very short-lived, limited in seedlings to a few weeks during which the maturation process seems to progress quickly as reflected by the noticeable morphological changes from one leaf to the next. Flowering stage is attained around 3- to 4-years on seedlings for this short-lived species. This developmental pattern is even more time-restricted in the case of shoots sprouting from mature stumps. The juvenile stage as reflected by leaf morphology seems to be ephemeral, evolving a lot within a few days. This could account for the rootability variations noted between shoots with composed and intermediate leaves. Another argument to consider is the extreme tenderness of these two categories of cuttings which increase the risks of irreparable stress affecting the rooting potential of these shoots, whereas the number of roots and the root length scores refute any deficiency in endogenous energy in comparison with other categories.

Contrary to the previous experiment (POUPARD *et al.*, 1994), treating the base of cuttings with "Seradix 3" had, overall, no effect on the rooting rates, with noticeable differences in terms of plant material responsiveness to this exogenous auxin between the 2 sub-experiments. Such variations of rootability in relation to auxin application have already been reported for several temperate arborescent species (MONTEUUIS and PAGES, 1987; MONTEUUIS *et al.*, 1987) arguing about physiological changes in plant material connected with the seasons. Although not exposed to such seasonal contrasts as in temperate countries, the physiological status of the *Acacia mangium* plant material investigated is susceptible to differences from one sub-experiment to the other one according to fluctuations of environmental conditions such as natural photoperiod, rainfall and possible interference of endogenous rhythms the existence of which has already been established for many tropical tree species (HALLE *et al.*, 1978). Such modifications of the physiological status of plant material in time could account for the numerous interactions pointed out between investigated factors and sub-experiments.

Conclusion

The observations emerging from this experiment tend to establish the preponderance of physiological condition of the plant material collected over chronological and even ontogenetical ageing considerations when aiming to get cuttings rooted, as has already been argued (BORCHERT, 1976; MONTEUUIS, 1989). In particular it appears that mature *Acacia mangium* can be cloned with great success from stump produced mature-like cuttings, providing these latter have been collected at the suitable stage of development. Without underestimating the real risks that stumps may not sprout once the selected trees have been felled and the lack of information regarding further behavior of these cuttings, such a potential for adventitious rooting from mature genotypes deserves special consideration for tree improvement and development programmes of *Acacia mangium*.

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Pressemitteilung

Obituary: Dr. ALAN L. ORR-EWING (1915 to 1995)

It is with deep personal regret that we record the death in February 1995 of Dr. ALAN ORR-EWING, one of British Columbia's most dedicated and distinguished foresters and a pioneer in forest genetics. While his research was mainly devoted to Douglas-fir, many ongoing initiatives in forest genetics in other timber species of the province owe much to ALAN's early determination and farsightedness.

Born in the British Isles and educated at Eton and at Edinburgh University, ALAN had, before his forestry career, distinguished himself in the Second World War. He received the Military Cross and was Mentioned in Dispatches. He was wounded and spent almost 5 years as a prisoner of war including a stay at the infamous Colditz prison. He kept his inventive mind active by planning repeated escapes.

ALAN had first visited Canada before the war and had been exposed to some of the old logging operations in British Columbia as a chokerman as well as serving as a research assistant at Lake Cowichan. After a brief period with the British Forestry Commission in the west of Scotland, he became a member of the B. C. Forest Service in 1948. He joined the Economics Division which soon became the Research Division, and initially worked on reforestation problems including stock quality, direct seeding and plantation establishment. In 1949 he took his Master's degree at the University of California at Berkeley and became interested in forest genetics. He was exposed to the work of the U. S. Forest Service Institute of Forest Genetics at Placerville and saw the potential for projects in British Columbia.

ALAN ORR-EWING in 1977 beside his 5-year old S_3 seedlings established at Cowichan Lake.

In 1951 he undertook a doctoral program at the University of British Columbia under Dr. GEORGE ALLEN and devoted his research work to the study of inbreeding in Douglas-fir. He followed the development of selfed and outcrossed pollinations and charted the course of seeds that did mature as germinants through the nursery and into breeding plantations at Lake Cowichan. He continued with inbreeding studies and some notable achievements were to follow some lines down to the S_3 generation and investigate the frequent occurrence of dwarfing in the inbred lines. These pioneering studies were among the first of their kind in examining genetic load, inbreeding depression in conifers, and the possibilities of using inbreeding as an improvement technique.

In the 1950s he started to lay the foundations for a comprehensive breeding program to improve planting stock of Douglas-fir. He studied variation, setting out demonstration plantings to illustrate the gains to be made by simple control of seed sources. He accumulated material for use in inter- and intra-specific hybridization and established a breeding arboretum and clone bank at Lake Cowichan.

In 1957 he started a program of intensive phenotypic selection in wild stands in order to establish the first seed orchard in the province. By 1958, with enthusiastic help from GERRY BURCH of B. C. Forest Products, the Forest Service and Industry came together in the cooperative Tree Improvement Board which helped to make the program productive on a much larger scale. The present Coastal and Interior Tree Improvement Councils were developed from this Board.

In 1964 he started another of his pioneering projects. He saw the possible potential for gains from wide inter-racial crossing in an extensive species like Douglas-fir, and he established a series of test plantations of progeny from parents spanning the range of the species. This material is currently being used to establish experimental F_1 and F_2 populations to examine segregation variance from intra-specific hybridizations. Again he left a legacy of material and information on which future work could be built.

While these technical initiatives were advancing, ALAN's great contribution was in convincing the forest community and the Ministry in particular of the potential the work offered and the need for long-term commitment. His enthusiasm to educate and demonstrate and his stubborn drive to improve plantation quality have proven a lasting legacy in the province. ALAN always published his research findings and his meticulous record keeping has left us with an invaluable resource.

ALAN was active, too, on the national and international stages participating in the activities of the Canadian Tree Improvement Association and in the Western Forest Genetic Association. His research earned him high esteem amongst his international colleagues. By maintaining contacts with them he ensured that any advances in approach and techniques could be considered for application to British Columbia's needs. He also served as an editor of Silvae Genetica.

ALAN will be remembered for his enthusiasm and single mindedness as far as his work was concerned but his quick mind was engaged on many broad fronts. His integrity and high professional and personal standards were exemplary. On a more personal level his sense of humor and kind support for those he met are also well and fondly remembered.

ALAN was recognized by the foresters of B. C. with the first Distinguished Forester Award in 1971. He was also elected a fellow of the Canadian Institute of Forestry in 1980. Although he retired in 1979, the work he started is constantly expanding and his legacy to the forests and people of B. C. will continue for years to come.

A. D. YANCHUK and J. C. HEAMAN

Buchbesprechungen

Ahorne. Von H. PIRC. 1994. Verlag Eugen Ulmer, Stuttgart. ISBN 3-8001-6554-6. 240 Seiten mit 115 Farbfotos und 37 Zeichnungen. Leinen DM 98,–.

Der Autor, Leiter der Abteilung Gehölzkunde/Baumschulwesen der Höheren Bundeslehr- und Versuchsanstalt in Wien-Schönbrunn, bringt in seinem Buch die farbenprächtige Arten- und Sortenvielfalt der Gattung *Acer* dem Leser näher. Im allgemeinen Teil des Buches wird auf Geschichte und Verbreitung, Morphologie, Entdeckung, Verwendung und Kultur eingegangen. Der Leser wird über den wertvollen Werkstoff Ahornholz, über Ahornsirup und Ahornzucker sowie über die Bedeutung der Ahorne als Elemente in der Kulturlandschaft informiert. Ein weiteres Kapitel ist der Bedeutung der Ahorne in der Garten- und Landschaftsgestaltung gewidmet. Weiterhin erfährt der Leser Interessantes über die Vermehrung der Ahorne sowie über Schädlinge und über Krankheiten. Im speziellen Teil stellt der Autor aus 16 Sektionen 83 Arten bzw. Unterarten und zahlreiche Sorten vor. Die Beschreibungen sind präzise und klar. Sie stellen wesentliche Merkmale der jeweiligen Art, Unterart bzw. Sorte, z. B. Verbreitung, morphologische Besonderheiten, Vermehrung, Standortansprüche, Gefahren und Hinweise zu Verwendung im Garten- und Landschaftsbau, heraus. Der Text ist durch zahlreiche stimmungsvolle Farbfotos und Zeichnungen illustriert. Eine kurze Literaturübersicht und ein Register beschließen die empfehlenswerte Informationsgrundlage über die formenreiche Gattung *Acer*.

M. LIESEBACH (Grosshansdorf)

Allgemeine Mykologie. Von H. WEBER (Herausgeber). Bearbeitet von 12 Fachwissenschaftlern. 1993. Verlag G. Fischer, Jena und Stuttgart. ISBN 3-334-60391-1. 541 Seiten mit 206 Abbildungen und 66 Tabellen. DM 148,–.

Das vorliegende Buch ist ein Gemeinschaftswerk von 12 Autoren aus verschiedenen Fachgebieten der Mykologie. Entstanden ist ein lesenswertes Werk, das die Bedeutung der Pilzarten in den Bereichen Umwelt, Industrie, Medizin, Land- und Forstwirtschaft beispielhaft darstellt. Insgesamt sind weltweit bereits über 100000 Pilzarten wissenschaftlich beschrieben und laufend kommen neue Arten hinzu. Viele Arten sind als Krankheitserreger an Menschen, Tieren oder Pflanzen bedeutungsvoll, einige Arten werden industriell in großem Umfang genutzt und manche Arten haben als Labororganismen unsere Kenntnisse über genetische Grundlagen und Vorgänge maßgeblich bereichert. Über diese Themen findet man in dem vorliegenden Buch viele zusammenfassende Informationen, wobei sich auch interessante Zusammenhänge zwischen den behandelten Gebieten ableiten lassen. Der Text ist in 10 Hauptkapitel unterteilt. Einer allgemeinen Einleitung in die Pilzkunde folgt ein Kapitel über die Zytologie und Morphologie. Fortpflanzung und Vermehrung sowie Molekularbiologie und Genetik werden in 2 weiteren Kapiteln behandelt, wobei auch auf die Anwendung gentechnischer Methoden und auf Fragen der damit verbundenen möglichen Risiken kurz eingegangen wird. Im Hinblick auf die Physiologie der Pilze wird das Schwergewicht eher auf Transportprozesse und Kompartimentierung gelegt. Im Kapitel über das System der Pilze wird die große Vielfalt anhand zahlreicher, anschaulicher Beispiele dargestellt. Die zugrundegelegte Systematik entspricht nicht unbedingt dem neuesten Stand, doch ist dieses Gebiet sowieso ständigen Veränderungen unterworfen. Ein weiteres Kapitel ist der Ökologie der Pilze gewidmet. Von besonderem Interesse dürfte das Kapitel über die Leistungen und die praktische Bedeutung der Pilze sein, da sich hier Angaben finden über die Speisepilzkultur, über Pilze in der Lebensmittelindustrie, über Eiweiß- oder Sekundärstoffmetabolit-Lieferanten sowie über Wechselbeziehungen mit Metallen oder über den Einsatz von Pilzen bei der biologischen Schädlingsbekämpfung. Die beiden restlichen Kapitel enthalten Beispiele von pflanzenpathogenen Pilzen und von Krankheitserregern bei Mensch und Tier. Viele Zeichnungen, Schwarz-weiß- und Farbabbildungen oder Tabellen veranschaulichen das Dargestellte. Literaturhinweise am Ende der Kapitel dienen der weiteren Vertiefung des Stoffes. Den Abschluß bilden ein Gattungs- und Artenverzeichnis sowie ein Sachregister. Das Buch ist allen an der Mykologie Interessierten als Einführung sehr zu empfehlen.

B. R. STEPHAN (Grosshansdorf)

Gehölzflora. Ein Buch zum Bestimmen der in Mitteleuropa wildwachsenden und angepflanzten Bäume und Sträucher. 10., überarbeitete Auflage mit Früchteschlüssel. Von J. FITSCHEN. Bearbeitet von F. H. MEYER, U. HECKER, H. R. HÖSTER und F.-G. SCHROEDER. 1994. Verlag Quelle und Meyer, Heidelberg, Wiesbaden. ISBN 3-494-01221-0. 808 Seiten mit 1052 Abbildungen und 2 Tabellen. Gebunden DM 59,–.

Wenn die „Gehölzflora" bereits nach 4 Jahren in einer neuen, inzwischen 10. Auflage erscheint, so spricht dies für eine große Nachfrage. Dieses Bestimmungsbuch hat sich bewährt und ist uneingeschränkt all denen zu empfehlen, die die rund 1700 in Mitteleuropa wild oder angepflanzt vorkommenden Gehölzarten und Kulturformen sicher und einwandfrei identifizieren wollen. Hierbei sind die dichotomen Schlüssel unentbehrlich, die alle für eine Unterscheidung wichtigen Merkmale herausarbeiten. Die Bestimmung wird erleichtert durch sehr gute Strichzeichnungen, deren Zahl gegenüber der vorigen Auflabe um weitere 77 Blatt-, Blüten- oder Fruchtabbildungen erhöht wurde. Die Beschreibungen der Arten sind eindeutig und übersichtlich und enthalten neben den morphologischen Merkmalen auch Hinweise auf die Blütezeit, den Standort, die Wuchsform, die eventuelle Frostempfindlichkeit sowie die Herkunft unter Verwendung einer Arealformel. Umfangreicher ist jetzt auch die weiterführende Literatur (7 Seiten).

B. R. STEPHAN (Grosshansdorf)

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