Who exactly are you? How multiple ploidy levels within the same species can mislead invasion science & management.

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What is ploidy & what does it have to do with invasion?

Unlike what many of us remember from college, the same species can have different numbers of chromosomes (ploidy level).

If we think we know a species, a different ploidy form – a different cytotype – could mislead us:

A) Polyplody is classically associated with different invasion traits – clonal reproduction, apomixis, size, genetic diversity & drought tolerance, etc. Thus, the “same species” could differ in traits that really matter to us.

B) It’s a different entry into the ‘lottery’ of having the right adaptations & introductions to new territory.

What’s the problem?

- Risk assessments are done by species, so they assume the same risk for all cytotypes. Invasion-related traits can be very different between cytotypes.
- Research can be corrupted when genetic tools fail, or ecological comparisons are confounded with chromosomal differences that also occur.
- Biocontrol is not equally effective across all cytotypes.

How common are cytotypes?

Cytotypes exist in many Cal-IPC listed species

Since multiple ploidy levels are common in invaders, how do I know if my species has them?

SEARCHING FOR MULTIPLE PLOIDY LEVELS:

- Search Google Scholar for “Genus” “species” “cytotype” and “Genus” “species” “ploidy”
- Search the Chromosome Counts Database CCDB that indexes multiple other data sources, including IPCN. (CCDB has some limitations – e.g. ask for tips – such as multiple copies of the same count)
- If you have a more serious interest (e.g. genetics or risk assessment): Search Web of Science / Google Scholar with the species & “polyploid” or “chromosomes”. Repeat Scholar and CCDB searches under other taxonomic names, described below.
- Do not search for the phrase “Genus species”. Often a paper might only include “Genus otherspecies” and “G. species” so you would miss it searching for the two words together.
- Search by previous taxonomic names, and names of sister species that can be difficult to distinguish in the field (including sister species in native range that were promoted from subspecies). Other researchers may have identified them as the same species.

TIPS FOR SUCCESS:

- For herbicide use / on the ground management: No major effect.
- Risk assessment: Need literature search, CCDB search. If cytotypes known, flag as additional risk of continued introductions. Some traits frequently associated with higher ploidy levels are also high-risk traits like selling.
- White list / black list: Species with multiple cytotypes must not be white-listed. Specific subsp., var., or ploidy levels acceptable. Different cytotypes are effectively different ecological species as far as risk goes. Meaningful trait variation.
- Biocontrol: Applying existing agents – No major effect; Developing agents – not equally effective across cytotypes, although could help narrow down the search range for new agents.
- Horticultural collection: Do not assume new variants found in wild have same safety / sterility / risk as existing cultivars. Chromosome count strongly advised if not inter-fertile with existing cultivars. This research not likely to apply to new cultivars from sports.
- Genetically: Check literature, CCDB. Different analyses required for ploidy variants. If a population / phenotype consistently fails PCR, has too many alleles, or odd results then count chromosomes.
- Ecological research or invasive – native range comparisons: Potential for confounding factors varies by project type – discuss particular project with me.

Recommendations

Cytotypes are much more common in invaders than we realize!

At least 150 invasive plant species have multiple ploidy levels. Usually 1 in invaded range, multiple in native range, but sometimes multiple in invasive range.

At least 1/3rd of Cal-IPC high and moderate list species have cytotypes! That is a widespread commonality considering it is widely unknown.

We’ll never know how that rate compares to non-invasives, since chromosome counts are not evenly gathered for all species. Still, we need to be careful not to make assumptions out of ignorance of ploidy variation.