

“A flower is a leaf, mad with love”

The sex organs that are flowers

Quote attributed to Goethe

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Looking back, I am surprised at how boring botany lessons were at university. Now a grizzled professional botanist with the Ph.D. credential, I can get away with having some fun at last. So, I am going to indulge, without apology, in a little anthropocentrism. Here is an idea of how teachers might interpret plants to teenagers with honest curiosity but little appetite for jargon.

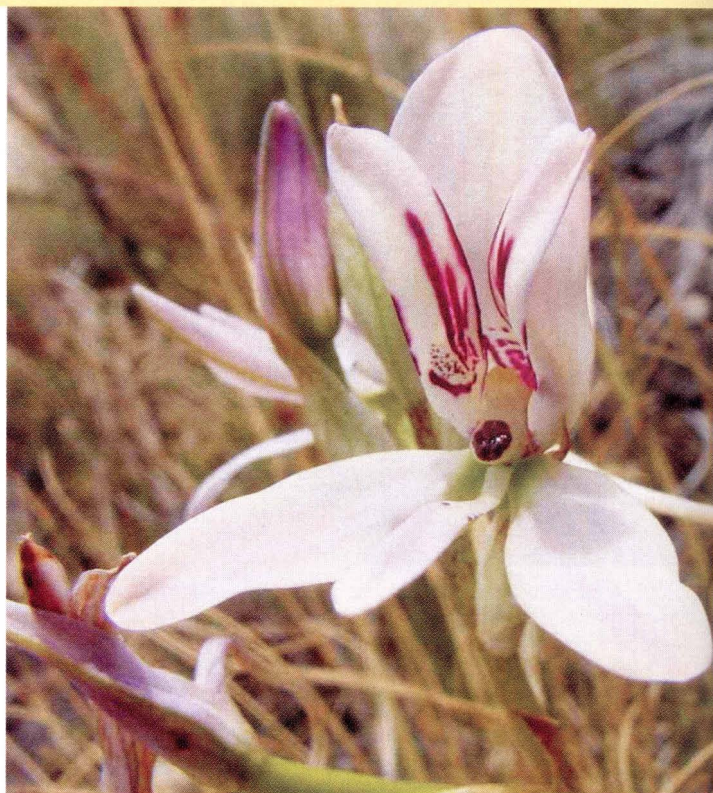
You are a plant, and you want sex. Sex is enjoyable for good reasons, although scientists have yet to agree just what these reasons are. It seems that sex is one way of boosting genetic variation. This keeps complex organisms well-adapted in the face of a continual onslaught of microbes. The principle behind this is that multicellular creatures are easily outbred by the single-celled creatures that attack them. Big forms struggle to keep up with their small enemies, which rapidly develop resistance to any chemical defence the host throws up against infection. In other words, the near-universality of sex in multicellular organisms may be owing to a simple problem of scaling. Who would have thought that germs could cause so much fun?

The trouble is, you are rooted to the ground. This means that, as a male, you cannot locomote to find a female, in order to mate with her. As a female, you share this frustration. Even the sperm of flowering plants do not swim. Perhaps this is why plants have invented a system of surrogate, postal sex, more titillating than the mundane sex lives of humans.

Plant genitals

Plants have the equivalent of a penis. This is called the filament by botanists - who follow the discreet terms of Victorian times, when botany flowered but sex was taboo. Instead of having your testes at the base of your penis, you have them at the tip where plant semen (pollen) can be picked up by the postal service. Pollen is produced by these testes, called anthers, at the tips of your filaments. The combined organ is called a stamen. Most flowers have not one but a whole brushwork of stamens, which collectively produce the plant semen we call pollen. (See glossary on page 79.)

If you are a female flowering plant, you have ovaries, as animals do. The womb of a plant is fashioned from a warped leaf called a carpel. And you also have a vagina, except that this one is turned inside out, to form a projection called the style. The reason for this eversion is simple: a stationary creature must project even the female sex organs to have a chance of catching pollen sent by the male against the odds of space and time. The pistil may even thrust in a sense, when the



The pollinators of this orchid, *Disa harveiana*, are long-proboscid flies that visit it in search of nectar. Some orchids are more stingy with nectar, and offer their chosen pollinator a sexual experience on false pretences. Certain species have floral parts looking and smelling like female insects. The male insect attempts to copulate with the flower, and in the process picks up the pollen. A good example of this is in *Disa bivalvata* (see page 107 in the new book *Wildflowers of southern Africa: Jewels of the Veld*, by John Manning and Peter Goldblatt. Photo: Jan Vlok.

flower is jerked by the wind. (It would be a human foible to attach any stigma to the conversion of vagina and vulva into a phallus as plants have done.)

Surrogate sex

The postal service used by plants for sex is not only a courier service, but also an 'escort' service. Pollinating agents do not just transport pollen from male to female flowers, they constitute what is effectively a sex object, a surrogate erotic partner, for each gender of the plant. For a plant wanting sex, the best way of using a good postal service is to seduce the courier, using the same ploys as in animal courtship. A flower shows off, surrounding its genitalia with attractive skirts made of the non-photosynthetic leaves we call petals. It offers gifts and sweet nothings. It capitalizes on the heat of the moment. It gets away with as much subtle deception as it can, pretending to be more attractive than it really is. And so arrive lusty animals, the pollinators.

As a plant, you have a particular resourcefulness: you photosynthesize, which no animal can do. This means that you can tap into a generous supply of solar energy, which powers all systems of transportation, including the limbs of escorts.

An obvious way of spreading pollen is by the wind. However, this is likely to be wasteful of the one thing a plant is likely to be short of: the nutrients, such as zinc and phosphorus, needed to produce sperm. Plants are affluent in energy, but they measure their nutrients, because these, unlike sunshine, seldom rain down on plants. Where pollen is lost to the four winds, there may be unaffordable wastage in making wind the postal agent. ('Anemophile' is a dirty word to most flowering plants.) What is more likely to work is to trade power in the way post offices sell stamps. Postal employees burn energy in locomotion, but cannot photosynthesize. Nectar is common in flowering plants, because watery sugar means instant energy in drinkable form, and various animals can be made to see a sex organ as a source of takeaway food. While the animal drinks, it cannot avoid a 'money job', whether in the form of dusty pollen or a sticky mass of pollen. When it visits the female flower, some of this pollen rubs off on to the stigma, at the tip of the style – the everted botanical equivalent of the vagina.

In the world of plants, nectar may be an aphrodisiac. However, in order to excite the escort, it pays a plant also to use perfume and make-up. The dizzying extravagance of floral frills, colours, and scents in the plant world is about courtship with surrogates. The plant woos and makes love twice, and the first-loved is the pollinator. Visualize a sugarbird visiting the large, bright flower of a protea. The protea presents what is essentially a whole brush of dozens of male organs (bright stamens), among which the sugarbird probes with its long beak and tongue, in order to lick up the nectar at their bases. In so doing, the bird is dusted with pollen on the feathers of its face. When it moves to another flower of the same plant species, some of this pollen is inadvertently rubbed off on to the female organ (the pistil located amidst the brush of stamens).

The sex act in flowers

When pollen reaches the pistil, or female organ of a plant of the same species, each pollen grain needs to

make sperm that penetrates all the way from the stigma, at the tip, down the style to the ovule, in the carpel at the base. What is more, pollen can usually only penetrate the ovule through a small opening - called the micropyle - equivalent to the cervix of mammals. Flowering plants grow the equivalent of an instant penis, a pollen tube, for this purpose, which performs the closest act to mating in animal terms.

Each pollen grain germinates to form a pollen tube, which grows into and down the pistil, until it brings the plant sperm to its goal, the plant egg. This task accomplished, the pollen tube perishes, ending the life of a stage of the plant life cycle (the microgametophyte) that has no purpose other than the sex act.

Most plants are hermaphrodites

Plants go to some length to compensate for their inability to locomote, and even the remarkable floral designs can go only so far to beat the tyranny of distance. For this reason, being hermaphrodite makes sense to plants far more than it does to animals. Botanists refer to hermaphroditic plants as 'monoecious' as opposed to 'dioecious.' This is some of the maddening jargon I had to deal with at school. After thirty years of practice I still cannot seem to recall which is which without the botanical dictionary (remind me again, does 'mono-' refer to one gender, or one plant?).

About 95% of the species of flowering plants on Earth are hermaphroditic. This means that each individual plant is both male and female. In many cases, each individual flower contains both male and female organs, side-by-side. This has the obvious advantage of doubling the chance of successful insemination for each individual plant. It also means that, as a last resort, you can mate with yourself. This is one step better than virgin birth or self-cloning, because at least the sperm cell (derived from the pollen) offers a different arrangement of genes from the egg cell (derived from the ovule).

Plants not only bend genders, but they also bend genes, in a phenomenon called 'polyploidy.' Plants prepare for the rendezvous between male and female by a radical re-arrangement of the chromosomes at home before they go out on a date. This is achieved by outright multiplication of the genetic material, a strange concept to most animals. If sexual reproduction is the

genetic equivalent of a game of poker, plants are capable of summarily producing a second pack of cards, and if necessary a third - as if from under the table. Just as most animals need not resort to hermaphroditism to make enough variety in their sex lives and genetic combinations, so they do not need to resort to polyploidy.

As in the case of sperm swarming in a vagina, pollen grains compete with each other for the privilege of inseminating the female on which they land. Each stigma of the plant rejects many pollen grains of foreign species, by preventing them from growing into a pollen tube. Even if the incoming pollen belongs to the correct species, it is not necessarily accepted by the female. Plants are adept at selective contraception in order to avoid being inseminated by genetically undesirable partners. The methods they use are perhaps more subtle (mechanical, temporal, and biochemical) than those used by humans.

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Next time you receive a bouquet from your lover, what you will have in your hand is a riot of sex organs in which every insemination involves four acts of mating. Yes, each germinating seed of the flowering plant will be the product of four separate moments of sexual consummation. First the equivalent of a penis (the filament) mates with a pollinator, then the equivalent of a vagina (the style) mates with the same pollinator. Then the pollen grain mates with a female organ (the stigma), and finally the pollen tube mates with the womb (carpel). Does this mean quadruple sexual gratification, relative to human experience? After all, flowering plants are the only organisms that have two inseminations of each ovule - known as double fertilization. One sperm cell fertilizes the actual egg cell, while the second fertilizes the cells surrounding the egg cell, to form a tissue (the endosperm) that functions similarly to the human placenta, although of different origin.