The occurrence and diversity of mycorrhizal fungi found in blueberry

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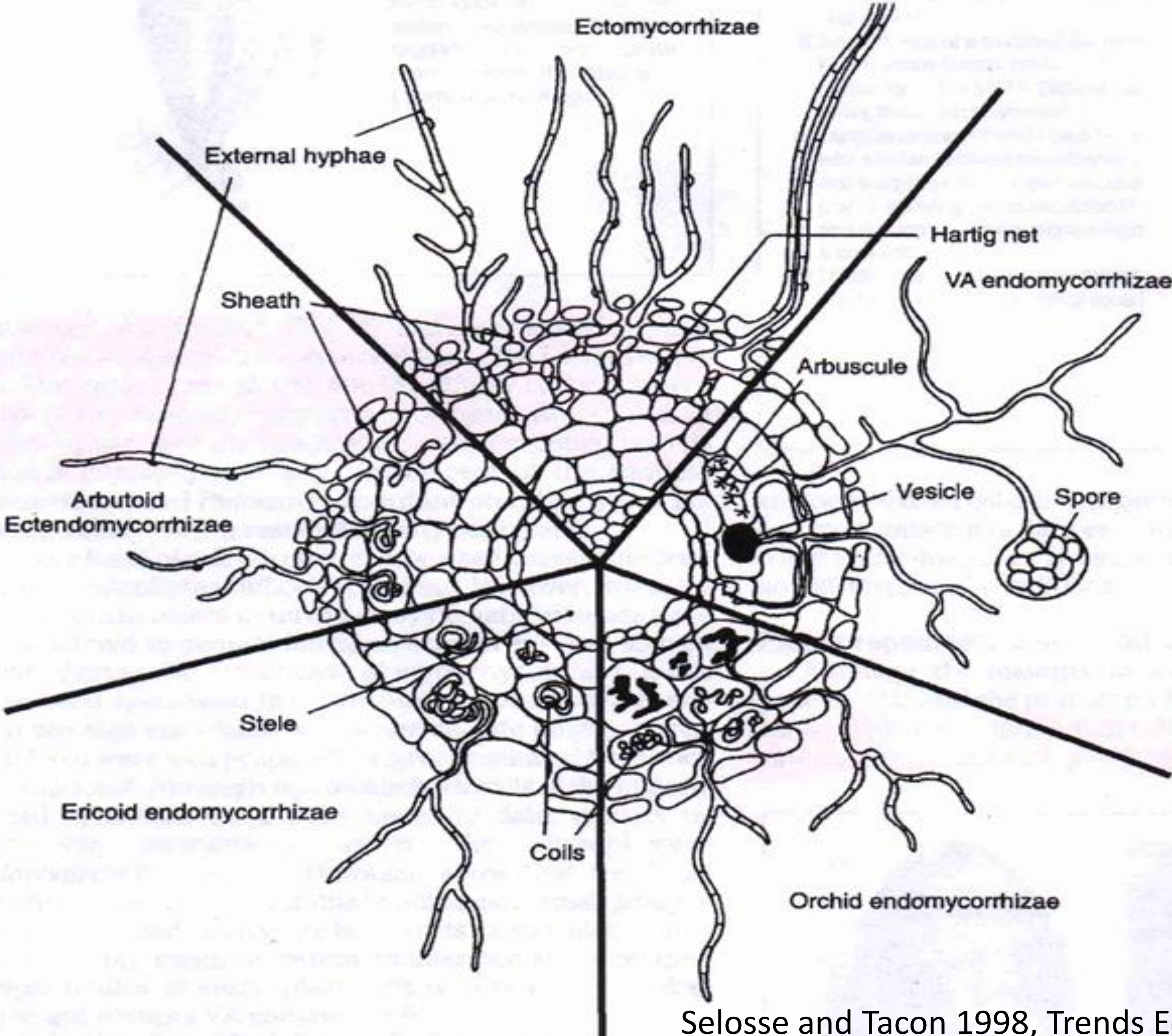
Blueberry root system

- Shallow rooting system mainly concentrated near the soil surface
    - Roots that are larger than 1mm in diameter act as anchors and transport water and nutrients
        - The next roots are dark brown and long lived ranging from 150 µm to 1mm and these mainly transport water and nutrients
            - The finest roots are 40 to 75 µm and are white or light brown and they take up water and nutrients from the soil and are short lived



Selosse and Tacon 1998, Trends Ecol. Evol.

ERICOID MYCORRHIZAE

- Plants are Ericaceae
- Form loose network on surface and hyphal coils inside epidermal cells of hair roots where nutrient exchange is thought to take place
- Shown to supply N and P to plant
- The outer cell layer of the cortex is targeted with coiled hyphal structures formed

Method

- Roots were collected from field and pot grown plants of different planting dates and varieties
- Fine roots were extracted in water and separated under a dissection microscope
- Representative portions were mounted and examined under a range of magnifications under a compound microscope
- Five different fields of view were selected and 30 cells were assessed for colonisation
- Percentage colonisation was then calculated

- 25 plants were examined representing 3 varieties

1. Darrow 2005, 2007, 2008
2. Chandler 2005
3. Ozarkblue 2008

- Newly emerged seedlings, potted plants and wild blaeberries


Figure 1a. Main lateral and hair roots


Figure 1b. Abundant hair roots


Figure 2. Ericoid hair root

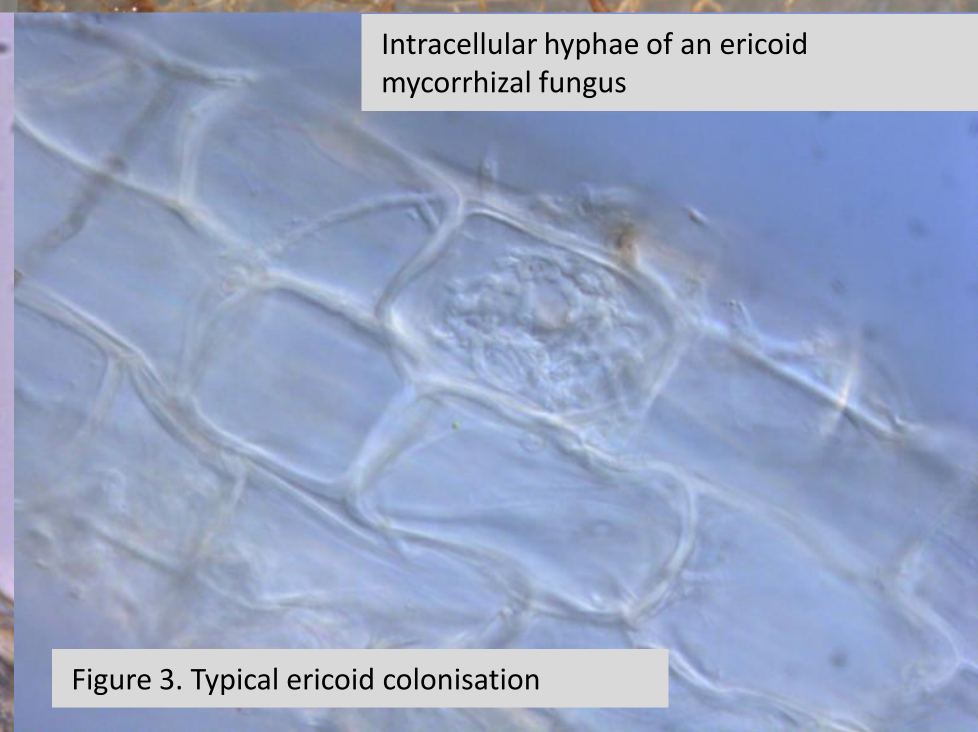


Figure 3. Typical ericoid colonisation

Figure 4. Multiple colonisation of cortical cells

Figure 5. Heavily colonised root

Figure 6. Abundant starch grains

Figure 7. Defence response with thickened cell walls

Figure 8. Heavily thickened intra-cellular hyphae

Dark septate endophyte

Variety details	% colonisation (range)	Comments
Darrow 2005	56 (24-87)	Extensive colonisation, some areas very clean. Thickened plant cells walls, defence response, serious secondary wall thickening in older parts, no colonisation in these areas
Darrow 2007	9.3	Only one sample contained hair roots
Darrow 2008	36 (2-66)	Roots good, extensive colonisation. Full of starch grains, little evidence of ericoid fungi in some samples, several microsclerotia, colonised by dark septate
Chandler 2005	67 (42-80)	patchily colonised but sometimes heavily so
Ozark Blue 2008	32 (14-58)	Overall poor root system – hasn't grown beyond the pot growth medium. All sorts of root invaders, hyphae and animals

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Variety	Year	sample no.	cells counted	colonised	% colonised
Darrow	2005	2	30	28	93.33
Darrow	2005	2	30	24	80.00
Darrow	2005	2	30	25	83.33
Darrow	2005	2	30	26	86.67
Darrow	2005	2	30	28	93.33
					87.33

Variety	Year	sample no.	cells counted	colonised	% colonised
Chandler	2005	2	30	20	66.67
Chandler	2005	2	30	22	73.33
Chandler	2005	2	30	29	96.67
Chandler	2005	2	30	26	86.67
Chandler	2005	2	30	23	76.67
					80.00

Variety	Year	sample no.	cells counted	colonised	% colonised
Darrow	2005	5	30	0	0.00
Darrow	2005	5	30	3	10.00
Darrow	2005	5	30	16	53.33
Darrow	2005	5	30	0	0.00
Darrow	2005	5	30	18	60.00
					24.67

Variety	Year	sample no.	cells counted	colonised	% colonised
Chandler	2005	3	30	20	66.67
Chandler	2005	3	30	16	53.33
Chandler	2005	3	30	10	33.33
Chandler	2005	3	30	12	40.00
Chandler	2005	3	30	5	16.67
					42.00

Results

- There was great variability in levels of colonisation among the samples and especially among the different varieties and between plants from different planting years of the Darrow variety.
- The root development also varied considerably, with the roots on the Ozark Blue plants being very poorly developed.
- Chandler and Darrow, both from 2005, showed the highest levels of colonisation with up to around 80% of the length of some roots being colonised.

- Overall, the presence and colonisation of blueberry roots by ericoid mycorrhizal fungi was very patchy.
- The high degree of variation between plants even within the same planting year would strongly suggest that the spatial availability of inoculum is a major factor in determining the level of colonisation of blueberry plants.

Additional results

- 95 plated roots- No useable isolates
- Chandler pots : Lot of colonisation – 35-40% of the cells are colonised
- Lingonberry overall 70-80% colonised, in some places 95-100% of cells occupied. Some of the hyphae are of much larger diameter than ‘usual’ ericoid fungi.
- Blueberry seedlings: Lot of colonisation – 55-60% of the cells are colonised
- Blaeberry: no useable roots obtained

Future work

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1. What is the relationship between level of colonisation and productivity?

2. What is the relationship between level of colonisation and plant nutrient status?

Thanks to…

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