removed 24 h prior to the experiment. During this period the remaining plant was left under the same conditions as the controls. ^{22}Na and ^{86}Rb were used for labelling NaCl or RbCl solutions.

Results of 3 representative excision experiments are summarized in the Table. As may be noted excision reduced the final total ion content of the sliced hypocotyls. Removal of roots and removal of cotyledons had also an apparent effect on the selective properties of hypocotyls. Removal of roots 24 h prior to the experiment negatively affected the uptake and final content of ^{22}Na, but did not affect or even slightly accelerated the uptake of ^{86}Rb (Table a)). On the, other hand, a decrease in uptake rates of rubidium was observed in plants from which cotyledons were removed (Table, b)). Excision of buds alone, or excision of buds and cotyledons exerted similar effects on the rates of rubidium uptake (Table, c)).

Similar trends, i.e. inhibition of sodium uptake following root excision and inhibition of rubidium uptake following excision of cotyledons, were observed in pure NaCl or RbCl solutions as well as in mixtures.

Excision of cotyledons did not affect the uptake or alter the content of sodium by hypocotyls when solutions of low NaCl concentrations were used. In treatments where high NaCl concentrations were used (> 10 mM) a slightly lower accumulation was observed.

The ratio of uptake at 30°C to uptake at 0°C was approximately 1.1 for sodium, as well as for rubidium, and was unaffected by excision. The process is thus presumably non-metabolic.

Selective uptake of ions is considered to be one of the very basic characteristics of the living cell, and a constant expenditure of metabolic energy is needed for its preservation. However, very little is known of the specific mechanisms or structures which contribute to this phenomenon. Bean hypocotyls are distinct among plant tissues in exhibiting an apparent preference for uptake of sodium ions, which exceeds by far the uptake of most other monovalent cations. Such selectivity seems to be part of a certain salt-evading mechanism which prevents in various plant species sodium ions from moving from the roots, across the hypocotyls into the upper shoot tissues[1–9]. Explanations of this phenomenon have mostly been attempted at the cellular level, and differences in selectivity were often ascribed to tissue characteristics, as well as to ionic constitution of the medium. However, plants do not constitute only a union of independent tissues, but comprise one inter-correlated system. Thus, the idea that ion uptake by bean hypocotyls is affected by the status of adjacent organs and that removal of one organ may alter selectivity of another one seemed most attractive. Unfortunately, only little is known of the effects of one organ on ion metabolism and behaviour of another one. Excision of plant tops reduced the total capacity of bean hypocotyls to accumulate ions. However, such reduction was not uniform and some ions were affected more than others. A similar phenomenon was described already by WENT[10,11] who suggested that hormones play a major role in the direction of nutrients within the plant body. Data obtained by other investigators also support his assumption. For example, it was shown[12–15] that phosphorus was preferentially moved into regions with a high content of auxin. Decapitation of plants caused, after 5 days, a shift in the normal content of nitrogen, phosphorus and potassium in the internodes, and in the lateral buds below the point of decapitation.

Control of selectivity can also be obtained by certain levels of growth substances moving down or up the plant axis[16–18]. Presence of various regulating substances or different levels of one substance may affect uptake of various ions either by changing the uptake capacity or by altering the retention capacity of the tissues.

Nothing specific on such effects is known at present. It is tempting to assume that changes in sodium content of hypocotyls are due to a lower uptake capacity and are caused by the removal of the source of cytokinins or gibberelins. Removal of buds and cotyledons, which affect rubidium accumulation may result from a disturbed auxin supply. Nevertheless, attempts to induce such changes by substitution of the organs by external sources of growth substances have failed, and the percise identification of the affector remains open. Ecologically, the meaning of such a finding is that disturbances in root growth permits a faster transport of sodium across the hypocotyl into the leaves and causes an earlier tocixity of sodium.

Zusammenfassung. Werden bei Hypokotylen von Bohnenkeimlingen die Wurzeln abgeschnitten, so beeinflusst das die Schnelligkeit der Absorption von Natrium, aber nicht diejenige von Rubidium. Abschneiden der Kotyledonen oder der Knospe beeinflusst die Absorption von Rubidium, nicht aber diejenige von Natrium. Kalzium hatte keinen Einfluss auf solche Unterschiede.

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Wood Quality of Eight *Eucalyptus* Species in Zambia

In its afforestation programme, Zambia introduced more than a dozen *Eucalyptus* species from Australia to test for their survival, adaptability and performance in Zambian environments. Equally important is to investigate their wood qualities such as density and fibre lengths which affect mechanical and utilization properties and suitability of timber for pulp and paper production. Reports on wood quality of *Eucalyptus* species grown in other countries are available (BOYD and KINGSTON[1], DADSWELL et al.[2] and RUDMAN et al.[3]) but little is known about between- and within-tree variation in density and fibre length in Zambia.

Material and methods. 4 trees, 6.5 years old, were sampled in each replication from 8 *Eucalyptus* species

(Table I), growing in a 4-replicated trial of 12 species at Chati Forest Reserve in the Copperbelt of Zambia. In each plot, 2 of the 4 trees demonstrated external gummosis and 2 were unaffected. Each type had 1 big and 1 small tree. Three discs were cut at 5, 15 and 25 ft (1.52, 4.57 and 7.62 m) above ground level. In each disc 2 random radii were chosen and segments 1 inch (2.54 cm) long were cut from the pith to the periphery. This was done as the annual rings were not visible. Density and fibre length of each segment was determined.

Results and discussion. Because there were missing samples, analysis of variance was restricted to a few selected species having the same number of samples. It revealed that density was significantly different between species and between trees in the species.

For comparison of species, only the first segment near the pith (representing about 3-years-old wood) was considered as it afforded the maximum number of samples for each species (Table I). All species showed increase in density (up to 17.5%) and fibre length (up to 13.8%) from the pith to the periphery except *E. phaeotricha* which exhibited very little increase or decrease in density.

Disc (height) effects were not marked for density and less for fibre length. There appear to be three classes (i.e. general trends ignoring minor differences) of variation with height. These are a) density decreases as height increases; loss in density inconsistent – *E. phaeotricha, E. tereticornis, E. pilularis,* b) density increases with height; gain in density inconsistent – *E. resinifera, E. cloeziana, E. saligna* and c) density higher at 15 ft than at 5 and 25 ft – *E. camaldulensis, E. citriodora.*

The variation in density is not matched by that of fibre length along or across the stem of all the species, which suggests that there is little relationship between the two traits.

Table I gives the mean values of species for density (0.487–0.614 g/cm^3) and fibre length (0.84–0.93 mm) near the pith. Values are expected to increase with age so that both traits should attain reasonable magnitude for utilization and pulping purposes. Among the investigated

Table I. Mean density and fibre length near pith at 3 height levels of 8 *Eucalyptus* species (each disc represented by 2 radii)

Species	No. of trees	Disc heights (ft)	Density (g/cm^3)	Fibre length (mm)
E. camaldulensis	8	5	0.486	0.86
	7	15	0.497	0.84
	7	25	0.484	0.82
		Mean	0.4890	0.840
		S.E.	0.0083	0.016
E. citriodora	15	5	0.612	0.91
	16	15	0.623	0.90
	15	25	0.606	0.92
		Mean	0.6136	0.910
		S.E.	0.0044	0.014
E. cloeziana	16	5	0.554	0.92
	16	15	0.554	0.95
	14	25	0.560	0.92
		Mean	0.5560	0.930
		S.E.	0.0057	0.013
E. phaeotricha	16	5	0.510	0.85
	15	15	0.504	0.82
	13	25	0.482	0.84
		Mean	0.4986	0.836
		S.E.	0.0072	0.011
E. pilularis	16	5	0.499	0.87
	16	15	0.490	0.87
	15	25	0.490	0.89
		Mean	0.4930	0.876
		S.E.	0.0074	0.009
E. resinifera	16	5	0.515	0.84
	15	15	0.519	0.83
	15	25	0.529	0.90
		Mean	0.5210	0.856
		S.E.	0.0092	0.014
E. saligna	14	5	0.485	0.92
	16	15	0.482	0.90
	15	25	0.495	0.92
		Mean	0.4873	0.913
		S.E	0.0040	0.012
E. tereticornis	16	5	0.550	0.88
	16	15	0.523	0.88
	16	25	0.515	0.91
		Mean	0.5293	0.890
		S.E.	0.0067	0.017

Table II. Wood density comparisons of gum affected and unaffected trees; and big and small trees (based on all the segments)

Species	No. of trees sampled at 3 heights (5, 10 and 15 ft)	Type		Size	
		Gum affected	Unaffected	Big	Small
E. camaldulensis	4, –, –	0.5022	0.4700	0.4885	0.4837
E. citriodora	6, 8, 6	0.6167	0.6107	0.6082	0.6188
E. cloeziana	8, 8, 6	0.5632	0.5555	0.5691	0.5495
E. phaeotricha	8, 6, 6	0.5176	0.4978	0.5353[a]	0.4846
E. pilularis	8, 8, 6	0.5018	0.4815	0.4990	0.4843
E. resinifera	8, 6, 6	0.5456[b]	0.4963	0.5102	0.5317
E. saligna	6, 8, 6	0.4805	0.4886	0.4931	0.4761
E. tereticornis	8, 8, 8	0.5420	0.5198	0.5345	0.5273
Overall mean		0.5337	0.5150	0.5297	0.5195

[a] Significantly different at 5.0% probability level. [b] Significantly different at 1.0% probability level.

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species *E. citriodora* (0.614 g/cm^3), *E. cloeziana* (0.556 g/cm^3) and *E. tereticornis* (0.529 g/cm^3) rank high in wood density. *E. cloeziana* is fairly uniform along the stem. Regarding fibre length, *E. cloeziana* (0.93 mm), *E. saligna* and *E. citriodora* (both 0.91 mm) are among the longest.

Comparison of gum affected and unaffected; and big and small trees. Gum or strictly speaking kino is present in the wood of almost all the *Eucalyptus* species in veins or pockets causing a degrade of timber. *Eucalyptus* species grown in Zambia have trees with varying degree of gum bleeding and deposition in the same plot. A direct comparison of affected and unaffected trees is possible to learn the effect of gum on wood density (Table II). The average density in gum affected trees is marginally higher than those of unaffected ones, but significant differences were present in *E. resinifera* only. Density in affected trees was higher in all discs and all segments than those of unaffected ones except at 15 ft in *E. citriodora* and at 25 ft in *E. cloeziana*. *E. saligna* seems to be an exception to the rule where the segments at three heights in unaffected trees have higher density than those of affected trees. There seems to be no relationship between the size of tree with the incidence of gum bleeding.

Except *E. resinifera* and *E. citriodora* the big trees have higher density than small trees but the difference is significant in *E. phaeotricha* only. The significant difference in big and small trees of same age of *E. phaeotricha* can be explained by the facts that 1. it shows a regular decrease in density from bottom to top and 2. in small trees the 15 and 25 ft levels are nearer the top than those in big trees so that the small trees will show lower values at the fixed height levels than the bigger ones. If on the other hand density goes on increasing from base to apex, the smaller trees should have higher density than the bigger ones as revealed by *E. resinifera*. For comparison purposes it is better to sample height as a percentage of the whole tree rather than assigning discs at fixed positions in the tree[4].

Résumé. La densité du bois et la longueur de la fibre ont été l'objet de recherches dans 8 espèces d'*Eucalyptus* de Zambie. Les espèces diffèrent considérablement par leur densité (0.487–0.614 g/cm^3), mais non par la longueur de leurs fibres (0.84–0.93 mm).

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Tapetal Development in the Anthers of *Allium sativum* L. and *Allium longicuspis* Regel

Allium sativum is an extremely variable species and has been grown as a crop plant for a long time. Central-Asiatic endemite *A. longicuspis*, differing from *A. sativum* by exserted anthers from the perianth, is thought to be the wild ancestor of common garlic[1].

A. sativum and *A. longicuspis* belong to the diploid species of the genus *Allium* with the basic chromosomal number $W = 8$[2–4]. A cytological investigation of *A. sativum* proved the striking karyotypical variability of various cultivars[5].

In both species the sexual reproduction is omitted, and bulbils are formed in the inflorescence besides the abortive flowers. The causes of pollen sterility are not yet clear and are explained by some authors as degeneration of the sporogenous tissue at different levels of anther development[6–8].

But there were no data available about the development of tapetum – the innermost layer of the anther sac wall – through which the sporophyte affects development of the male gametophyte.

Materials and methods. The cloves of *Allium longicuspis* Regel were obtained from the Central Botanic Garden in Moscow, while the cultivar 'Bzenecký paličák' served for the trial with *Allium sativum* L. var. *sativum*. The anthers were sampled from the flowers at the praemeiotic, meiotic and postmeiotic stages of development. The objects were fixed in Carnoy's fluid and stained by means of modified orceine method without pretreatment.[9] The constant preparations were made of the anthers fixed in Navašin's solution. The sections 10 μm thick were stained by means of Cajal-Brožek's method in the saturated solution of basic fuchsine and picroindigocarmine.[10]

Results and discussion. The tapetal layer is differentiated at the praemeiotic stage of development from the parietal tissue of the anther sac wall. At the beginning of

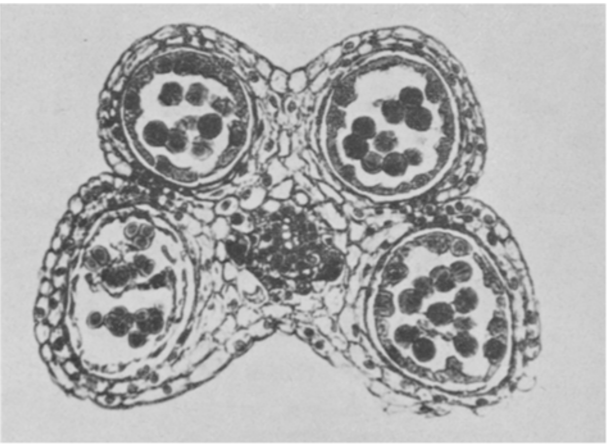

Fig. 1. The cross section of the anther of *Allium sativum* L. cv. 'Bzenecký paličák'. Pollen tetrads are surrounded by persisting tapetal layer. ×220.

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