Pollen germination across the seasons

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This note describes a simple technique to provide a reliable and readily available source of pollen at various times of year, and an indication of the most favourable germination conditions.

Prior to the early 1990s, and the arrival of the Science and Plants for Schools (SAPS) project, there was very little published material on techniques for obtaining reliable pollen germination in science classes.

Nuffield Biology Teachers' Guide II (Nuffield, 1966) suggested that groups of students use different concentrations of sucrose (5, 10 and 15%) to see if their plant pollen would germinate. Three plants, narcissus, tulip and bluebell, were used. The experiment was designed to show that different types of pollen required different concentrations of sugar.

In the section on the germination and growth of pollen in *Nuffield Advanced Science, Biological Science* (Nuffield, 1970), students were provided with a molar solution of sucrose to which boric acid and yeast extract had been added, and asked to prepare a series of dilutions, 0.2, 0.3, 0.4 and 0.5 mol dm^{-3}, and investigate the growth of pollen from any particular species with respect to sugar concentration. In this investigation, the technique of the 'hanging drop' and the use of the 'moist chamber' were introduced. It is also mentioned here that boron, in the form of boric acid, is used, *'as it is essential for the growth of pollen tubes in some species'*.

Hawkins (1974) suggested using pollen from the Lily *Lilium regale*. Again, the technique of the hanging drop was suggested with a sucrose strength of 0.5 mol dm^{-3} and some boric acid added.

SAPS published their own protocol (see website) for the germination of pollen from 'fast plants' (*Brassica rapa*) in 1991. The specific concentration of sucrose for this plant material is 1.2 mol dm^{-3}, and it is mixed with an equal quantity of 'mineral salt solution' to a specified recipe.

I have used 'fast plants' and the SAPS protocol for pollen-tube growth over the past eight or so years with great success in many workshops for teachers, and also with our PGCE students. But what about reliability of pollen germination with more commonly available (but seasonal) material?

I started trialling plant material using the SAPS protocol early in spring and continued through to the end of autumn. Where necessary, I adjusted the concentration (molarity) of sucrose to give the optimum conditions for fast pollen germination (see table). On

some occasions I found that the 'mineral salt solution' actually inhibited germination, and where this was the case, the pollen was germinated in sucrose solution only.

Most material was collected on warm dry days when flowers were fully open, and, as suggested in the SAPS protocol, older flowers were selected in preference to newly opened ones.

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References

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Science and Plants for Schools (SAPS) website: http://www.saps.plantsci.cam.ac.uk

Table 1 Sucrose concentrations providing favourable germination conditions for commonly available plant pollens. Sucrose solution is mixed with equal quantity of 'mineral salt solution' except where comments include SO (= sucrose only).

Plant pollen	*Sucrose solution /mol dm^{-3} (%)*	*Start growth time/min*	*Month(s)*	*Comments*
Wallflower cultivars (*Cheiranthus* spp.)	1.2 (41.1%)	20–30	April/May	High percentage germination, good tube growth.
Bluebell (*Hyacinthoides hispanica x non-scripta*)	0.4 (13.7%)	30–40	May	High percentage germination, very long tube growth.
Rape (*B. napus*)	1.3 (44.5%)	35–40	May/June	High percentage germination, slow tube growth.
Bluebell (*Hyacinthoides non-scripta*)	0.2–0.5 (6.8–17.1%)	35–40	May	Medium–high percentage germination, very long pollen tubes after 2 hours.
Common meadow buttercup (*Ranunculus acris*)	0.4 (13.7%)	25–30	April/Sept	SO.
Creeping buttercup (*Ranunculus repens*)	0.5 (17.1%)	35–50	May/Aug	SO. Slow tube growth.
Welsh poppy (*Meconopsis cambrica*)	0.5 (17.1%)	60–70	May/Aug	Medium percentage germination.
Bulbous buttercup (*Ranunculus bulbosus*)	0.2 (6.8%)	50–70	April/July	SO. Good percentage germination after 2–3 hours.
Large bindweed (*Calystegia sylvatica*)	1.2 (41.1%)	20–25	June/Aug	Contents of pollen grain often evacuated through pollen tube during growth period.
Foxglove (*Digitalis purpurea*)	0.4–0.5 (13.7–17.1%)	30–40	June/Sept	SO. Good percentage germination.
Great willow herb (*Epilobium hirsutum*)	1.2–1.3 (41.1–44.5%)	30–40	July/Aug	Tube growth continues for several hours and cytoplasmic streaming easily visible.
Rosebay willowherb (*Epilobium angustifolium*)	1.1–1.3 (37.7–44.5%)	15–20	July/Sept	Exceptionally fast germination and tube growth. Noticeably 3 tubes per pollen grain.