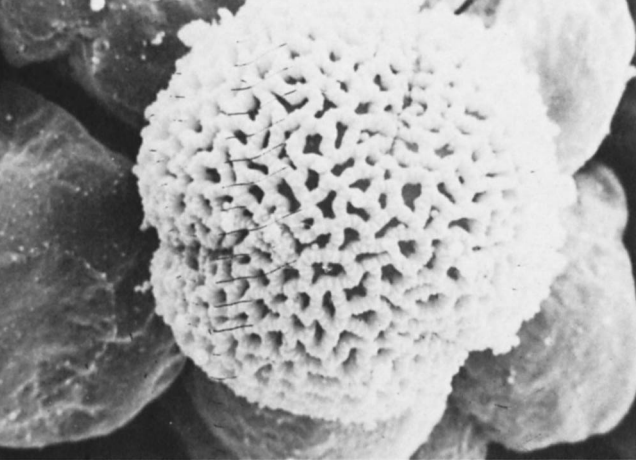

Olive pollen grain resting on stigmatic surface.

K. Pinney

'Swan Hill' as an ornamental olive cultivar

Ricardo Fernandez-Escobar □ George C. Martin

The absence of fruit is desirable in ornamental plants, including the olive. The 'Swan Hill' olive cultivar is often planted as an ornamental because it flowers profusely each year without setting fruit. A few fruit may persist on mature trees and in environments where root development is restricted; even so, it is rare to see more than four fruit on a large 'Swan Hill' tree in California.

In previous work, we found that abnormalities in the embryo sac appeared to be the main cause of unfruitfulness in 'Swan Hill'. In Arizona studies, this cultivar produced virtually no airborne pollen, and only 10 percent as much pollen was collected from around a single tree as from 'Manzanillo' in a similar setting. In those same studies, pollen grain counts per anther were similar for 'Swan Hill' and 'Manzanillo', but anther dehiscence, or shedding of pollen, was hindered in 'Swan Hill': less than 15 percent of the anthers fully dehisced.

We conducted an investigation to compare the pollen production and germination percentages of 'Swan Hill' and other selected olive cultivars growing at the University of California, Davis, experimental orchards.

Pollen production tests

A preliminary experiment established the conditions for collecting a small quantity of olive pollen. Inflorescences from the 'Picual' olive were removed from shoots collected in the field just before pollen discharge, placed in small containers, and kept at 20°, 30°, 40°, 50°, 60°, and 70°C (68°, 86°, 104°, 122°, 140°, and 158°F) until anthers dehisced. The pollen released was sieved with cheesecloth, and pollen germination was evaluated after incubation for 24 hours at 25°C (77°F) in a liquid medium of 10 percent sucrose, 0.01 percent boric acid (H_3BO_3), and 10 ppm tetracycline. There were four replications per temperature treatment, and three drops of media containing pollen per replication were placed on a slide used to evaluate pollen germination. About 100 pollen grains were counted per drop. Statistical analyses were performed on the data.

Anthers dehisced after 20 hours at 20° or 30°, 3 hours at 40°, 2 hours at 50°, 1 hour at 60°, and less than 1 hour at 70°C, showing a nonlinear relationship between temperature and time of anther dehiscence in the range of temperature studied. While the rate of dehiscence increased with temperature, the pollen taken from each dehiscence temperature germinated at a lower percentage as the temperature rose, declining from 45 percent at 20° to 2 percent at 60°C. The negative effect of temperature on pollen germination has been reported in olive pollen storage studies and in studies of other species. Since the percentage of pollen germinated at 20°C was similar to the value reported for 'Picual' in a previous work, we selected 20°C to induce anther dehiscence and germinate pollen in subsequent experiments.

In the spring of 1985, we took shoots of 'Swan Hill', 'Ascolano', 'Sevillano', 'Santa Caterina', and 'Rubra' from the field to the laboratory, kept the shoots at 20°C until pollen was released, then sieved the pollen and stored it at −20°C (−40°F). We estimated pollen production by grouping the varieties in classes based on gross pollen release in the containers and the number of shoots per container. We evaluated pollen germination as in the preliminary experiment, and conducted statistical analysis of the results.

TABLE 1. Pollen production and germination percentage of five olive cultivars

Cultivar	Pollen production	Germination*
		%
'Santa Caterina'	Medium	60.2 a
'Ascolano'	High	53.7 ab
'Sevillano'	Medium	43.5 b
'Rubra'	Very high	30.3 c
'Swan Hill'	Low	0.0 d

*Figures followed by different letters are significantly different, Duncan's multiple range test, 5% level.

Despite its larger anthers, 'Swan Hill' produced a small quantity of pollen, unlike the other four varieties (table 1). This result agrees with quantitative data from Arizona studies.

Olive pollen frequently germinates in low percentages, and some scientists suggest these are the result of morphological abnormalities in the pollen. In our work, 'Santa Caterina' and 'Ascolano' pollen had high germinability in contrast with 'Swan Hill', which had 0 percent germination. 'Sevillano' had high enough pollen germination to be considered as a pollinating variety.

These results agree with those obtained previously in California. In contrast, 'Sevillano' pollen germination has been much lower in Spain. If we assume that the genetic characteristics of 'Sevillano' in both California and Spain are the same, environmental factors, including cultural practices, might explain the differences in germinability obtained in the two areas.

Conclusions

'Swan Hill' produces small quantities of non-viable pollen and is an extreme case of both female and male sterility. As such, it is an interesting specimen for scientific purposes. Our studies also showed that olive pollen can be collected in small quantities by exposing inflorescences with open flowers to 20°C for 20 hours, just before anther dehiscence.

The small amount of pollen produced, coupled with the absence of fruit, makes this olive an attractive choice as an ornamental in California, particularly in densely populated communities. Although the relationship between pollen viability and allergic reactions in humans has not been established, the low pollen production of 'Swan Hill' may be important. Previous reports have indicated that a plant must produce large quantities of pollen to cause allergic reactions.

As reported in other studies, the lack of fruit also allows this cultivar to achieve additional vegetative growth, which adds to its ornamental value.

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