The East Malling investigators have opened several new avenues for further research The influence of vigor-inducing rootstocks and the use of vegetative wood from hedges should be considered in relation to accepted theories of physiological juvenility The propagative power of hardwood stem tissue has definitely been increased by these methods The interrelationship of time of collection, growth regulator treatment, and controlled-temperature storage is significant. The application of these principles and methods with proper modifications to other plant species should advance the progress and knowledge of plant propagation quite materially.

Acknowledgement:
The writer extends his thanks and appreciation to Mr R J. Garner and Dr. E S J. Hatcher of the East Malling Research Station for their kindly cooperation and the unreserved contributions of their research data.

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MODERATOR WARNER 'The next man on our program is Mr. March of the National Arboretum in Washington, D.C. He will discuss the hardy eucalypti

Mr. Sylvester G March read his prepared address on "Hardy Eucalypts." (Applause)

HARDY EUCALYPTS

SYLVESTER G. MARCH
Propagator
U S. National Arboretum
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The mention of eucalyptus to most people brings to mind thoughts of the Koala bear and Australia Uniquely, the genus *Eucalyptus,* with its 500 species, is native only to Australia, Tasmania, and neighboring islands.

In addition to eucalyptus leaves being an essential part of the diet of the Koala, eucalypts play an important role in the economy of Australia Its wood is used for paper pulp, fibreboard, commercial lumber, firewood and charcoal. From its bark comes tannin and from its leaves, essential oils. These essential oils are used in disinfectants, perfumes and medicines.

At the turn of the century a good deal of effort was expended to establish plantations of this rapid-growing tree in California, New Mexico, Arizona, and Florida, but land proved to be of greater value for farming and therefore most of the eucalypt plantations have disappeared. Today, in California the eucalypt is best known as an ornamental tree for street planting. So intensively have they been planted there, that most Californians believe them to be indigenous. There is a story told about a soldier from California stationed in Australia during World War II in which he remarked, "Say, you got some of our eucalpts here!"

In its native habitat the genus is distributed widely over areas of greatly varying climatic conditions. The regions that interest us most

are the colder areas of New South Wales and Victoria on Australia's southeast coast, and the southerly adjacent island of Tasmania. The Blue Mountains in New South Wales and the Australian Alps in Victoria reach elevations of 3,500 to 7,300 ft. It is in this mountainous region where those species of eucalypts which are relatively cold-tolerant can be found The weather records of the Kosciusko Meteorological Station in New South Wales, which is midway between Sydney and Melbourne, indicate an annual average of 157 days with frost, and that a minimum temperature of 5° F. had been recorded

Tasmania, which is only some 150 miles to the south of New South Wales, belongs to the same Great Dividing Range System of the continent and has elevations to 5,200 ft The Waratah Station in Tasmania has recorded a minimum of 4° F. and an average of 44 days of frost per year.

Two and a half years ago, seeds of several species of *Eucalyptus* were sent to the National Arboretum in Washington, D.C., by the Forestry and Timber Bureau in Canberra, Australia. Some of the seeds that were sent came from trees growing in the coldest regions of Australia and Tasmania The plants raised from this seed were planted out in the fall of 1957, and received no protection during last year's severe winter, in which a low of 3° F was recorded at the National Arboretum It is of course much too early to evaluate what the ornamental usefulness and cold tolerance of eucalypts will be It is interesting, however, to note the initial response of the eight species which have shown varying degrees of cold-resistance at the National Arboretum.

E. niphophila, which has handsome blue-gray foliage, withstood our low temperature of 3° F. without any dieback or foliage burn This species has withstood temperatures of 10° F at the U S. Plant Introduction Station at Glenn Dale, Maryland, located some 12 miles from the National Arboretum.

A closely allied species of *E niphophila* is *E. pauciflora* In its native habitat of New South Wales, Queensland, and Tasmania, *E. pauciflora* is found growing on cool mountain sites and in subalpine areas which have frosts in winter and moderate snowfall, cool summers and moderate and regular rainfall. At the Arboretum, this species also withstood our low 3° F , without any inury.

The species that surprised us most was *E camaldulensis* Last fall three six-foot plants were set out Reports we had from Norfolk, Virginia, indicated the species to be hardy there, so our hopes for survival at the Arboretum were high. Much to our disappointment, the plants were killed to the ground Somewhat discouraged, the dead tops were lopped off at ground level. Later in the spring, much to our surprise, several shoots broke from below ground level and now range from 6 to 8 ft. in height.

This experience brought to mind the idea that in colder regions, some of the species might be treated as herbaceous plants. It must be quite humiliating for the lofty *Eucalyptus,* with some of its species reaching heights of 300 feet in Australia, to condescend to being treated as an herbaceous plant.

Perhaps the most attractive species is *E. gunnii.* In its juvenile state the very attractive leaves are extremely glaucous and interestingly

arranged on the stem. At the Arboretum, in two contrasting situations, *E. gunnii* behaved quite differently. The foliage on plants protected by a building showed some evidence of winter burn, but did not suffer from any dieback. In another situation, without any protection, it behaved herbaceously like *E. camaldulensis.* It too broke from below ground level and made good growth of about 6 ft. this season.

Several other species which have given indications of cold-tolerance at the Arboretum are *E aggregata, E. largiflorens, E. rubida,* and *E. stellulata.*

Presently, the accepted method for propagating eucalypts is by seed. Of the species mentioned, *E. niphophila* and *E pauciflora* require moist stratification for 60 days at 40° F for best germination. Germination time for most species is between six and 18 days. By early spring sowing and over-wintering the plants the first winter in a cool greenhouse, they will be ready for planting out the following spring. After our experience last winter with species that behaved herbaceously, it would be well to give these plants some protection the first two winters in an effort to build up a hardy woody stem. Such protection for two winters might make the difference between the plants acting herbaceously or shrub-to-tree-like thereafter.

In the event cold-resistant selections are made from existing species or new hybrids, a commercially feasible method of asexual propagation will have to be devised Athough our first attempts to root *Eucalyptus* from cuttings have been unsuccessful, we will continue our efforts. Grafting has been tried with *E niphophila* at the Arboretum and has proven successful. On the West Coast, air-layering, grafting and inarching have been used in the propagation of desirable varieties.

A great deal needs to be done in the way of exploration for *Eucalyptus* and other ornamentals of which we desire more hardy forms. Unfortunately, in the past, effort has not been made by plant collectors to obtain plant material from the colder regions of the plant's natural distribution range. The National Arboretum, as part of its research program, is keenly interested in the furthering of exploration in this country and abroad for new ornamentals and hardier forms of those already in cultivation.

As research on this genus is in the early stages at the Arboretum it will be several years before testing can be undertaken by other Botanic Gardens and before plant distribution will follow.

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MODERATOR WARNER: Thank you, Mr. March. I am sure that in the future we are going to benefit from the publication of these minutes, because these talks are obviously so full of information that only by digesting the minutes published next year will we get the full value of them.

The next man we have needs no introduction to the members who are here He was my near neighbor until he moved out to Iowa, Dr. John Mahlstede

DR. MAHLSTEDE. This discussion entitled, "Graft Failures in Apple Stions," might more specifically be designated as "The Effect of Sanitation on the Stands of Apple Grafts"

It is quite apparent that the theme of many of our presentations here at these meetings has been centered around sanitation.

It has been referred to directly during the current sessions by Jack Hill who emphasized the need for cleanliness in and around our propagating facilities. The removal of wastes, debries, and general decontamination procedures have been highlighted as being very important factors contributing to the success of any one particular propagation sequence.

Dr. Richard Hampton, in his excellent presentation on *Prunus* viruses and their relationship to propagation techniques also referred to the need for sanitation and clean scionwood Carnation growers in Colorado have done essentially the same thing in producing disease free cuttings, a process conducted through the culturing and isolation of disease-free stock plants.

Sanitation has also come to light more or less sub rosa; Bill Flemer referred to it in pointing up the nematode problem. Harvey Gray has mentioned it in his cesspool reference, Fred Galle has referred to it in connection with soil sterilization to eliminate weeds and pathogens in transplant beds

When one becomes older he has a tendency to reminisce. On this subject of sanitation I think back to my Professor, Teacher and friend, Steve O'Rourke, who on the first day in his propagation course passed out a one sheet dissertation on sanitation Here he pointed out one fact, i.e , the propagation house is like a maternity ward, keep it clean.

All in all the reasons for these precautions are the elimination of failures and the increase of propagation efficiency.

Dr. J. P. Mahlstede presented his prepared address entitled, "Graft Failures in Apple Stions" (Applause)

GRAFT FAILURES IN APPLE STIONS*

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INTRODUCTION

Ever since man first began grafting plants there have been failures. In some years a nurseryman might have unusual success and have a 80 or 90 per cent take Other years, with the same understock and the same scion variety, handled under what the propagator considered identical conditions, stands of 50 or 60 per cent might be realized.

The essential aspects of understock culture of the common red cedar have received particular attention in recent years, since this material is the most commonly used stock for junipers and has given the most trouble to propagators of evergreens. Frequent transplanting to promote the formation of a liberous root system, and a good sanitation program are considered requisite to an acceptable, commercial stand

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