

The More Flowers a Visitor Works on One Plant, the Smaller the Share of Pollen from Other Plants

— the total from other plants grows as $1 - (1 - 0.3)^k$ to **0.971752** at **10** flowers, but pollen from the same plant grows faster, to **6.760825** — the separator is whether one asks about the total pollen delivered or the share within it — [Paper 866]

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Abstract

It is easy to assume that a visitor working many flowers pollinates better. This paper counts that, on one plant, the total and the share of pollen from other plants point opposite ways. No new theorem or law is claimed. First, the total from other plants grows: if 0.3 of the body's pollen is left at each flower, the total after k flowers is $1 - (1 - 0.3)^k$: **0.971752** at 10 flowers, **3.239175** times that at 1 flower (Section 2). Second, and this is the core. Even so, the share from other plants falls: of the pollen delivered, the share from other plants is 1.000000 with 1 flower, **0.629630** with 2, **0.271977** with 5 and **0.125670** with 10 (Section 2). Third, pollen from the same plant grows faster: pollen from other plants never exceeds the 1 brought in, but pollen from the same plant is picked up again at every flower and reaches **6.760825** at 10 flowers (Section 2). Fourth, later flowers receive little from other plants: pollen from other plants reaching flower j is $0.3 \times 0.7^{j-1}$; the tenth flower receives 0.012106, a share of **0.012458** of what it receives (Section 3). Fifth, per-flower amounts and totals were obtained separately and match: per-flower pollen from other plants matched the formula within 10^{-12} for all ten flowers, and summing per-flower amounts returned the totals within 10^{-12} (Section 3). Sixth, the separator is whether one asks about the total pollen delivered or the share within it: the total rises with more flowers and the share falls. The same visit points opposite ways depending on which is asked (Section 4). **Keywords:** pollination, pollen, geitonogamy, outcross pollen, share, model.

Scope of this paper (scope note): No new theorem or law is claimed: that pollen moves between flowers of the same plant (geitonogamy), and that pollen on a visitor's body is left a little at each flower and runs down, are both known in pollination studies. No real values are claimed: the share left, 0.3, and the amount picked up, 1, are model values matching no plant and no visitor. Mechanisms are not included: pollen lifetime, limits on how much a stigma accepts, rejection of the plant's own pollen, and visitors grooming themselves are not included. Fruit set is not discussed: whether delivered pollen becomes seed, or how many fruits form, is not treated. Relation to earlier papers: no earlier paper takes pollination as its subject. Paper 864 showed that higher up the chain there is less of the substance, yet it is more concentrated. This paper stands beside it. There a fixed share per level shrank the living mass in the denominator and the concentration rose. Here a factor 0.7 per flower shrinks the pollen from other plants while pollen from the same plant is added, and the share falls. What is added is laying out totals and shares by the number of flowers worked, measuring that the share falls to 0.125670 while the total grows 3.239175-fold, following what each flower receives up to the tenth, and placing the separator on total delivered versus the share within it.

1. Notation and the Question

Setting: a visitor arrives at a plant carrying 1 unit of pollen from other plants. At each flower it leaves a share d of each kind of pollen on its body, then picks up p of the plant's own pollen and moves on. With a_j the pollen from other plants and b_j the pollen from the same plant received by flower j :

$$a_j = d(1 - d)^{j-1}, \quad \sum_{j=1}^k a_j = 1 - (1 - d)^k, \quad \text{share from other plants} = \frac{\sum_j a_j}{\sum_j a_j + \sum_j b_j}$$

We set $d = 0.3$ and $p = 1$. b_j was not written as a formula but counted flower by flower from the same-plant pollen left on the body.

Question: does working more flowers on one plant deliver pollen from other plants better?

2. Number of Flowers Worked

Computation 2.1: the number k of flowers worked in a row on one plant was varied and the pollen left was counted.

k	from other plants	from same plant	share from other plants
1	0.300000	0.000000	1.000000
2	0.510000	0.300000	0.629630
3	0.657000	0.810000	0.447853
5	0.831930	2.226900	0.271977
10	0.971752	6.760825	0.125670

Observation 2.2

this is the core. The more flowers worked, the smaller the share from other plants. The share is 1.000000 with 1 flower, 0.271977 with 5 and 0.125670 with 10: from the second flower on, the visitor starts carrying pollen from the same plant.

Observation 2.3

the total grows, but has a ceiling. The total from other plants is 0.971752 at 10 flowers, 3.239175 times that at 1, and matched $1 - (1 - d)^k$ within 10^{-12} . It never exceeds the 1 brought in. Pollen from the same plant is picked up again and again, has no ceiling, and reaches 6.760825 at 10 flowers.

3. What Each Flower Receives

Computation 3.1: for ten flowers in a row, what each flower receives was laid out.

flower	from other plants	from same plant	share at this flower
1	0.300000	0.000000	1.000000
2	0.210000	0.300000	0.411765
3	0.147000	0.510000	0.223744
5	0.072030	0.759900	0.086582
10	0.012106	0.959646	0.012458

Observation 3.2

later flowers receive little from other plants. The tenth flower receives 0.012106 from other plants against 0.959646 from the same plant, a share of 0.012458: per-flower pollen from other plants matched $d(1-d)^{j-1}$ within 10^{-12} for all ten flowers, and summing per-flower amounts returned the $k = 10$ row of Computation 2.1 within 10^{-12} .

4. The Separator

Observation 4.1

the separator is whether one asks about the total pollen delivered or the share within it. Asked as a total, more pollen from other plants arrives the more flowers are worked: asked as a share, it is buried in pollen from the same plant the more flowers are worked. The same numbers of the same visit point opposite ways depending on which is asked.

Observation 4.2

placed beside Paper 864.864 showed that a fixed share per level leaves less substance higher up, yet at a higher concentration. There the denominator shrank and the ratio rose. Here the numerator is multiplied by 0.7 per flower while pollen from the same plant is added to the denominator, and the ratio falls.

Observation 4.3

what is not said. Real plants and visitors, pollen lifetime, stigma limits, rejection of the plant's own pollen and fruit set are not treated. What is shown is that working more flowers raises the total and lowers the share.

5. Census and Closing

1. total is $1 - (1 - d)^k$ (Section 1): capped by the 1 brought in.
2. share 1.000000 with 1 flower (Computation 2.1): only from other plants.
3. 0.629630 with 2 (Computation 2.1): same-plant pollen begins to mix in.
4. 0.271977 with 5 (Computation 2.1): still falling.
5. 0.125670 with 10 (Computation 2.1): the core.
6. total 0.971752 at 10 (Observation 2.3): grows 3.239175-fold.
7. same-plant pollen 6.760825 (Computation 2.1): no ceiling.
8. share 0.012458 at the tenth flower (Computation 3.1): later flowers receive little.
9. per-flower and totals within 10^{-12} (Observation 3.2): independent.
10. total delivered, or share within it (Observation 4.1): the separator; Paper 864.

Closing: The more flowers a visitor works on one plant, the smaller the share of pollen from other plants. If 0.3 of the body's pollen is left at each flower and 1 unit of the plant's own pollen is picked up, the share is 0.629630 with 2 flowers, 0.271977 with 5 and 0.125670 with 10: from the second flower on the visitor carries the plant's own pollen, which is picked up again and again and reaches 6.760825 at 10 flowers. The total from other plants grows to 0.971752 but never exceeds the 1 brought in: of the pollen the tenth flower receives, only 0.012458 is from other plants. Placed among the earlier papers: no earlier paper takes pollination as its subject; beside Paper 864, where a fixed share per level shrinks the denominator, we placed the side where a fixed share per flower shrinks the numerator and the denominator grows. To be honest: the share left and the amount picked up are model values, and pollen lifetime, stigma limits and rejection of the plant's own pollen are not included.

References

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