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By Jacob Berkowitz

Dwarf mistletoe reveals its sex secrets

Hold-off putting up the mistletoe: the dwarf mistletoe could soon eclipse its better known Christmas cousins as the green fertility symbol of choice for holiday party goers. In fact the discovery of the intimate details of the sex life of the dwarf mistletoe is even getting traditionally staid botanists hot and bothered.

The research shows that the dwarf mistletoe, a member of the *Viscaceae* family with the better-known Christmas varieties, is truly worthy of being hung with pride. The stubby variety might be a clumpy green parasite of conifers, but it turns out it has the world's only water-pump seed ejection system. One that can fire a seed up to a dazzling 20 meters (65 feet). So who you calling dwarf now?

"The dwarf species I studied in Manitoba has a gestation period of one-and-a-half years after which the seed, the equivalent of the baby, explodes out of the fruit. This extreme buildup of water pressure as a seed dispersal system is unique in the plant world," says Dr. Cynthia Ross, an assistant professor at the University College of the Cariboo in Kamloops, British Columbia.

Dr. Ross, who describes herself as a "plant gynecologist", is the first to figure-out some of the cellular characteristics behind the dwarf mistletoe's impressive ejection system. The results of her NSERC-funded research, co-authored with the University of Manitoba's Dr. Michael J. Sumner, are published, in part, in the current issue of the *Canadian Journal of Botany*.

The seeds of the larger Christmas mistletoes (*Viscum album*, parasites of trees in Europe, and *Phoradendron serotinum*, of those in the eastern U.S.) are dispersed by birds. Indeed, "mistletoe" literally means "turd-on-a-twig". This refers to the fact that offspring of these parasitic plants start to grow on a new tree host after being eaten and deposited, with their own kick-start fertilizer, by a bird.

But the dwarf mistletoe takes spreading its seed into its own hands. Through a painstaking microscopic analysis of the seed's embryonic development, Dr. Ross determined that the growing fruit stores water in a gelatinous substance secreted by helical, or spring-shaped, cells. The water pressure builds until, combined with the spring-like nature of the cells, the fruit explodes.

In Manitoba this mass birthing event occurs during a two-day period around Labour Day. (Really).

"It's an event that takes place very quickly, " says Dr. Ross of the ejection of the rice-grain-sized seeds. "I've been hit by them."

But as if this discovery weren't enough to warrant the dwarf mistletoe a place of honour by the front door, Dr. Ross says her probing has revealed another floral first that's "really going to shake things up" in the world of plant reproduction science.

The male portion of the dwarf mistletoe sends out its pollen tube prematurely (or pre-emptively, depending on your interpretation).

"In all previously described flowering plants, the formation of the egg and its accessory cells is thought to trigger a chemical signal that causes the pollen tube to find the egg and fertilize it. But with my dwarf mistletoe, the pollen tube, which contains the plant's sperm, grows down through the young flower and reaches the area where the egg is going to be long before the egg develops. And that contradicts all of the previous literature," explains Dr. Ross.

Understanding the bedroom details of the dwarf mistletoe's life feeds more than just verdant curiosity. Dwarf mistletoes (species of the genus *Arceuthobium*) are the most destructive pathogens of standing timber in North America. These parasites suck water, minerals and sugars from their tree hosts stunting their growth and in some cases killing the trees. These include economically important trees, such as lodgepole pine in British Columbia and jack pine in central and eastern Canada.

"We could potentially target the unusual characteristics of dwarf mistletoe reproduction in disease control, either at the pollination or seed dispersal stages," says Dr. Ross. "Neighbouring plants, thanks to their more mundane sex life, would likely be safe from whatever we use to kill the pathogen."

Mistletoe's association with sacred winter celebrations, fertility, and kissing is an ancient one, extending back into pre-Christian Europe. The European mistletoe parasitizes apple and oak trees and thus in winter stands-out in brilliant green against its leafless hosts. This evergreen nature, and the fact that the plant seems to emerge seedless from bird dung, prompted ancient peoples' regard for it as a symbol of fertility, endurance and strength.

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Dr. Ross' article *Development of the unfertilized embryo sac and pollen tubes in the dwarf mistletoe* *Arceuthobium americanum* is available for free download at http://pubs.nrc-enrc.gc.ca/cgi-bin/rp/rp2_tocs_e?cjb_cjb11-04_82

N.B. re: Images: Dr. Ross can supply high-resolution (300 dpi) digital images of dwarf mistletoe.