Germination Strategies for New Ornamental Species

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INTRODUCTION

Maximisation of germination is a major part of successful introduction for new species of plants which may prove of some horticultural importance or value. The difficulties associated with importation of live plant materials, (such as seeds and other propagating materials), and the obvious high costs involved leads to the logical conclusion that any strategies which may lead to increased germination rates of seeds particularly, are worthy of investigation. This short discussion will focus on the application of a relatively unusual and apparently not widely known method of enhancing the germination of recalcitrant species, namely "smoking".

GERMINATION USING CONVENTIONAL STRATEGIES

Table 1 shows germination rates for some reasonably well known species from the Cape, South Africa. These species were germinated using laboratory germination techniques, with the seed sown on filter paper, soaked in distilled water. A regime of 16 h light and 8 h dark was used in the trials. A temperature of 20C was maintained.

Table 1. Germination rates for a range of South African species, under controlled conditions.

Species	Average germination rate (%)
Dietes grandiflora	13
Moraea loubseri	1
Lobelia valida	6
Greyia radlkoferi	16
Ceratotheca triloba	18
Monopsis lutea	Less than 1
Tarchonanthus camphorata	Less than 1

It is obvious from the data in this table that the germination rates of these species are very low. The likely success rates for small numbers of seeds would be a little disappointing, time consuming for little or no result, and potentially fruitless considering the small number of seeds available for some species. It is known that a large number of other species exhibit similar rates of germination under conventional germination strategies. Any strategy that enhances germination rates should be utilised to ensure efficient and cost-effective germination.

THE FYNBOS ASSOCIATION

The species listed in Table 1 represent a range of plant types; biennials *(Ceratotheca)*,

cormous perennials (*Moraea*), herbaceous perennials (*Lobelia*), and shrubs (*Tarchonanthus*). Some of these plants form part of the fynbos association. Fynbos is characterised by the presence of "restios", (reed-like plants), heathers (*Erica*), and members of the Proteaceae, such as *Protea, Serruria*, and *Leucadendron.* There is also an abundance of species from such genera as *Helichrysum, Watsonia, Moraea, Gladiolus*, and *Disa,* to name a few.

THE CAPE FLORAL KINGDOM

The focus of this discussion will be on plants from South Africa; in particular, plants from the fynbos, the prevalent vegetation type of the Cape Floral Kingdom of Southern Africa (see Fig. 1).

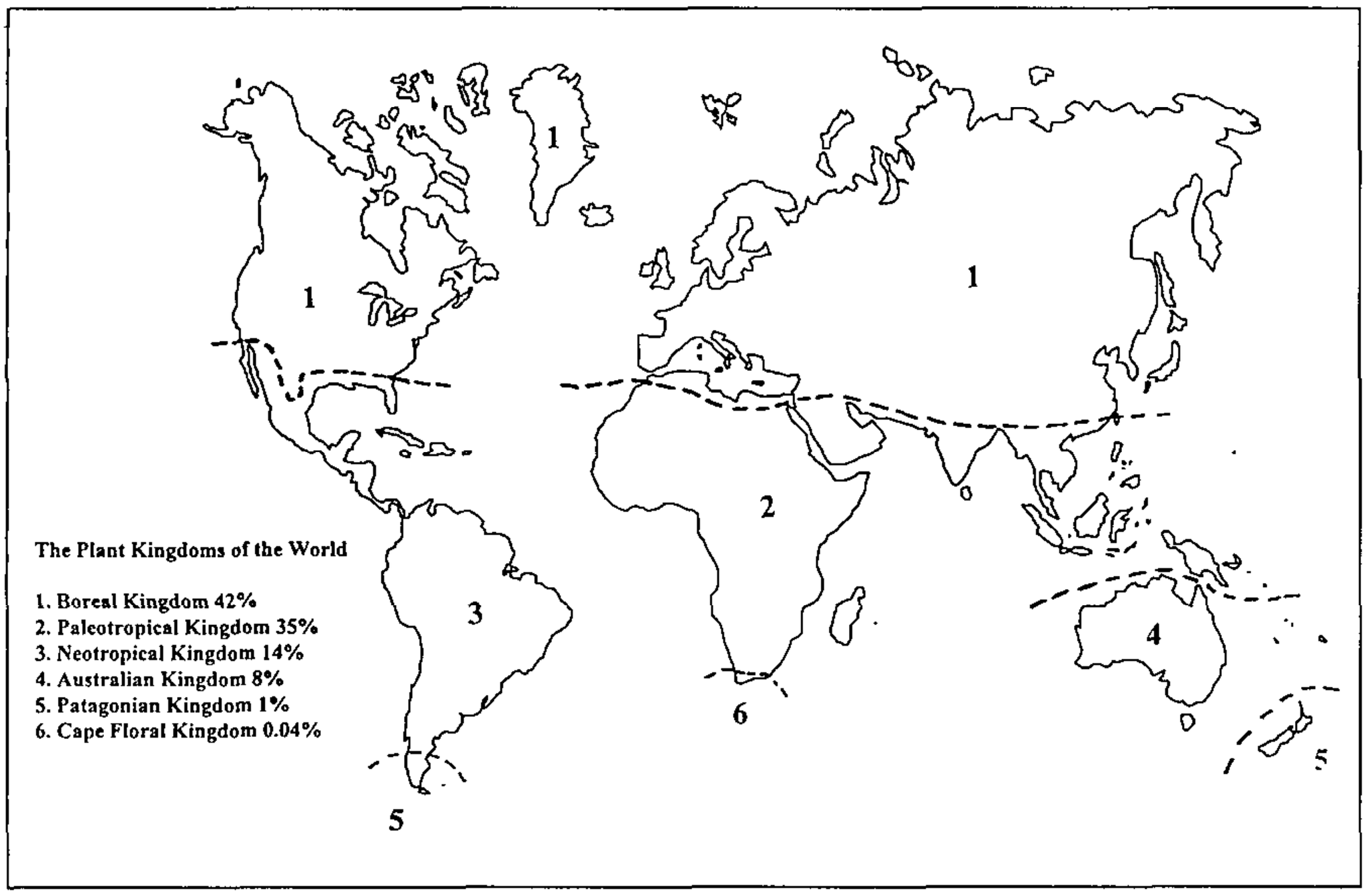

Figure 1. Location of the Cape floral kingdom, or fynbos biome.

The Cape Floral Kingdom has only 0.04% of the land surface area of the Earth, yet it contains more than 8500 species of plants. More than 6000 of these species are endemic to the kingdom (growing nowhere else on Earth naturally), and there is a very concentrated variety of plants, with some areas containing over 120 species per 100 m^2. In short this is a very rich area botanically, and a wealth of plant material awaits evaluation for adventurous horticulturists. Many of the species are already widely grown, but the overall picture is one of opportunities for those wishing to experiment with new introductions.

The flora making up the fynbos association is typically fire adapted. This fire adaptation has led to the discovery of a germination enhancing technique which has important implications for the potential introduction of otherwise difficult-to-germinate species.

This paper will discuss very briefly the practical implications of recent and ongoing research into the germination of otherwise difficult seeds, using the smoking technique. Research in this area was initiated in South Africa, and has progressed

to the point where approximately 200 species have been tested for smoke sensitivity, with approximately half of these showing positive response to the treatment. It is interesting to note that the process can apparently be generalised to plants from Australia and the Mediterranean. All of these floras show some fire adaptation, or even fire dependence for continued healthy existence.

Some of the most outstanding results achieved so far are from the genus *Erica,* which in one species has shown an increase in germination rate from 14 seeds per gram of untreated seed to 1000 seeds per gram for smoke-treated seed.

A species of "restio", *Rhodocoma* showed an astounding increase from 10 seedlings per gram, untreated, to 2400 seedlings per gram treated. These results show that it is indeed worth pursuing smoke treatment as a strategy to improve germination.

SMOKING PROCESS

The process does not need any special or elaborate equipment. Figure 2 shows the general layout of a simple apparatus that will produce the desired results. Equipment needed is as follows:

- A suitable drum in which to light a smoking low fire. A close fitting lid and air inlet are required.
- A small tent to contain the smoke, this may be a child's pup tent, or a more elaborately constructed plastic structure.
- A suitable hose or pipe to conduct smoke from the fire to the tent arrangement.
- A supply of dry and green plant materials from fynbos (in this case) vegetation. Save all your *Protea, Leucadendron, Restio, Watsonia, Freesia,* trimmings.
- Seed trays containing sown seed.

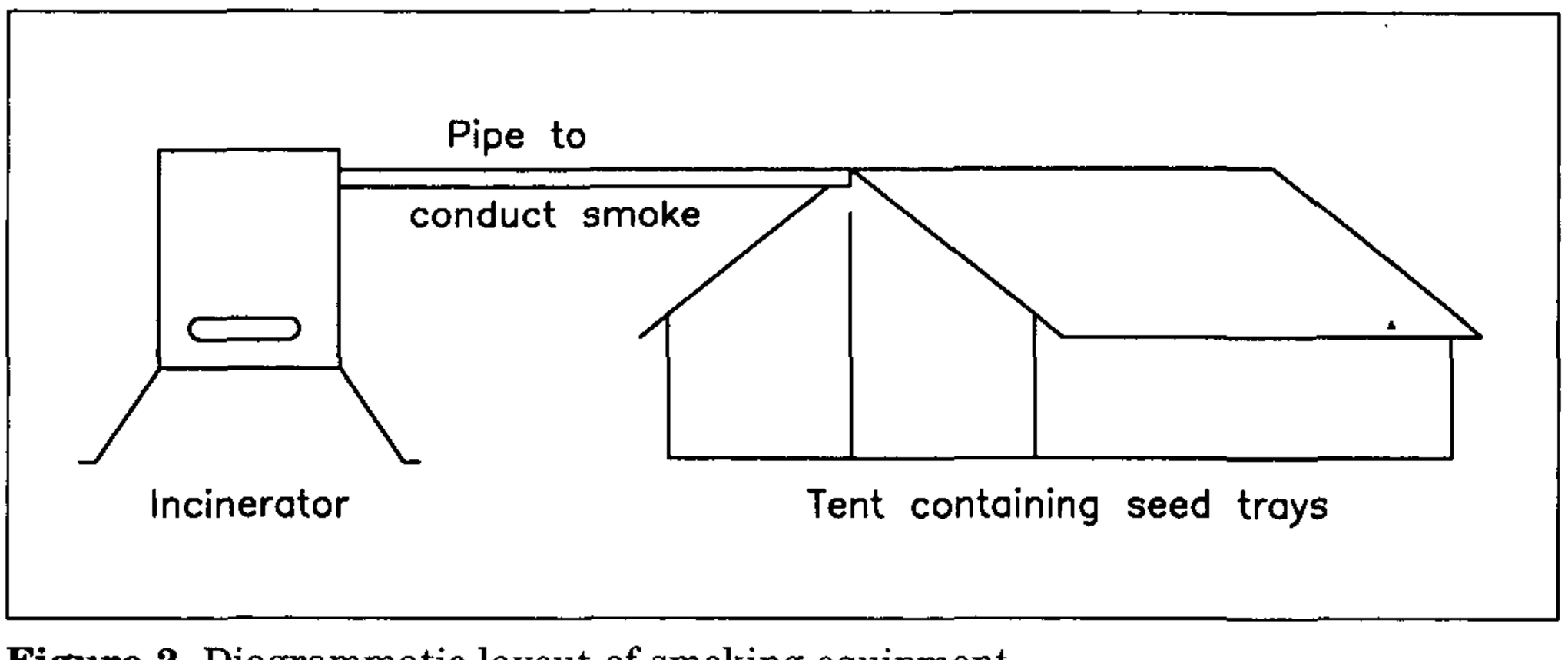

Figure 2. Diagrammatic layout of smoking equipment.

The method of smoking the seed is simple. The fire should be lit and tended so that it does not burn too fiercely, but instead produces a large amount of smoke. Adjust the flow of air through the drum so that smoke fills the tent, through the pipe. It may be useful to cool the smoke by keeping the pipe cool with water. Continue the process for about an hour (up to 2 h has been used). When the smoking process has been completed, the seed trays should be removed and watered sparingly. It is recommended that overwatering should be avoided to prevent leaching of the germination enhancers from the seed-raising mix.

AUSTRALIAN PLANTS

The same process has been used to aid in, and enhance the germination of, Australian plants, with some 70 species from 38 genera showing extremely positive results so far. Some familiar names occur in the list, e.g. *Conospermum, Epacris, Eriostemon, Hybanthus, Lechenaultia, Pimelea.* Some of the species concerned were previously very difficult or impossible to propagate successfully using seed. The Australian research shows germination can be increased as much as 50 times for some species. As has been observed earlier, there are important implications here for the preservation of rare plants and cost-effective propagation for some promising ornamental species. Some of the species are described as being impossible using conventional germination techniques.

INSTANT SMOKE

A recent development from the Conservation Biology Research Unit at Kirstenbosch in South Africa is "Instant Smoke", which consists of absorbent paper impregnated with smoke saturated water. In practice the papers are soaked in a small amount of water, and seeds are soaked in the resultant solution. After a predetermined period of soaking (usually 24 h), the seeds can be removed from the smoke solution and sown as usual. An alternative strategy is to drench sown seed-trays with a solution of "instant smoke" in water. The effects of this treatment are the same as for the physical smoking exercise, without the problems associated with collection of fynbos materials to burn, and lighting of fires.

CONCLUSION

In our own nursery we propose to experiment further with the effects of different types of vegetation being used as the source of smoke. It will be apparent that it is difficult to collect enough foliage from South African plants with which to keep a fire going for up to 2 h. As we are now in a position to produce our own seed from a number of genera and species, mainly *Moraea* and *Gladiolus,* it appears worthwhile to see if equivalent results to those described above can be obtained by using more readily obtainable local vegetation.

It has been our own experience that germination of seeds of some species of *Protea* and *Erica* and many bulb species is very difficult using conventional techniques. There is a high frustration level in sowing expensive seed and getting mediocre results. In addition, the smoking process should provide an effective method of building up numbers to saleable volumes.

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