

HOPBUSHES ON THE WIND

Dodonaea is probably the only member of the family Sapindaceae that is wind pollinated. The family is predominantly tropical and most species grow in closed forest communities. Dodonaea is the largest Sapindaceae genus in Australia and it differs from most other genera in that it has come to occupy the more open areas such as woodlands and open shrublands.

There are many characteristics of Dodonaea, and the environment it grows in, that show us the genus is wind pollinated, i.e. it is anemophilous.

Wind pollination is essentially random and basically inefficient. It depends on large numbers of pollen grains and the whims of atmospheric circulation to transport them to the sticky stigmas of a receptive flower. It appears to have arisen independently in several families of the flowering plants. In some families, e.g. the grasses (Poaceae) and in northern deciduous forests it is the main form of pollination.

I've outlined below a number of features of Dodonaea that suggest these plants are pollinated by the wind.

1. The flowers lack petals or any brightly coloured tissues that are usually necessary to attract animal pollen vectors. The absence of petals allows unhindered dispersal of pollen grains by air currents.

2. Since no nectar is produced, the female flowers lack any floral reward to attract pollinators.

3. The anthers and stigmatic surfaces are fully exposed during flowering. The sepals fold back away from the anthers in male and perfect (i.e. bisexual) flowers and in female flowers the style protrudes well beyond the sepals which enclose the ovary. It is interesting that the two prostrate species, D. procumbens and D. humifusa, usually have long pedicels in the male flowers and long styles in the female and perfect flowers. Both of these features help to raise the reproductive structures above the foliage for wind pollination.

4. The stigmatic surface area varies in size, but the stigma is branched or tri-partite. This increases the receptive surface area available for interception of the pollen.

5. The inflorescences are almost always produced at the ends of the branches, and so the flowers are projected beyond the foliage, which otherwise may be an obstruction to free pollen movement in the air.

6. Dodonaea flowers have large anthers producing copious amounts of pollen, which can easily be seen as yellow pollen 'rain' during flowering. In other plant families growing in temperate

areas there are many anemophilous dioecious tree species which produce enormous quantities of pollen relative to the number of ovules available for pollination and fertilisation.

I have counted the pollen produced by the male flowers of 3 species and each flower was found to contain more than 96,000 pollen grains (average of 131,000).

In floral biology work the ratio of pollen grains to ovules (p/o) is accepted as a ratio indicative of the breeding system of that species. That is, a high p/o means the flowers of that species produce much more pollen than ovules and that it is likely to be an outbreeding or cross-pollinating species. A low p/o will probably be an inbreeder or self-pollinator. Most Dodonaea flowers have only 6 ovules and so you can easily work out that they have a very high p/o ratio and that they cross-pollinate.

7. The pollen of Dodonaea viscosa can travel considerable distances. Air-borne pollen, presumably originating in New Zealand, has been collected several thousand metres above sea level in atmospheric pollen surveys conducted from New Zealand.

I have collected some Dodonaea pollen over 2 km from the nearest known population. As you would expect the density of pollen decreases with increasing distance from the source population.

8. Although it isn't directly related to wind pollination, pollen viability is another factor to be considered. It's of little use a plant producing lots of pollen if it doesn't have high viability and most of it is not capable of fertilisation. I've found that all Dodonaea species have more than 83% viable pollen and most species tested have more than 90%.

9. Dodonaea pollen grains are relatively small. Most wind pollinated species possess small pollen grains, not only because they are light to transport, but also because they are less likely to be intercepted by leaves and branches. In terms of energy consumption it is also cheaper to produce smaller grains than larger ones.

10. It is an advantage for dioecious anemophilous species to be gregarious since this decreases the chance of pollen being trapped by other species. As most of you will know individuals of Dodonaea are usually closely spaced and often a single Dodonaea species is not only the dominant, but also the only member of the shrub layer of a particular community.

11. For similar reasons dodonaea's are absent from dense heath communities and rainforests. They are usually found in habitats of relatively open vegetation such as open sclerophyll forests, woodlands, mallee communities or arid shrublands. In these communities pollen is less likely to be wasted by becoming lodged

in the foliage or flowers of a different species.

12. Pollen seems to be released only under climatic conditions favourable for wind pollination to be successful, i.e. warm and dry. In the populations in South Australia on which I have done long term studies, flowering occurred in early summer or late spring at a time when mean rainfall and humidity drop to summer minimums, mean temperature and the number of clear days increase and the average wind speed reaches its maximum for the year. I've only ever seen pollen being released on dry, warm and/or windy days.

So you can see that there are several characteristics which support the fact that Dodonaea is wind pollinated. Dodonaea's in southern Australia especially should be nearing their peak flowering time now. If you have natural populations growing nearby perhaps you could try to observe some of these characteristics. Of course, you may be able to add others that you think might be advantageous to a plant relying on the wind for pollination and ultimately successful seed production. Naturally I'd be pleased to hear from you if you have any comments or more points to add to the above list (or for any other reason!).

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