considérable pour le composant dominance X environnement dans l'expérience portant sur les croisements entre arbres précoces seuls parce qu'une plus grande part de la variation génétique dans cette expérience peut être attribuee a l'aptitude spécifique a la combinaison.

On constate également des différences entre sous-populations qui paraissent résulter de conditions differentes de concurrence pour l'espèce dans diverses associations végétales.

On discute le rôle des interactions génotype X environnement dans les expériences qui ont pour but de connaitre la structure génétique et le type des interfecondations dans les populations naturelles et dans les vergers a graines.

Literatur

(1) v. DELLINGSHAUSEN, M., und STERN, K.: Über einige besondere Blütenformen der Birke. Silvae Gen. 7, 181—188 (1958). — (2) FROLOWA, G. D.: Fragen der Biologie des Blühens einiger Birkenarten. Bot. Journ, 41, 885—889 (1956), russisch. — (3) JOHNSSON, H.: Hereditary precocious flowering in Betula verrucosa and B. pubescens. Hereditas 35, 112—114 (1949). — (4) LENGER, A., et GATHY, P.: Étude biometrique de la production en cones et en graines du pin de Koekelare. Critères de sélection. Biométrie-Praximétrie 1960, 45—60. — (5) LERNER, I. M.: The genetic bases of selection. John Wiley, New York 1958. — (6) MERGEN, F.: Natural and induced flowering in young pine trees. Rec. Adv. in Bot., Univ. of Toronto Press, 1961, pp 1671—1674. — (7) STERN, K.: Uber den Erfolg einer über drei Generationen geführten Auslese auf frühes Blühen bei Betula verrucosa. Silvae Gen. 10, 48—51 (1961). — (8) WAREING, P. F.: Problems of juvenility and flowering in trees Symposium. Journ. Linn. Soc. Bot. 56, 282—289 (1959).

Seasonal Variation in Root and Shoot Formation from Leaf Cuttings of Populus simonii var. fastigiata Schneid.

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(Received for publication October 30, 1962)

Introduction

Autovegetative regenesis of plants by means of cuttings has been practiced for over 2,000 years (2). When leaf propagules came into use is exceedingly uncertain, although if the vast number of species and varieties propagated by floriculturists and horticulturists in this manner is taken into account, it leads to the assumption that leaves have been used in this mode of asexual plant production for a long period of years.

This form of propagation, using leaves, could be of value to geneticists interested in the improvement of forest trees through the use of clonal material; however, before it can be accepted studies will be required which concern themselves with deciphering the enigmas of root and shont formation from leaf propagules.

The first portion of this research was designated to test the effect of date of collection (seasonal variation) and indolebutyric acid (IBA) treatment on root formation from Populus simonii var. fastigiata SCHNEID. leaf cuttings. After this primary step, the second phase was concerned with a study of the effect of constant photoperiod and normal day regime on the survival of and shoot formation from the rooted cuttings. Further, it was desired to relate date of collection with shoot formation.

Review of Literature

Literature concerning the autovegetative propagation of tree species from stem cuttings is available in myriad amounts (see, e. g., 9). Accurate information regarding the use of tree leaf cuttings, however, is almost nonexistent. A summary of some of the more pertinent information concerning root and shoot formation from tree leaf propagules is presented in Table 1. For a fuller understanding of the trials which have been performed with leaf cuttings from numerous plant species the reader is referred to the extensive review by HAGEMANN (12).

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Since seasonal variation in root and shoot formation from excised leaves does not appear to have been studied, the papers which deal with this aspect of propagation as it affects the rooting of stem cuttings must be relied upon for background information (5-10, 13, 14, 16, 18-21). These papers provide too voluminous and complex data for presentation here. It should suffice to state that seasonal variation in rooting ability can probably be shown for cuttings from any plant species, if the experiment is properly designed, though it can rarely be explained.

Procedure

Cuttings were collected at two week intervals during the period from June 29, 1961 through September 18, 1961

Table 1. — Pertinent data concerning root and shoot formation from leaf cuttings of tree species.

Species	% Root Formation	% Shoot Formation	Chemical Treatment*)	Author
Acer platanoides L.	0	0	none	12
Acer pseudoplatanus L.	50	0	none	12
Aesculus hippocastanum L.	0	0	none	12
Fagus sylvatica L.	0	0	none	12
Fraxinus excelsior L.	0	0	none	12
Juglans regia L.	0	0	none	12
Picea abies (L.) KARST.	0	0	none	12
Pinus coulteri DON.	0	0	none	12
Pinus excelsa WALL.	0	0	none	12
Pinus resinosa AIT.	68	0	2-M, 4-CPA	15
Pinus rigida MILL.	0	0	none	12
Populus alba L.	ca. 30	?**)	IAA	11
Populus angustifolia JAMES	45	0	none	12
Populus canescens SM.	ca. 30	?**)	IAA	11
Populus nigra (hybrid)	26	4	IBA	H***)
Populus tremula L.	ca. 30	?**)	IAA	11
Populus trichocarpa HOOK	6	6	none	12
Salix fragilis L.	0	0	none	12
Tilia cordata MILL.	ca. 30	?**)	IAA	11

*) 2-M, 4-CPA = 2-methyl, 4-chlorphenoxyacetic acid; IAA = indoleacetic acid; IBA = indolebutyric acid.
**) Shoot formation was obtained but no percentages are given.
***) HAISSIG, unpublished.

from one 25-year-old *P. simonii* var. *fastigiata* tree growing on the State University of New York College of Forestry campus. This tree was selected due to the author's previous knowledge of the ease with which it could be propagated from hardwood and softwood cuttings.

Leaves were stripped from the lowest branches (18) and divided into two groups of 50 members each. One of the following treatments was administered to each set: (1) 24-hour soak in distilled water (controls), or (2) 24-hour soak in 10 ppm IBA in distilled water.

Leaf petioles were immersed approximately one-half inch in the solution during the treatment period. Illumination was provided by one 60-watt incandescent light bulb located three feet from the cuttings. Before installation in the medium the leaves were rinsed with tap water and one-half of the distal portion of each leaf blade was severed by means of a scissors in order to reduce transpirational loss from the cuttings.

The rooting medium consisted of a four-inch-deep stratum of brown sand located in a greenhouse. Enclosing the rooting bed was a polyethylene-covered cabinet which contained two 40-watt daylight-type fluorscent tubes that supplied constant illumination during the rooting period. Watering was done by hand.

Cuttings were allowed to remain in the bed until they were rooted or dead. By not removing cuttings in both treatments from one installation date at the same time, the maximum number of rooted individuals was obtained in each treatment.

Rooted leaves from a single installation and treatment were removed from the medium simultaneously and potted in two-inch diameter plastic pots filled with a 1 : 1 mixture of loamy sand-peat moss. They were then placed in a humidity cabinet identical to the one they were rooted in for a period of one week in order to lessen the shock of transplanting.

After the seven-day transition period each treatment group was divided into two equal parts. One-half of each treatment was placed on open greenhouse benches where the cuttings received the normal photoperiod at Syracuse, New York. The other portion was segregated to a portion of the greenhouse where it received continuous illumination identical to that under which the leaves were rooted.

Results

Root Formation

The percentages of cuttings which rooted are shown graphically in *Figure 1*. From this illustration it can be seen that IBA treatment resulted in a markedly lower percentage of rooted leaves from the June 29 installation and in a considerably increased percentage form the September 18 group. Other than in these two instances IBA treatment does not appear to have significantly affected root initiation, except that the mean rooting time for cuttings given the IBA treatment was decreased in all instances to three weeks as opposed to six weeks for the controls.

Figure 1 also depicts the strong seasonal variation which was obtained, especially from the control installations. Collections from July 9 — August 19 rooted in excellent numbers. The drastic decline in root initiation from the control cuttings taken after this time will be discussed below.

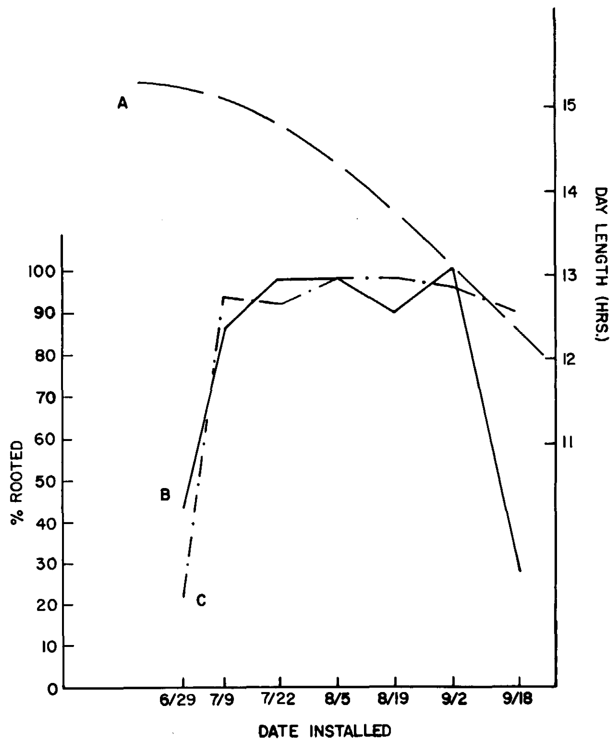

Figure 1. — Percentages of rooted *Populus simonii* var. *fastigiata* leaf cuttings plotted against date of installation and day length at Syracuse, New York. (A) Day length, (B) Control, (C) 10 ppm IBA treatment.

Survival

A survival count was made on the cuttings under each photoperiod on January 1 (from three to six months after the leaves were installed in the rooting medium). *Table 2* provides the results of this score.

Table 2. — Percentages of rooted *Populus simonii* var. *fastigiata* cuttings surviving on January 1, 1962 by date of installation during 1961, pre-installation treatment, and photoperiod received after rooting.

Date Installed 1961	Normal Day Regime		Constant Illumination	
	Water Soak*)	10 ppm IBA	Water Soak	10 ppm IBA
6-29	0	0	0	0
7-9	0	0	46	17
7-22	8	0	44	17
8-5	4	0	32	48
8-19	5	29	22	72
9-2	0	12	24	54
9-18	0	5	14	44

*) Both treatments administered for 24 hours. Percentages based on the numbers of cuttings rooted out of original groups of 50 per treatment.

The effect of continuous illumination on survival is great. Constant light no less than doubled the survival percentages provided by the normal day regime, with the exception of the June 29 installation. It should be noted that control cuttings installed during July survived in greater numbers than did leaves treated with IBA. Subsequent to this time the survival percentages reversed. This relationship between IBA treatment and time of collection is vividly evidenced in the survival percentages for those cuttings maintained under the normal day regime.

Shoot Formation

Lack of shoot formation from the rooted cuttings is the most discouraging portion of this experiment. Five leaves formed shoots. These leaves were installed in the cutting bed on July 22 with no IBA treatment and had rooted 98 percent after a period of six weeks. Interestingly enough these five leaves (10% of the rooted leaves in their group) formed shoots before removal from the rooting medium. No shoots were formed by other cuttings. The leaves which did not form shoots died by June 1962 even though they had formed extensive root systems.

Discussion

Root Formation

Seasonal variation in the rooting capacity of *P. simonii* var. *fastigiata* leaves cannot be fully explained. It appears that the low percentages of rooted leaves obtained from the June 29 installation of both treatments are due in part to the juvenility of the leaves taken, since at that time they are without the bud for approximately two months. Their carbohydrate supply may be insufficient at that time to promote survival. Further, it seemed that these individuals became dessicated with greater rapidity than did older leaves. This resulted in premature death in the cutting bed.

IBA treatment probably resulted in a rooting percentage below that obtained from the controls installed at the same time (June 29) due to the fact that the natural auxin content of leaves is known to be high at this time (1, 3). Therefore, the additional IBA may have proven toxic.

The decline in rooting obtained from cuttings installed near September 1 is no doubt partially connected with the day length under which the ortet was growing before the cuttings were selected. It has been found by NITSCH and NITSCH (17) that *Populus canadensis* MOENCH. stem cuttings collected from July 10 to September 3 rooted 80 percent. During that period the day length remained above 13 hours. An installation by these authors 22 days later when the day length had fallen below 13 hours showed a 60 percent decrease in the number of rooted cuttings obtained.

Control cuttings used in this study rooted 100 percent when collected on September 1 (day length 13 hours and 9 minutes), but only 28 percent when taken 16 days later at which time the day length at Syracuse was 12 hours and 25 minutes. This is a 72 percent decrease in slightly over two weeks. *Figure 1* illustrates the relationship between a 13-hour day length and the reduction in root formation.

The remainder of the rooting decline in September may be attributed to a more advanced formation of the abscission layer than is present earlier in the summer, and to a decrease in the natural auxin content which accompanies the abscission of leaves (3). The latter hypothesis is supported by the fact that the IBA treatment on September 18 evoked a 62 percent increase in root formation over that obtained from the control cuttings. This seems to point out that root formation from the control cuttings was hindered by a lack of natural auxin.

Survival

The increased survival noted for the cuttings exposed to a constant photoperiod was of no importance to shoot formation since prolonged life did not provoke the differentiation of meristematic tissue. However, any increase in the life span of a rooted leaf will give future propagators time to apply other treatments which, it is hoped, will result in the formation of shoots from a great majority of the rooted leaves. In this study, increased survival appeared to have been induced by the action of constant light in increasing the volume of roots produced and in promoting general good health of the rooted leaves.

As mentioned earlier there is an indication (see *Table 2*) that IBA treatment increased survival of the rooted cuttings when applied to those leaves installed after August 5. This situation can be seen for leaves grown under either photoperiod. It may be attributed to the fact that up to mid-July the natural auxin content of the leaves is probably high enough to support the proper level of physiological activity, but after this time supplemental auxin becomes of aid in stimulating these processes. At least it may contribute to more normal root development.

Shoot Formation

Because the number of shoots formed was so small, and because these shoots formed from cuttings treated identically and installed at the same date as those lacking shoot formation, an attempt to determine the exact effect of chemical treatment and of time of collection would be of little value. Some items should be discussed, however, to take advantage of the available data.

The five leaves which did form shoots were taken from the ortet and installed in the rooting medium at the time when rooting was very high (98 percent) for the controls and during the period which resulted in the highest survival of untreated, rooted leaves. IBA treatment at this time (July 22) did not increase root initiation nor did it promote survival of the rooted leaves, but rather seems to have increased mortality among the rooted individuals. A postulation of the reason for this could be that the supply of auxin, rhizocaline, and other cell factors (4) was such that root initiation took place in adequate amounts to support a new plant at the time when the energy supply within the leaf maintained itself at a level high enough to support root elongation, plus the subsequent formation of a shoot. The IBA soak to which the other lot of leaves was subjected may have introduced enough auxin to influence this physiological balance in an adverse manner. However, it must be remembered that just like the existence of rhizocaline the above statements are mere speculation.

By the end of 1961 the five-month-old shoots which originated in all cases from callus tissue at the base of the petiole were normal and healthy in appearance and had reached heights of from four to fifteen centimeters. The mother leaves died immediately after the new shoots broke-forth from the potting soil.

Conclusion

A general conclusion that can be reached after studying the rooting and growth of cuttings is that a continuum is formed by the chain of physiological actions which allows root initiation and subsequent shoot formation. This is so whether shoot growth initiates from meristematic tissue present at the time a cutting is selected or, as is the situation with true leaf cuttings, from newly differentiated cells. Discrete stages are almost impossible to ascertain. Therefore, especially in a preliminary study as was this one, it is not fallacious reasoning to consider the processes as a continual flow of physiological activity which can be wholly or partially dammed at any point. To find such major obstructions was the purpose of this study. Some of these may have been isolated. At least the following can be stated with some certainty:

1. Leaf cuttings of *P. simonii* var. *fastigiata* may root at least 80 percent when they are taken from mid-July to late August (if conditions are similar to those found around Syracuse, New York) and treated with 10 ppm of IBA or with distilled water for 24 hours.

2. Survival of rooted cuttings is negligible under normal greenhouse conditions, but increases favorably when the rooted leaves are given 24 hours per day of continuous light of the amount and kind specified in this paper.

3. Survival of rooted cuttings under a constant photoperiod is greatest for the water-treated individuals when they are selected during July and for the IBA-treated cuttings taken in mid-August.

4. Shoots may form at least from some cuttings which are taken during late July and treated with distilled water or nothing, if they are propagated under continuous illumination.

Summary

Little is known of seasonal variation in root and shoot formation from leaf cuttings of tree species. This is unusual since clonal material produced in this manner could be of use to geneticists working in forest tree improvement.

The study reported herein was concerned with determining the effect of seasonal variation and IBA treatment on root formation from *Populus simonii* var. *fastigiata* leaf cuttings. Also, the effect of constant light on the survival of these rooted cuttings was determined.

Strong seasonal variation in root formation, and possible variation of this type in shoot formation was found. In addition it was shown that IBA treatment can be of value when applied to leaf cuttings taken during mid-August in that it seems to promote survival of rooted individuals. In general, IBA treatment decreases the rooting time, but may prevent formation of shoots. The effect of continuous photoperiod on survival was marked and in many instances prevented the almost total loss of rooted cuttings which was experienced when rooted leaves were grown under the normal day regime at Syracuse, New York.

Zusammenfassung

Titel der Arbeit: *Jahreszeitliche Variation bei der Wurzel- und Sproßbildung aus Blattstecklingen von Populus simonii var. fastigiata Schneid.*

Über die jahreszeitliche Variation bei der Wurzel- und Sproßbildung aus Blattstecklingen von Baumarten ist noch wenig bekannt. Das ist ungewöhnlich, da auf diese Weise erzeugtes Klon-Material in der Forstpflanzenzüchtung für Arbeiten der Genetiker benutzt werden könnte.

Hier wird über den Effekt der jahreszeitlichen Variation und von IBS-Behandlung auf die Wurzelbildung bei Blattstecklingen von *Populus simonii* var. *fastigiata* berichtet. Ebenso wird die Wirkung konstanten Lichtes auf das Überleben solcher bewurzelter Stecklinge festgestellt.

Es wurde eine starke jahreszeitliche Variation bei der Wurzelbildung und eine mögliche derartige Variation bei der Sproßbildung gefunden. Zusätzlich ließ sich zeigen, daß die IBS-Behandlung dann von Bedeutung war, wenn sie Mitte August bei den Blattstecklingen erfolgte. Sie scheint dann das Überleben von bewurzelten Individuen zu fördern. Im allgemeinen verkürzte die IBS-Behandlung die Bewurzelungszeit; sie kann aber auch die Sproßbildung verhindern. Die Auswirkung einer ununterbrochenen Photoperiode auf das Überleben war merklich, und in vielen Fällen wurde dadurch ein Totalverlust von bewurzelten Stecklingen verhindert, der sonst immer verzeichnet wurde, wenn die bewurzelten Blätter unter den normalen Tagesverhältnissen von Syracuse, New York, gewachsen waren.

Résumé

Titre de l'article: *Variation saisonnière dans la formation des racines et des pousses de boutures de feuilles de Populus simonii var. fastiqiata Schneid.*

La variation saisonnière de la formation des racines et des pousses à partir des boutures de feuilles des espèces forestières est mal connue. Cela est regrettable puisque les clones produits de cette façon pourraient être utiles aux généticiens travaillant à l'amélioration des arbres forestiers.

Cette étude porte sur la détermination de l'effet de la variation saisonnière et du traitement à l'IBA sur la formation des racines de boutures de feuilles de *Populus simonii* var. *fastiqiata.* On a déterminé également l'effet d'une illumination constante sur la survie de ces boutures racinées.

On a observé une forte variation saisonnière dans la formation des racines et la probabilité d'une variation de ce type dans la formation des pousses. En outre, on montre que le traitement à l'IBA est efficace lorsqu'il est appliqué à des boutures de feuilles prélevées à la mi-août puisqu'il paraît favoriser la survie des plants racinés. En général, le traitement à l'IBA réduit la durée nécessaire à l'enracinement, mais il peut empêcher la formation des pousses. L'effet d'une photopériode continue sur la survie est net et en beaucoup de cas elle empêche la perte presque totale des boutures racinées qui se produit lorsque les feuilles pourvues de racines sont soumises au régime photopériodique normal à Syracuse, New-York.

Literature Cited

(1) Avery, G. S.: Differential Distribution of a Phytohormone in the Developing Leaf of *Nicotiana*, and Its Relation to Polarized Growth. Bull. Torrey Bot. Club. **62**: 313—330 (1935). — (2) Avery, G. S., and Johnson, E. B., with the collaboration of R. M. Addams and B. E. Thomson: Hormones and Horticulture. McGraw-Hil Book Co. N. Y., 1947. — (3) Bonner, J.: Plant Biochemistry. Academic Press Inc., N. Y., 1950. — (4) Burström, H.: Physiology of Root Growth. Ann. Rev. Plant Physiol. **4**: 237—252 (1953). — (5) Chadwick, L. C.: Factors Influencing the Rooting of Deciduous Hardwood Cuttings. Proc. Amer. Soc. Hort. Sci. **28**: 455—459 (1931). — (6) Deuber, C. G.: Vegetative Propagation of Conifers. New Haven, Conn. Acad. of Arts and Sci. **34**: 1—83 (1940). — (7) Deuber, C. G., and Farrar, J. L.: Rooting Norway Spruce Cuttings Without Chemical Treatment. Science. **90**: 109—110 (1939). — (8) Deuber, C. G., and Farrar, J. L.: Vegetative Propagation of Norway Spruce. Jour. of For. **38**: 578—585 (1940). — (9) Doran, W. L.: Propagation of Woody Plants by Cuttings. Mass. Agric. Exp. Sta. Bull. 491, 1957. — (10) Farrar, J. L., and Grace, N. H.: Vegetative Propagation of Conifers. X. Effects of Season of Collection and Propagation Media on the Rooting of Norway Spruce Cuttings. Can. Jour. Res. **19C**: 391—399 (1941). — (11) Fröhlich, H. J.: Untersuchungen über das physiologische und morphologische Verhalten von Vegetativvermehrungen verschiedener Laub- und Nadelbaumarten. Allg. Forst- und Jagdzeitung **132**: 39—58 (1961). — (12) Hagemann, A.: Untersuchungen an Blattstecklingen. Gartenbauwiss. **6**: 69—195 (1932). — (13) Haissig, B. E.: Seasonal Variation in the Rooting Capacity of Norway Spruce and Balsam Fir Cuttings and Air-Layers. M. S. Thesis, State Univ. New York College of For., Syracuse, N. Y., 1962. — (14) Hudson, J. P.: Propagation of Plants by Rooting Cuttings. II. Seasonal Fluctuations of Capacity to Regenerata from

Roots. Jour. Hort. Sci. 30: 242—251 (1955). — (15) JECKALEJS, H. J.: The Vegetative Propagation of Leaf-Bundle Cuttings of Red Pine, *Pinus resinosa*. For. Chron. 32: 89—93 (1956). — (16) KIRKPATRICK, H.: Effect of Indolebutyric Acid on the Rooting Response of Evergreens. Prof. Paper Boyce Thompson Inst. Vol. 2, No. 30, 1940. — (17) NITSCH, J. P., and NITSCH, C.: Photoperiodic Effects in Woody Plants: Evidence for the Interplay of Growth Regulating Substances. Photoperiodism and Related Phenomena in Plants and Animals. Pub. No. 55. AAAS. (R. WITHROW, ed.), 1959. — (18) OGASAWARA, K.: Studies on Cuttings of Forest Trees. I. The Relationship Between the Rooting Behavior and Region of the Tree from Which Cuttings were Collected. Jour. Jap. For. Soc. 38: 297—300 (1956). — (19) SNOW, A. G.: Use of Indolebutyric Acid to Stimulate Rooting of Dormant Aspen Cuttings. Jour. of For. 36: 582—587 (1938). — (20) SNOW, A. G.: Chemically-Induced Rooting of Sugar Maple. Northeastern For. Exp. Sta. Tech. Note No. 27, 1939. — (21) THIMANN, K. V., and DELISLE, A. L.: The Vegetative Propagation of Difficult Plants. Jour. Arnold Arboretum 20: 116—136 (1939).

Referate

GOO, M.: **Development of flower bud in Pinus densiflora and P. thunbergii.** Jour. Jap. For. Soc. 43, 306—309 (1961).

Für diese Untersuchungen wurden laufend von je einem Baum beider Arten Knospen fixiert und eingebettet. Mit Hilfe üblicher Mikrotomschnitte stellte man die entsprechenden Entwicklungsstadien fest. Erste Knospenanlagen konnten ab Mitte Juli beobachtet werden. Blütenprimordien wurden bei beiden Geschlechtern von *P. thunbergii* 10 bis 14 Tage später beobachtet als bei *P. densiflora*. SEITZ

GORJUNOVA, L. N.: **Ein Klon der einhäusigen Aspe Populus tremula L. auf der Kola-Halbinsel.** Botan. Žurn. 46, 705—707 (1961). *[Russisch]*

In einem Walde des Gebietes von Murmansk befindet sich ein Klon von *P. tremula*, bestehend aus 53 Bäumen im Alter von 30 bis 35 Jahren, von denen 14 blühen. Die meisten Kätzchen haben zwittrige und männliche Blüten, einige Kätzchen nur zwittrige Blüten, Kätzchen mit nur weiblichen Blüten sind selten. Die androgynen Kätzchen sind kürzer (2—6 cm gegen 8—11 cm bei einhäusigen Bäumen), die Staubbeutel haben eine hellere Farbe und öffnen sich 2 bis 4 Tage später. Kreuzungen der zwittrigen Blüten mit eingeschlechtlichen hatten schlechte Ergebnisse. Es scheint eine funktionell unvollkommene Entwicklung vorzuliegen. v. DELLINGSHAUSEN

GREMMEN, J.: **Shoot dieback of poplar caused by Septotinia podophyllina.** Nederl. Bosbouw Tijdschr. 34, 416—419 (1962). *[Dutch w. summ.]*

In der Baumschule der Forstl. Versuchsstation in Wageningen (Holland) kennt man *Septotinia podophyllina* auf verschiedenen Pappelsorten. Der Pilz verursacht Blattflecken und einen vorzeitigen Laubfall. Bei *‚Serotina'* bewirkt er seit 2 Jahren ein Absterben kleiner Zweige, ähnlich dem von *Pollaccia radiosa* bekannten Schadbild. — Der Pilz dringt auch in die jungen Stämmchen ein und verursacht dunkel gefärbte Wunden, die sich vergrößern, bis der Sproß abstirbt. Es sieht dann so aus, als sei er geringelt worden. — An Altbäumen ist der Pilz bisher nicht bekannt. — Blattbeschädigungen und damit die Infektionsgefahr sollen möglicherweise durch Spritzen von Insektiziden und Fungiziden verringert werden. Es wird aber auch daran gedacht, nach resistenten Pappelarten und Sorten zu suchen. SEITZ

GROSE, R. J., and ZIMMER, W. J.: **Some laboratory germination responses of the seeds of river red gum, Eucalyptus camaldulensis Dehn, syn. Eucalyptus rostrata Schlecht.** Austr. J. Botany 6, 129—153 (1958).

Mit 31 Samenproben aus 13 verschiedenen Orten des natürlichen Areals von *E. camaldulensis* stellte man Keimprüfungen unter wechselnden Umweltbedingungen an. Die Probenahme ermöglichte das Erfassen von Unterschieden innerhalb des Einzelbaumes, zwischen eng benachbarten und zwischen weiter entfernten Bäumen der gleichen Herkunft, sowie zwischen den Herkünften. Die Keimproben wurden in etwas modifizierten feuchten Kammern angesetzt. Anlage und Auswertung der Versuche geschah nach mathematisch-statistischen Grundsätzen.

Unter Lichtabschluß steigen Keimenergie und Keimprozent von + 21° C (15%) bis 35° C (98%) an und nehmen mit weiter ansteigender Temperatur wieder ab (43° C = ohne Keimung). Eine erhebliche Keimförderung wurde bereits durch kurzfristige (4 Std.) Aufbewahrung im optimalen Temperaturbereich erzielt. Dieser Effekt trat jedoch nur ein, wenn zuvor geringere Keimtemperaturen geboten worden waren (21° C). 8 Std. Vorbehandlung im Temperaturoptimum wirkten sich bei anschließender Keimung in 21° C nur förderlich auf den Keimbeginn, nicht aber auf das Keimprozent aus. Wechseltemperaturen in verschiedener Kombination führten nicht zu einer Keimverbesserung gegenüber den Ergebnissen bei konstanter Temperatur von 35° C. Stratifizierung (600 Std. bei + 8° C) steigerte die Keimschnelligkeit.

Versuchsserien bei + 27° C und wechselnden Lichtbedingungen machten die keimfördernde Wirkung des Lichtes deutlich. Das Keimprozent bei Dauerlicht lag um 14—15mal höher als bei ständiger Dunkelheit. Selbst kurze Lichtperioden von 2 Minuten pro Tag wirkten signifikant keimfördernd. Dabei ist die Länge der kontinuierlichen Lichtgabe von größerem Einfluß als die Gesamtdauer der Lichtgaben. Dauerbelichtung führte allerdings zu geringeren Keimprozenten als 8 Std. Licht pro Tag. Generell war der keimfördernde Effekt des Lichtes umso stärker, je weiter die Keimtemperatur vom Optimum entfernt war. Aber auch nach Dunkelkeimung bei 35° C ließ sich durch kurze Lichtgaben das Keimprozent erhöhen. — Die günstigsten Keimbedingungen für *E. camaldulensis* scheinen bei 8 Std. Licht pro Tag und 35° C zu liegen.

Zwischen den verwendeten Herkünften gab es keine Unterschiede im Keimverhalten und in den Temp- und Lichtansprüchen. Die Streuung in den Keimprozenten von Bäumen innerhalb der Herkünfte war ebenso groß wie die Streuung zwischen den Herkünften. Auch die Keimfähigkeit der Samen von verschiedenen Kronenseiten eines Baumes war nicht voneinander unterschieden. SCHÜTT

GRUT, M.: **Deep-planting of poplars.** Jour. South African For. Assoc. No. 40, 1962, 19—22.

Einer von A. MORELLI (in der Zeitschrift *Cellulosa e Carta* 1959, No. 9) beschriebenen Pflanzmethode für Pappeln entsprechend, wurden nun nach erfolgreicher Anwendung in Israel und Aegypten auch durch das Institute for Forestry and Wood Technology in Stellenbosch in Südafrika Versuchspflanzungen nach dem Tiefpflanzverfahren angelegt. Mit einem Bohrer (Durchmesser ca. 10 cm) wurden dazu Pflanzlöcher bis zu 6 m (durchschnittlich 3 m) tief gebohrt, in die die Ruten von 2/3-Pappeln versenkt wurden, deren Wurzelstock zuvor entfernt worden war. Benutzt wurden „Canada-Pappeln" und die italienische Sorte „I-214". Gepflanzt wurde im Abstand von ca. 5 × 6 m. Diese in die Tiefe versenkten Setzstangen, deren Seitenäste bis auf wenige an der Spitze abgeschnitten worden waren, erreichen auf diese Weise selbst auf sehr armen Sandböden noch Grundwasser und bilden bereits nach kurzer Zeit ein gutes Wurzelsystem aus. SEITZ

GYÖRFFY, B.: **Az erdei fák hibridjeinek fölénye és a heterózis jelenség genetikai értelmezése.** (Hybrid-Wüchsigkeit der Waldbäume und die genetische Erklärung des Heterosis-Phänomens.) Erdészeti Kutatások 1961, 1—3, 327—340. *[Ungarisch]*

Über die Heterosiserscheinung werden folgende Fragen angegangen: — (1) Die Manifestierung der auf die Eltern bezogenen Überlegenheit der Hybriden zu einem gegebenen Zeitpunkt, und zwar als das Endresultat des Wachstums und der Entwicklung, d. h. die Zunahme der Teile in Zahl oder Größe. — (2) Der Vergleich der charakteristischen Eigenschaften der Entwicklung, der Physiologie und des Stoffwechsels der schnellwüchsigen Hybriden mit denen der Eltern. — (3) Diskussion der Hypothesen über genetische Mechanismen, die zur Erklärung der Heterosis dienen können. — Auf praktische Richtlinien für die Ausbeutung der Überlegenheit von Hybriden in der Forstwirtschaft wird ebenfalls hingewiesen. KOPECKY

HAAN, H. DE: **Is there a need for a radical reorganization of publishing the results of plant breeding research?** Euphytica 10, 201—204 (1961).

In einer niederländischen Zeitschrift war 1960 die Frage aufgeworfen worden, ob es nun nicht an der Zeit sei, das wissenschaft-