Modelling infection in clonal networks

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INTEGRATION OF CLONAL PLANTS has

ADVANTAGES

- support of daughter ramets
- resource sharing
- division of labour
- information sharing

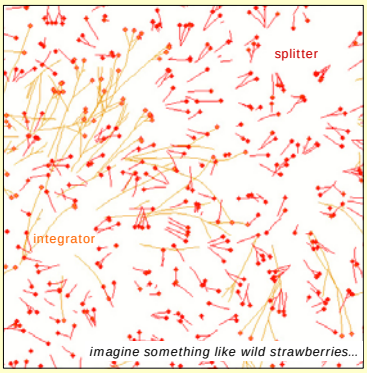
DISADVANTAGES

- spread of diseases within interconnected ramets system

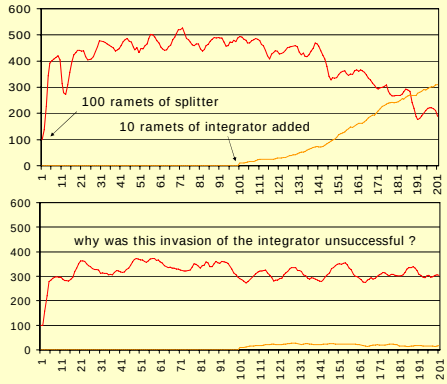
what does it entail?

QUESTIONS

1. **Under what circumstances is it advantageous to have interconnected ramet system?**
2. **Are there any (relative) advantages of infection for the splitter – e.g. in competition for resources.**
3. **Which species parameters interact with the effects of the infection?**



two random runs of the model



MODEL

We used spatially explicit model of clonal growth that models processes like growth of rhizomes, branching, rhizome fragmentation, ramet formation and growth, competition and translocation. It also incorporates infection which spreads through rhizome system instantly and negatively affects ramet performance.

The boundaries are toroidal to avoid edge effect.

http://www.natur.cuni.cz/~herben/rhizome/rhizome.html

SETTING

SPECIES

- **splitter** – connection dies off when 5 nodes are formed
- **integrator** – connection dies off after 10, 20 or 30 more nodes are formed, otherwise identical to splitter; integrator 5 nodes long was used as control

COURSE OF SIMULATION

- **beginning –** start with 100 ramets of the splitter
- **after 100 steps** – 10 ramets of the integrator added
- **after 200 steps** – simulation stopped, numbers of ramets and infected ramets of both species were counted
- **15 runs** were made for each parameter combination, data shown are means

PARAMETERS

INFECTION RATE – proportion of ramets infected at each step, spatially independent, zero means no infection (0 to 0.1)

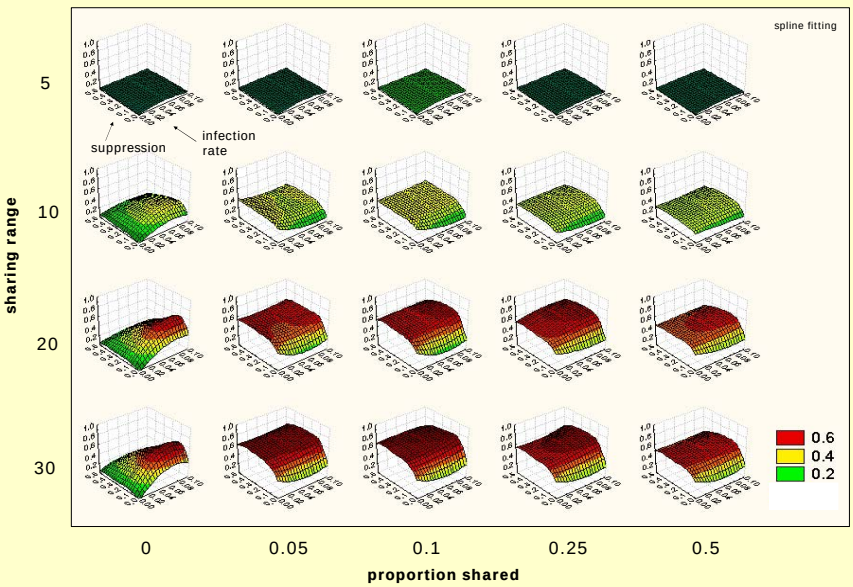
SUPPRESSION – proportion of resources retained by the ramet under pressure of the infection, zero means the ramet is killed instantly (0 to 0.5)

PROPORTION SHARED – maximum proportion of resources that can be translocated from one ramet through rhizomes (0 to 0.5)

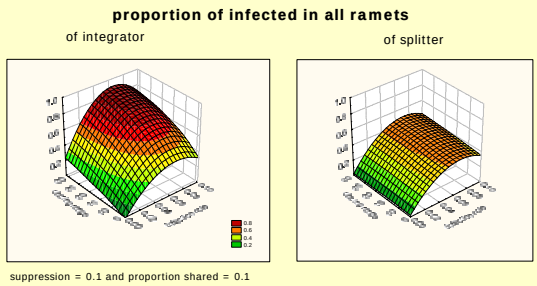
SHARING RANGE – length of integrator (5, 10, 20 and 30)

other parameters like ENVIRONMENT PRODUCTIVITY and SPEED OF INFECTION SPREAD are not plotted within this poster, the first is quite important – the bigger productivity the more pronounced differences, the latter seems to be quite unimportant

proportion of integrator ramets in all ramets



proportion of infected in all ramets



suppression = 0.1 and proportion shared = 0.1

RESULTS

- SHARING RANGE is the strongest factor - the longer integrator, the better; system with 20 nodes shows results similar to the one with 30
- already small sharing (PROPORTION SHARED ~ 0.05) gives great advantage to integrator, but too much sharing can be even a little disadvantage
- even with no sharing at all, the integrator is relatively successful – this is due to sleeping buds that can produce new ramets at the basipetal end of the rhizome
- the effect of the infection is twofold, there is the direct effect on all ramets but there is also the indirect effect on species competition