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Tree-mendous

Aspen trees in Fishlake National Forest, Utah, USA

The oldest and largest organism on Earth

A grove of aspen trees in the USA is the oldest and largest organism on the planet, according to recent DNA analysis. **Liz Sheffield** investigates this impressive achievement

A quaking aspen in Fishlake National Forest, Utah, has more than 47 000 tree trunks connected to a vast, largely underground, root system. All originated from a seed that started growing up to 80 000 years ago, during the last ice age. The grove of trees has been named Pando – Latin for 'I spread'. It is the largest known grove on Earth and the heaviest living organism on record. The grove extends over 4.3 hectares and weighs an estimated 6000 tonnes. This is equivalent to 40 blue whales or three times the world's largest single-stem tree – California's largest giant redwood.

The grove owes part of its success to the fact that the seed was triploid. Having three sets of chromosomes rather than the usual two conveys enhanced adaptability and competitive ability – and a flair for rapid territorial expansion. Polyploids have strong invasiveness. But there is a snag – triploids are invariably unable to breed with others. They are 'condemned' to rely on asexual reproduction via cloning.

When is a clone not a clone?

The *Oxford Dictionary of English* definition of a clone is 'an organism or cell, or group of organisms or cells, produced asexually from one ancestor or stock, to which they are genetically identical'. Given that all stems of Pando are derived from a single ancestor they should all be clones, right? Well, no. The problem is the vast timescale and the inevitability of mutation. Over the very many years (the fewest estimated at 18 000) that Pando has been growing, and due to the way that plants grow, mutations that have arisen will have accumulated in the tissues subsequently produced (see Figure 1).

The researchers who sampled Pando's leaves and roots found almost 4000 genetic differences between the 'clones' of Pando. So, strictly speaking, we should

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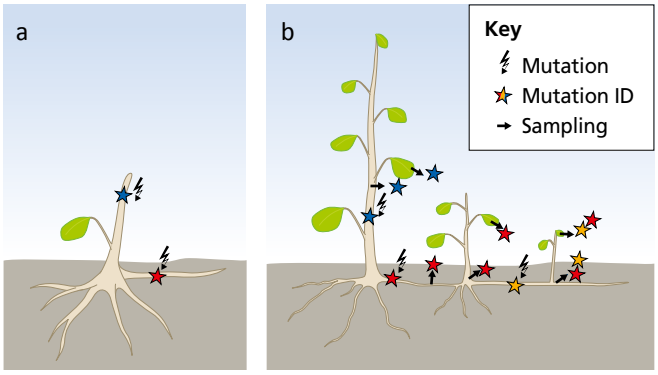

Figure 1 Mutations that happen in the tissues of an established stem (for example, blue in a) are not passed on to others, but mutations in lateral growth that has yet to generate upright stems (for example red and orange in b) continue to be found in all tissues of subsequent 'clones'

not consider this grove of trees to be clones. But the research indicates a means by which organisms restricted to asexual reproduction can retain the ability to adapt to changing conditions. So, rather than being a condemnation, cloning can provide an organism with the opportunity to adapt.

Problems for Pando

One problem with reliance on asexual reproduction is that trees cannot colonise new environments. Even though some mutations will make them better adapted to changed conditions, the vast majority of the genome remains the same. This means that any major local perturbation (a hurricane or landslide, for example) can be catastrophic. Similarly, any microorganisms capable of colonising the trees will have unfettered access to a huge extent of resources.

Happily, the only microorganism currently causing any problem to Pando is a fungus called *Venturia tremulae*, which causes a condition known as shepherd's crook (curled topmost points of the stems). Most stems recover well, but it may only be a matter of time before mutations in the fungus render it far more damaging.

Another problem for Pando is its ageing 'population' of trees. Foresters responsible for Fishlake forest compare the situation with that of visiting a town of more than 47 000 people and realising that almost all of the townsfolk are more than 85 years old. Pando has worryingly few new upright stems surviving, and this is a great concern for its future.

Absent friends

The main reason for the poor survival of new upright stems is the absence of carnivores. The recent spreading of the nearby human population has led to habitat destruction and the relentless slaying of wolves, bears, mountain lions and other predators, so the local herbivores are thriving. Rabbits, deer and even cattle now browse the new shoots of Pando, secure in the knowledge that their grazing will not be interrupted. Thankfully there are efforts to fence off parts of the forest, and restrict the access of cattle, so hopefully the world's largest inhabitant will recover and persist for many years to come.

Weblinks

Booker, C. and Rothman, M. (2019) 'Earth's most massive living thing is struggling to survive', *PBS News*: **https://tinyurl.com/3f4bundb**

Kudiabor, H. (2024), 'The world's oldest tree? Genetic analysis traces evolution of iconic Pando forest', *Nature*: **https://tinyurl.com/yxcd4h99**

Activities

Read about rewilding in the USA: **https://tinyurl.com/3u4d88pn**

Debate the pros and cons of rewilding with your classmates. For example, see: **https://tinyurl.com/3te9zka9**

See how deliberate fires are used to maintain the ecosystem of Fishlake and other national forests in the USA: **https://tinyurl.com/4dhhmzpk**