4.5 POLLEN GERMINATION AND VIABILITY

In *A. sessilis* (both leaf forms), sucrose concentrations of 4%, 6% and 8% were not optimum for pollen germination, resulting in a very low percentage of germination which was less than 2%. Thus, these sucrose concentrations were not used in subsequent replicates (Figure 97).

In *A. sessilis* 'Red', the mean percentage germination was the lowest in sucrose concentration of 10% (3.10 ± 2.45%) ($p < 0.05$) (Appendix 4.5.2.1A). The low mean percentage of germination was because most of the pollen grains in the sucrose concentration of 10% secreted protoplasm or did not germinate (Figure 98A–C). Sucrose concentration of 12% also produced a low mean percentage of germination (4.14 ± 2.39%) and it was not significantly different from sucrose concentration of 10%.

On the other hand, sucrose concentration of 16% showed the highest mean percentage of germination which was 19.70 ± 6.24%. This was followed by sucrose concentrations of 14% (19.23 ± 6.83%), 22% (18.76 ± 13.56%), 18% (17.58 ± 8.27%), and 20% (12.95 ± 9.21%). However, the differences among these five concentrations were not significant ($p > 0.05$) (Appendix 4.5.2.1A).

Aside from showing the highest mean percentage of germination, the sucrose concentration of 16% also produced the longest pollen tubes (16%: 137.26 ± 39.54 µm). Massive germinations were recorded especially when the pollen grains were distributed in a group and very few morphological abnormalities were observed. Therefore, the sucrose concentration of 16% appeared to be the optimum concentration for pollen germination.

Although sucrose concentrations of 20% and 22% gave a high mean percentage of germination, the length of pollen tube was the shortest in the sucrose concentration of 20% (79.74 ± 18.26 µm). This was followed by sucrose concentration of 22% which

also produced short pollen tubes (89.39 ± 19.59 µm) (Figure 98C & D). Besides, a lot of pollen tubes with morphological abnormalities were also observed (Figure 99C & D). Therefore, sucrose concentrations of 20% and 22% were not optimum for pollen germination although the mean percentage of germination was high.

Similar to *A. sessilis* 'Red', the mean percentage of germination of the sucrose concentration of 10% was significantly the lowest in *A. sessilis* 'Green' (3.26 ± 1.68%) ($p < 0.05$) (Appendix 4.5.2.2A). A low mean percentage of germination has also been recorded in the sucrose concentration of 12% (7.85 ± 7.44%). However, the difference between these two concentrations was not significant ($p > 0.05$) (Appendix 4.5.2.2A).

The highest mean percentage germination was recorded in the sucrose concentration of 20%, followed by 18%, 14% and 16%. However, the difference among these four concentrations was not significant ($p > 0.05$) (Appendix 4.5.2.2A). Although sucrose concentration of 20% gave the highest mean percentage (28.88 ± 11.28%), this was not the optimum concentration for germination as the pollen tube was the shortest (103.98 ± 13.91 µm) and there were high occurrences of morphological abnormalities.

Sucrose concentration range of 14%–18% appeared to be the optimum concentration with high germination percentage, long pollen tubes (Figure 97B) and fewer abnormalities in pollen tubes. Among these concentrations, sucrose concentration of 18% was recorded with the highest mean percentage of germination (24.43 ± 15.09%) followed by 14% (24.31 ± 11.56) and 16% (22.52 ± 9.05). The differences between these three concentrations were small and not significant ($p > 0.05$) (Appendix 4.5.2.2A). In terms of the length of pollen tube, it was significantly the longest in the sucrose concentration of 14% (157.77 ± 25.02 µm); ($p < 0.05$) (Appendix 4.5.2.2B). This was followed by 16% (138.27 ± 24.78 µm) and 18% (115.64 ± 30.84 µm).

Pollen tubes with morphological abnormalities were mostly observed in the higher concentrations such as 20% and 22%. Examples of abnormalities were bifurcated pollen tubes or pollen tubes with coiled ends. Another abnormality was that two pollen tubes grew from two different apertures of a pollen grain but only one would continue to elongate. Normally, most of the pollen grains produced only one pollen tube i.e. exhibiting the monosiphonous condition (Figure 98A & B).