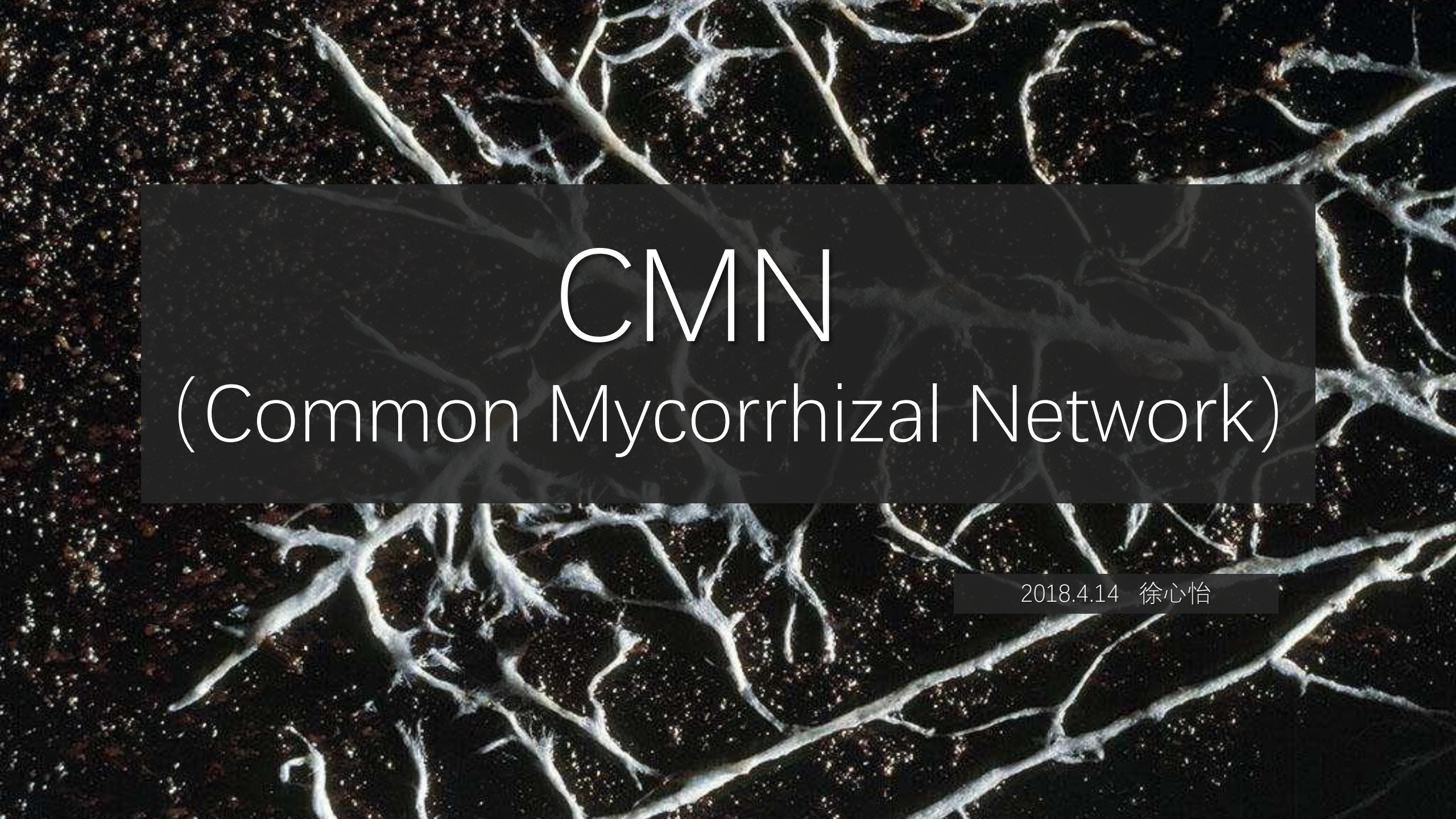


A detailed microscopic image showing a complex, branching network of mycorrhizal hyphae. The hyphae are light-colored, appearing white or pale yellow, and are set against a dark, granular background that represents soil or organic matter. The network is dense and interconnected, with many fine, hair-like structures branching out from thicker stems.

CMN

(Common Mycorrhizal Network)

2018.4.14 徐心怡

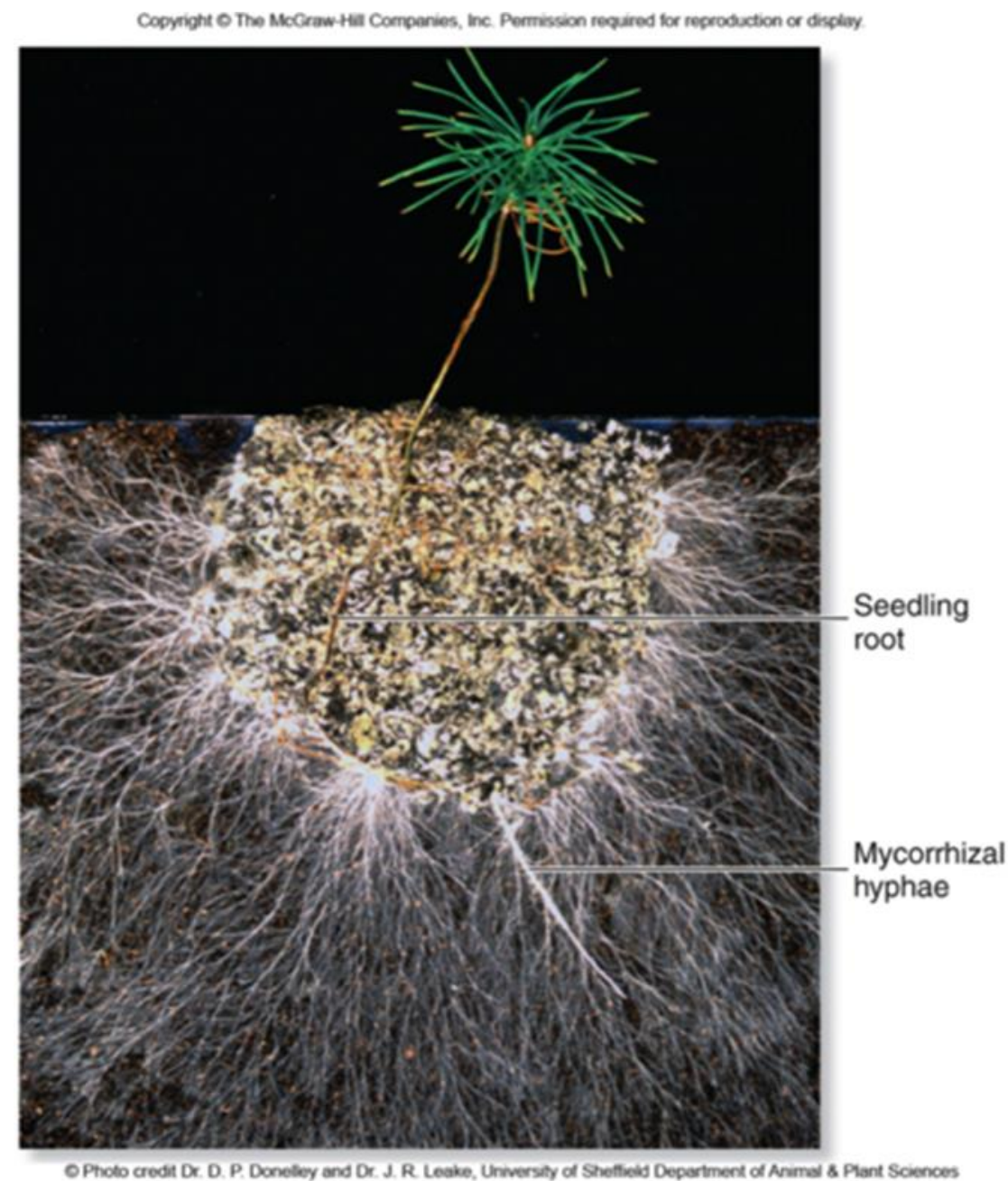
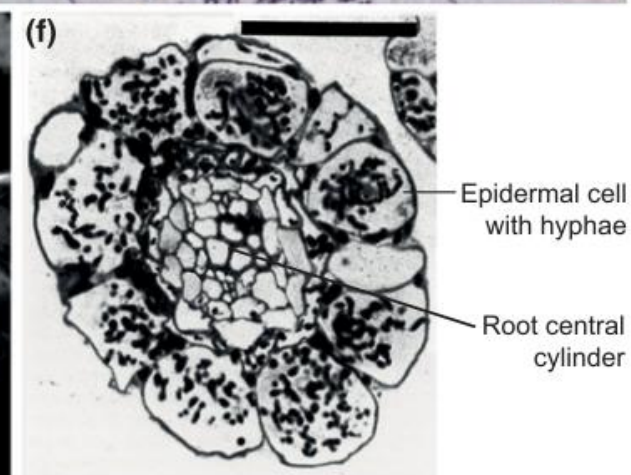
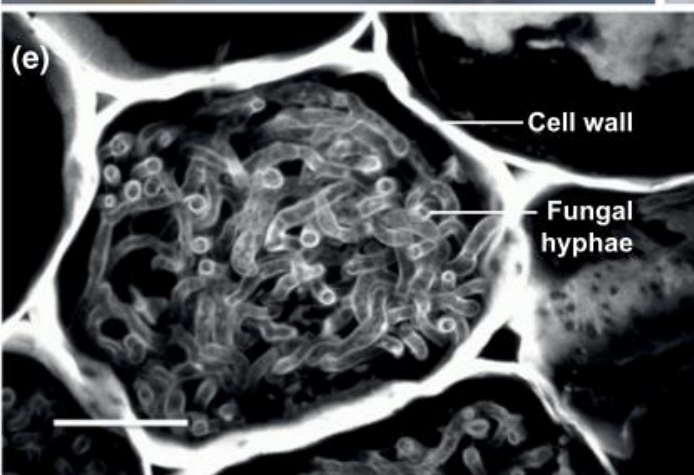
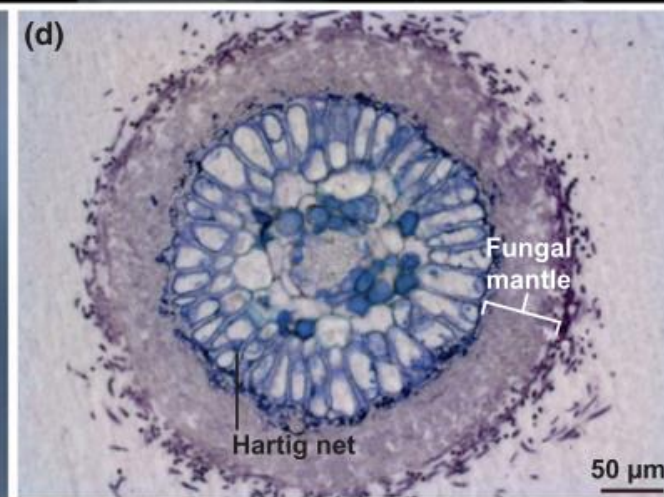
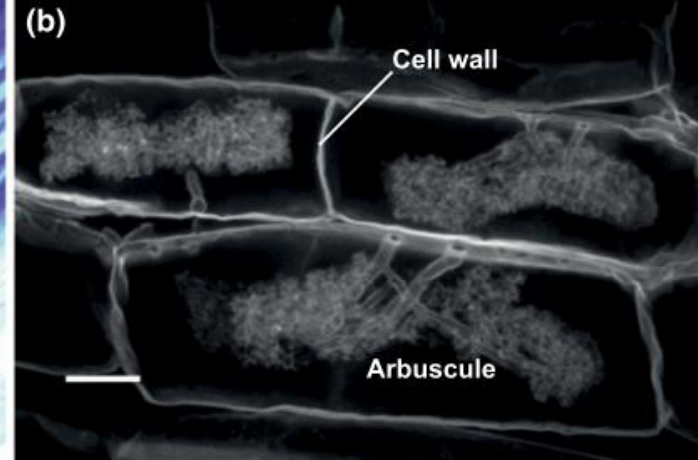
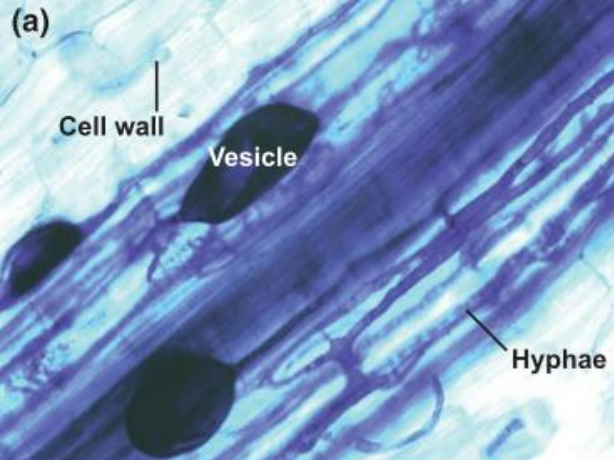
目录

- 菌根简介
 - 菌根分类
 - 共生关系
- 菌根网络
 - 网络结构
 - 网络社会关系
 - 2-个体关系
 - 营养物质转移
 - 微生物异养植物的3-个体关系
 - 防御信号传递
 - 化感物质传递
 - 亲属识别

About mycorrhiza

- 1885, Frank
- 1970-1990
- 2005-2015

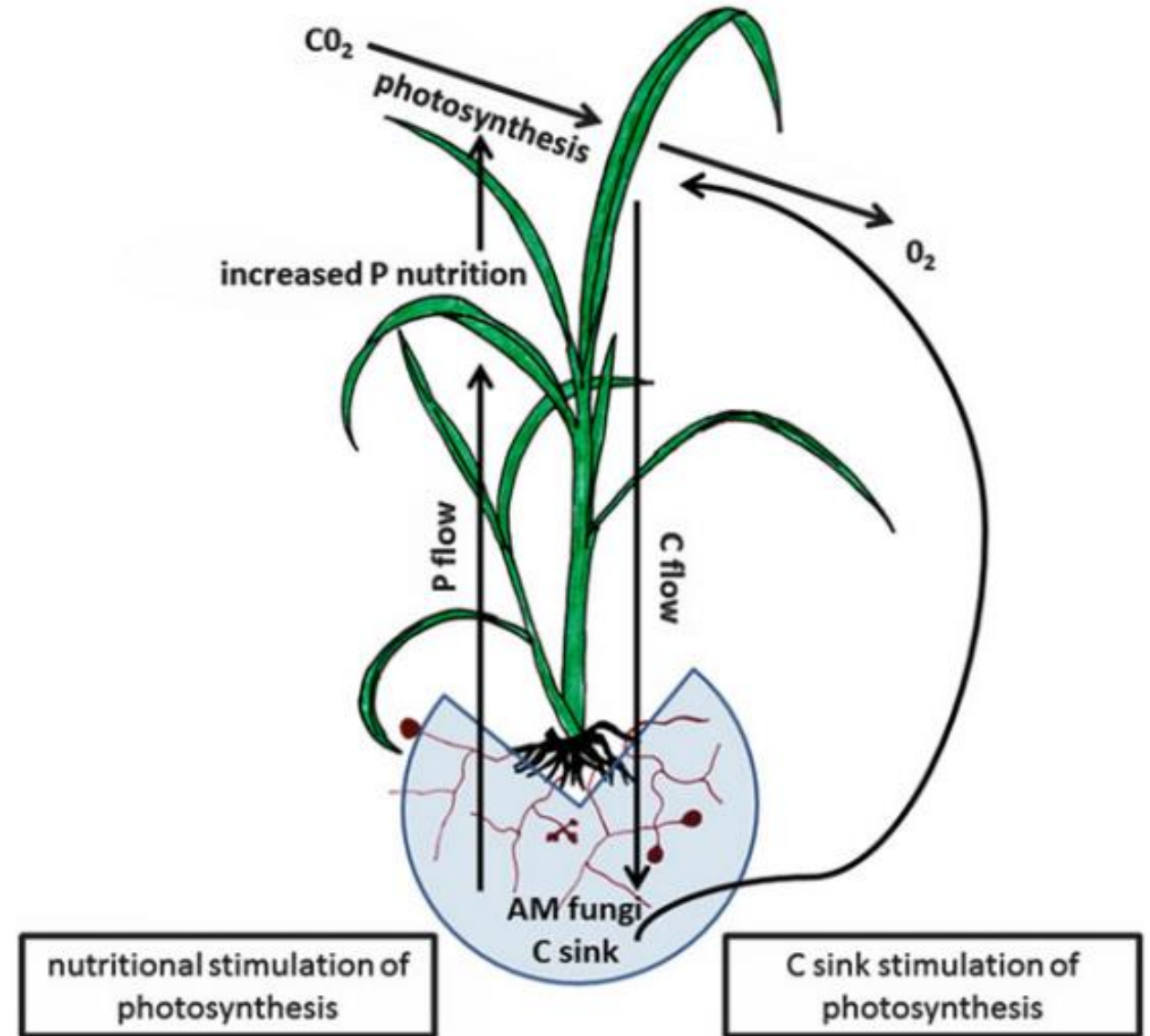
- Arbuscular mycorrhizal fungi ——(AMF)——丛枝菌根 (74%)
- Ectomycorrhiza ——(EMF) ——外生菌根 (2%)
- Orchid mycorrhiza ——兰科菌根
- Ericoid mycorrhiza ——杜鹃花科菌根



© Photo credit Dr. D. P. Donnelly and Dr. J. R. Leake, University of Sheffield Department of Animal & Plant Sciences

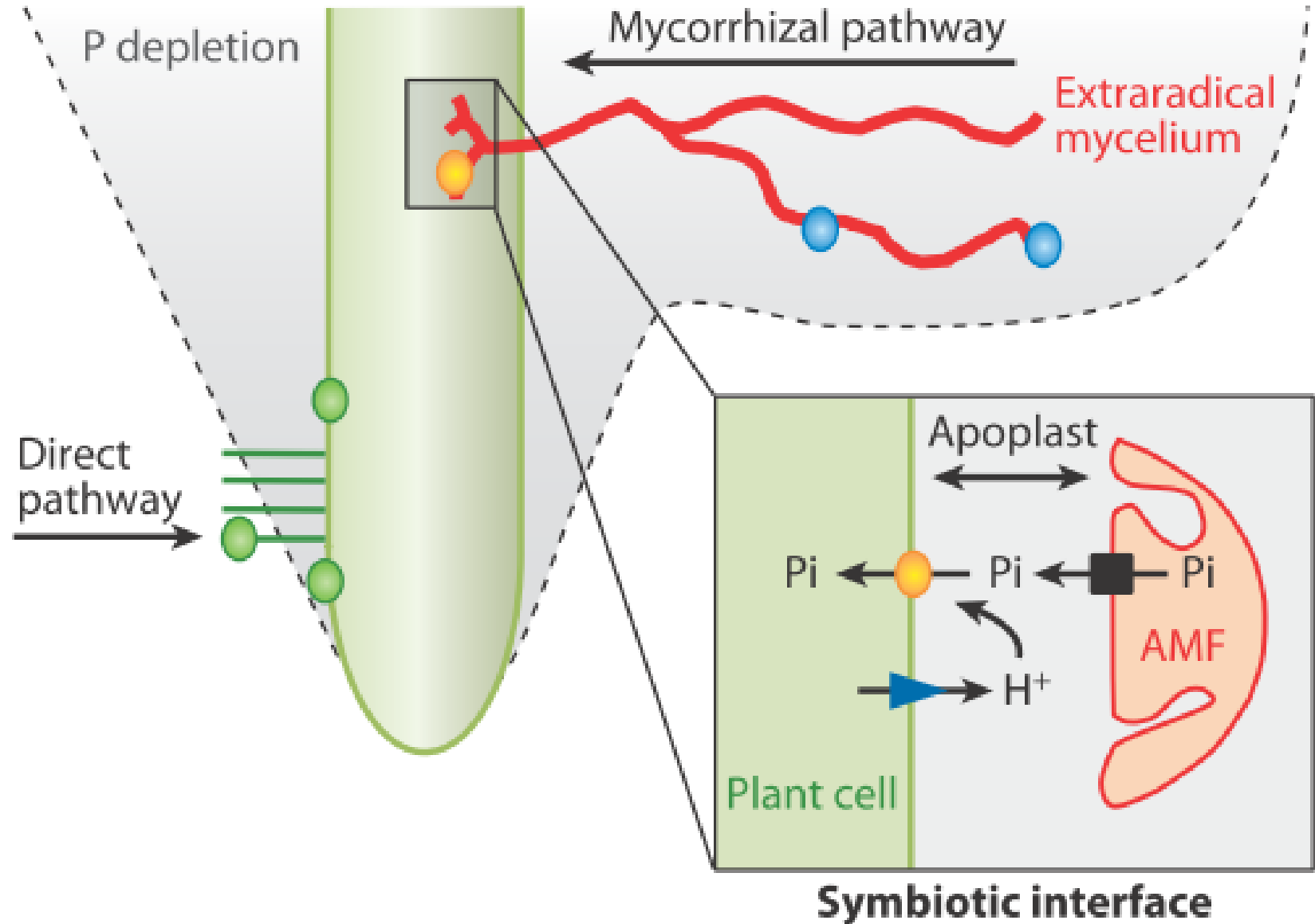
The symbiosis

- 植物提供
 - 5%-20%的光合产物 (C)
- 菌根提供
 - P
 - N
 - 微量元素



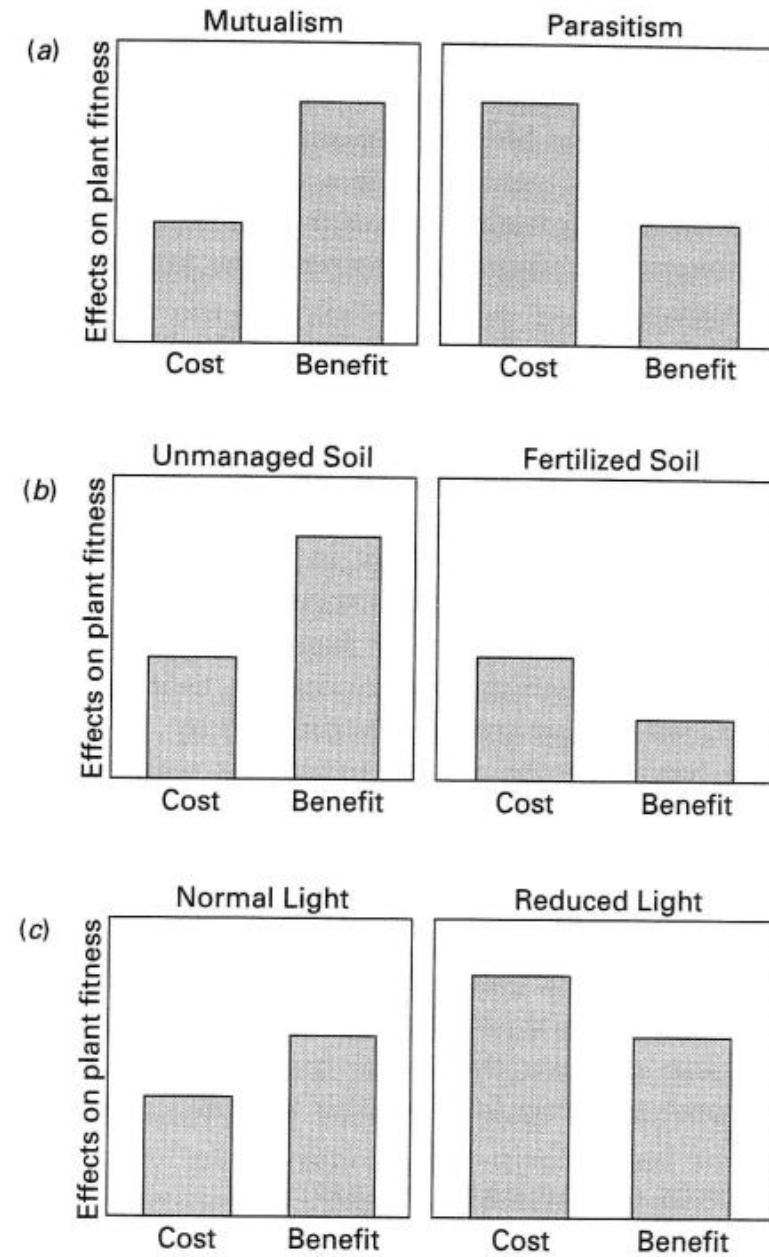
KEY

- High-affinity Pi transporters
- AM fungal High-affinity Pi transporters
- Colonized cortical cell Pi transporters
- ▶ H^+ -ATPase
- Unknown mechanism



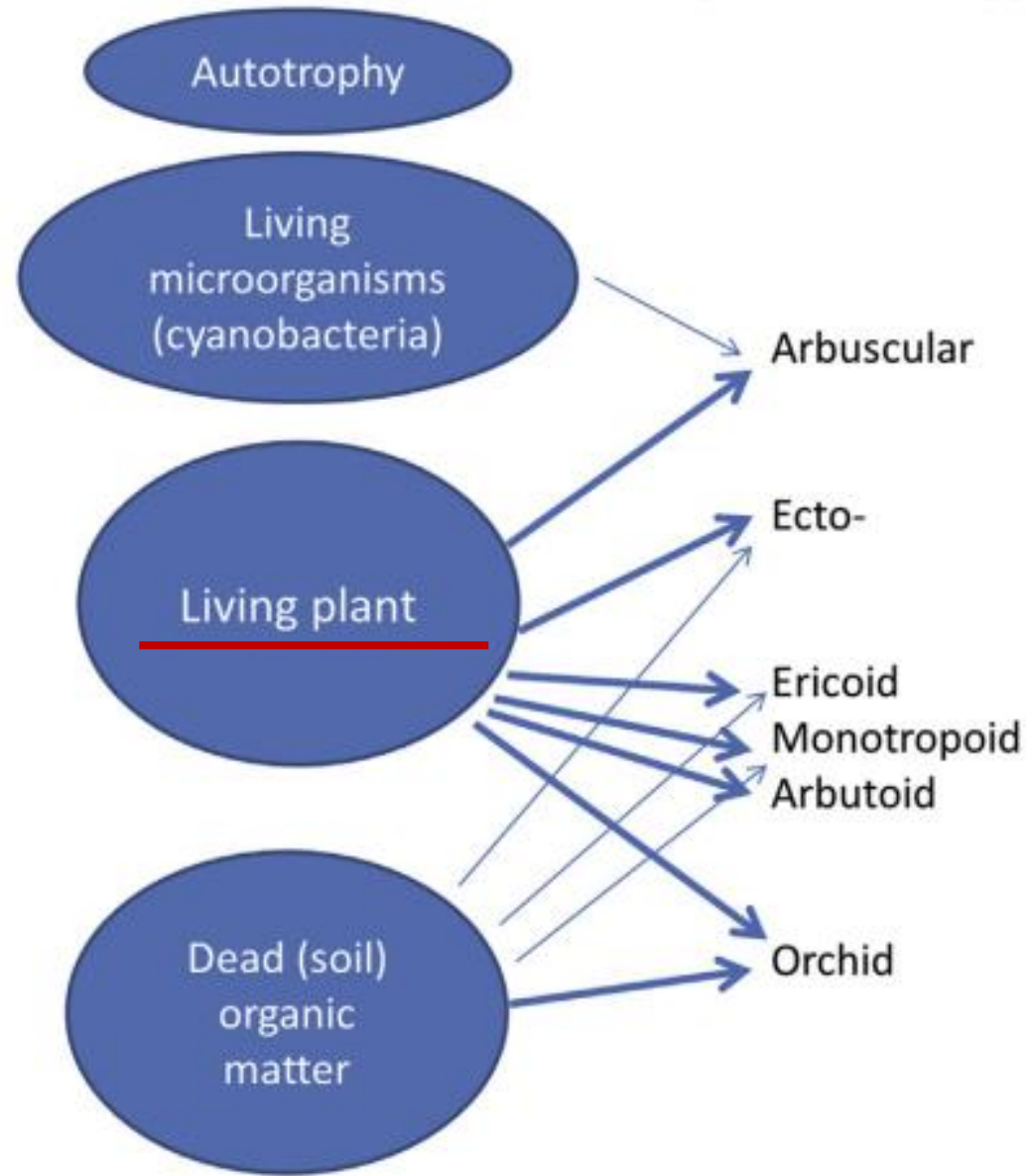
Gradient of fungal responses	-			Competition (-, -)
	0		Neutralism (0, 0)	Amensalism (-, 0)
	+	Mutualism (+, +)	Commensalism (0, +)	Parasitism (-, +)
		+	0	-
Gradient of plant responses to mycorrhizal associations				

- JOHNSON etc, 1997



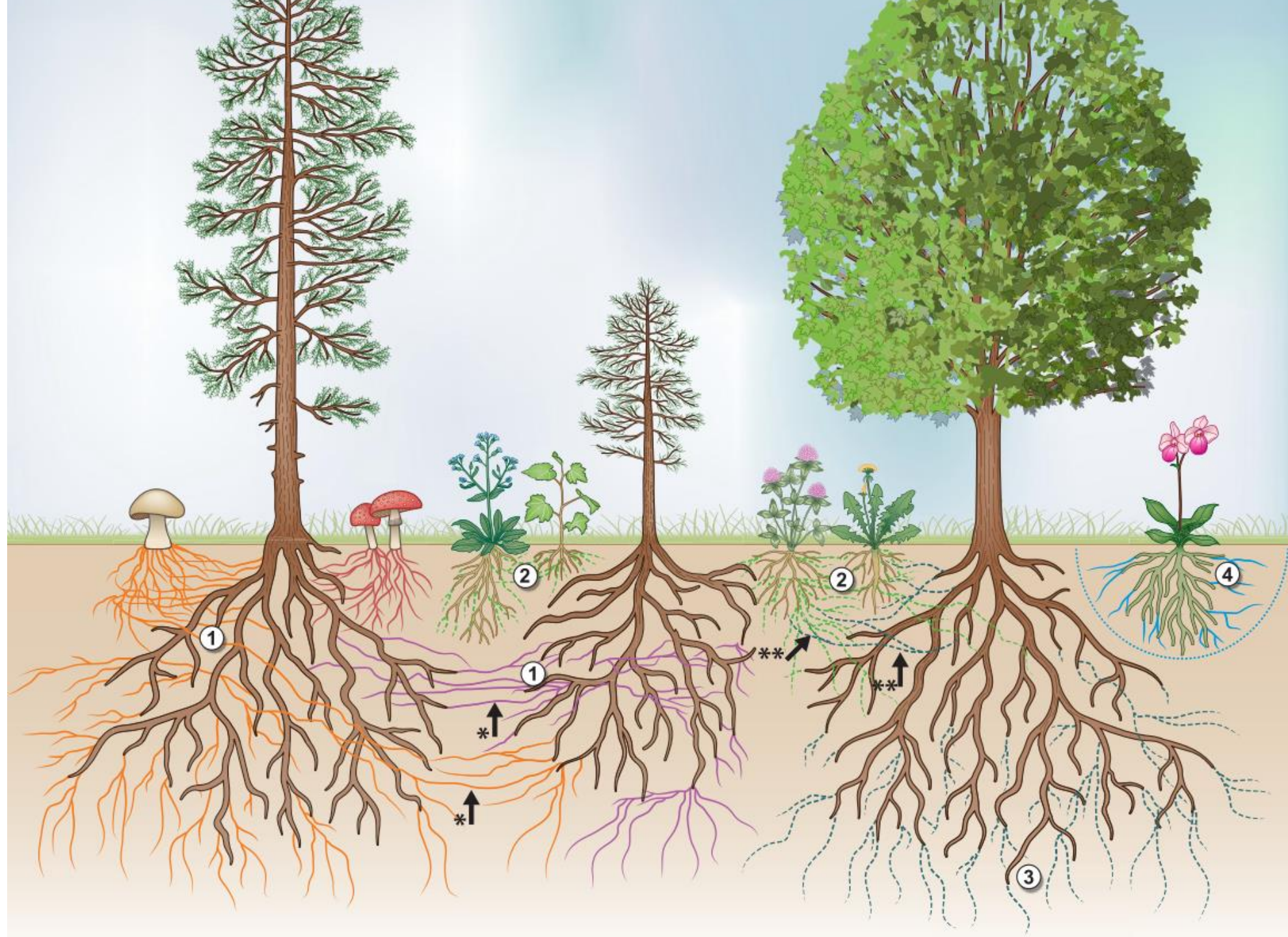
C sources

Mycorrhizal type

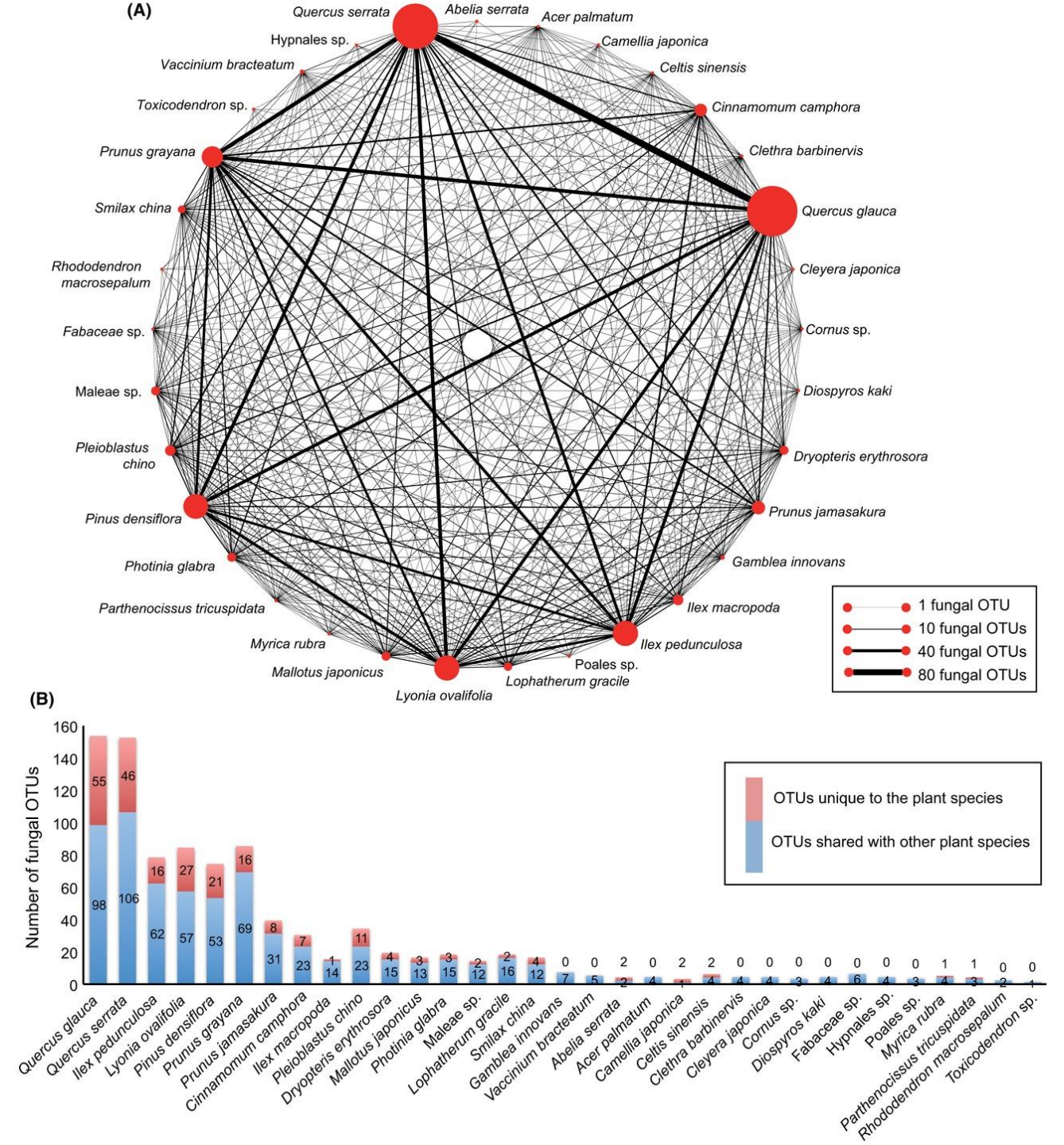


CMN: the “wood-wide-webs”

- World Wide Web
- 与早期互联网的结构十分相似
- 首先将信息传递给附近的局域站点，然后再传播得更远



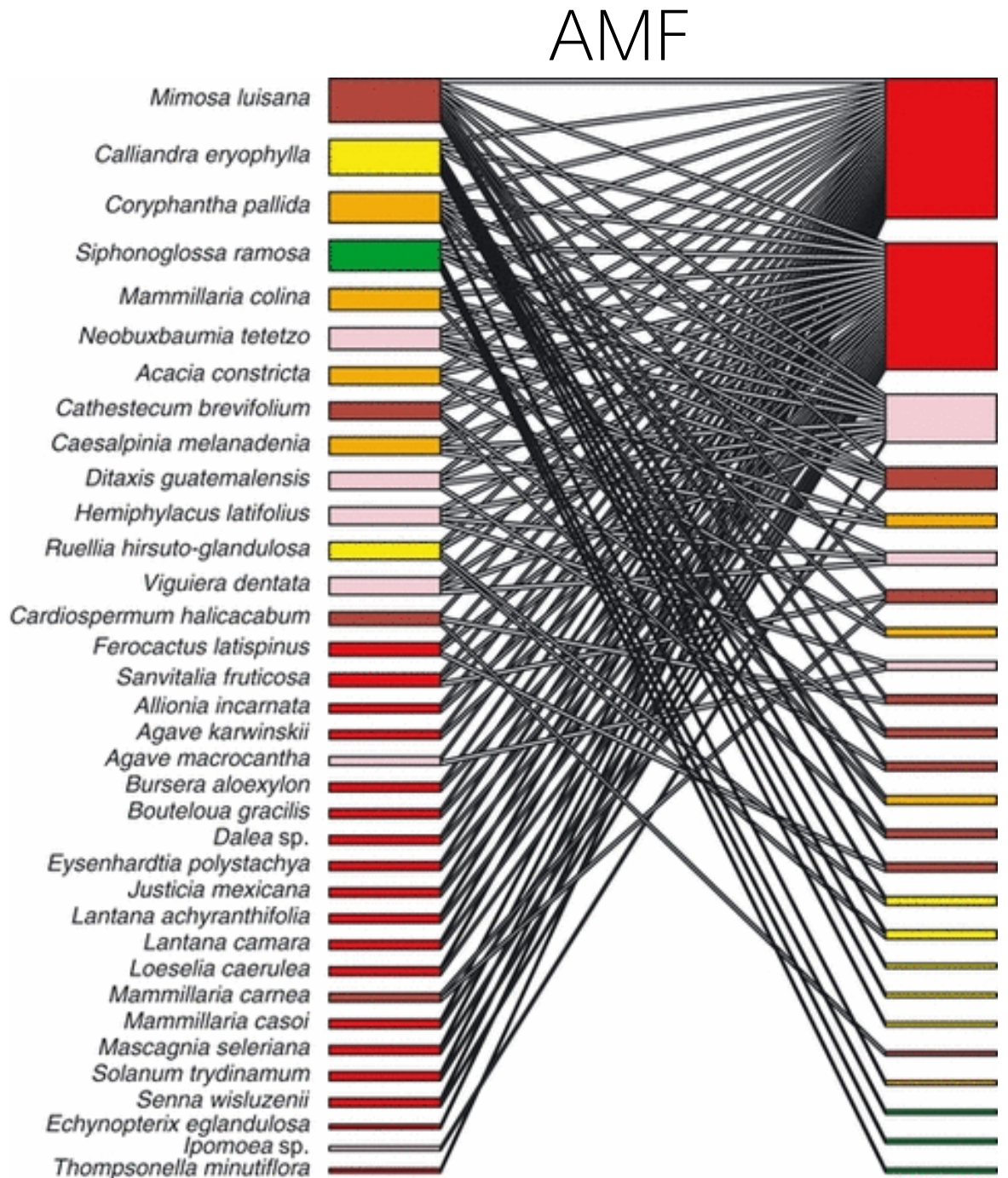
Network structure



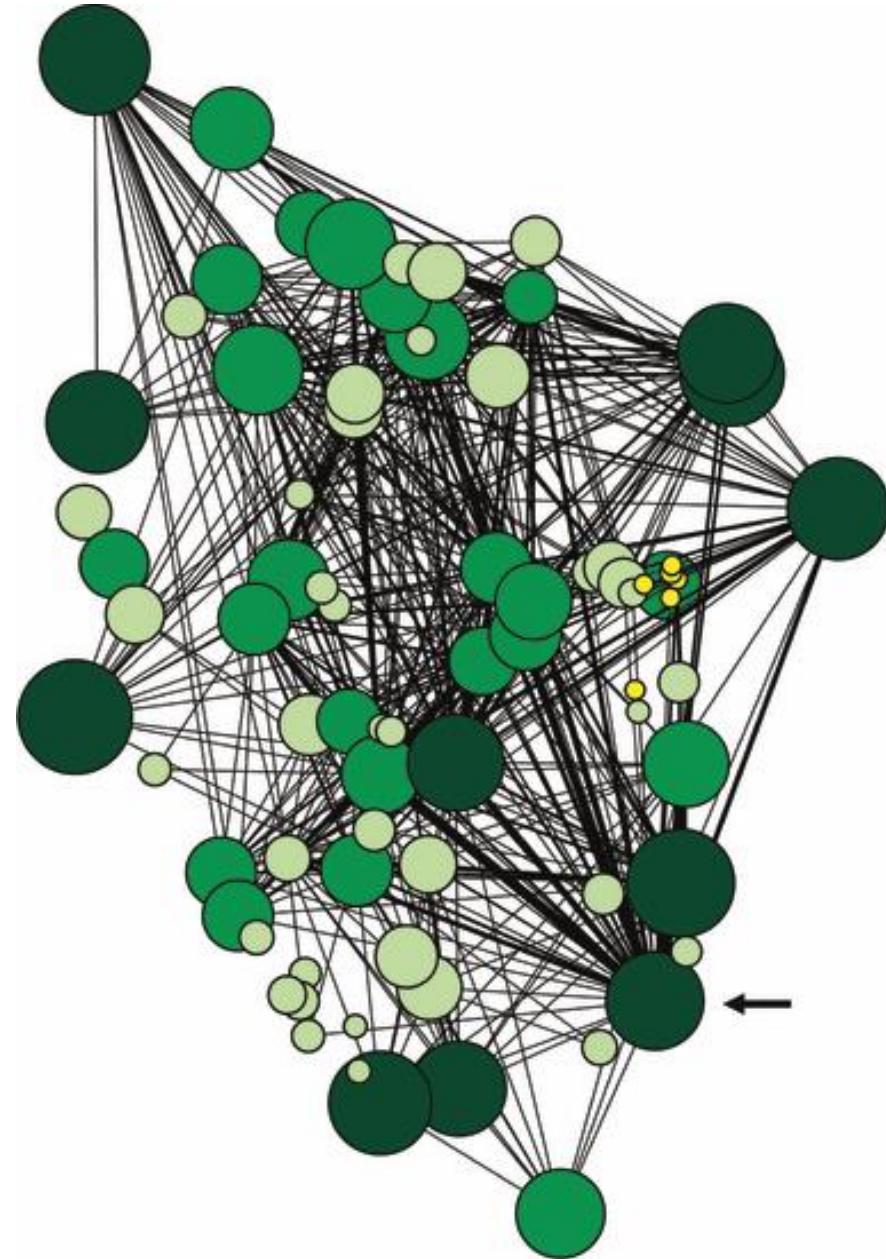
- Toju, Hirokazu etc, 2013

Network structure

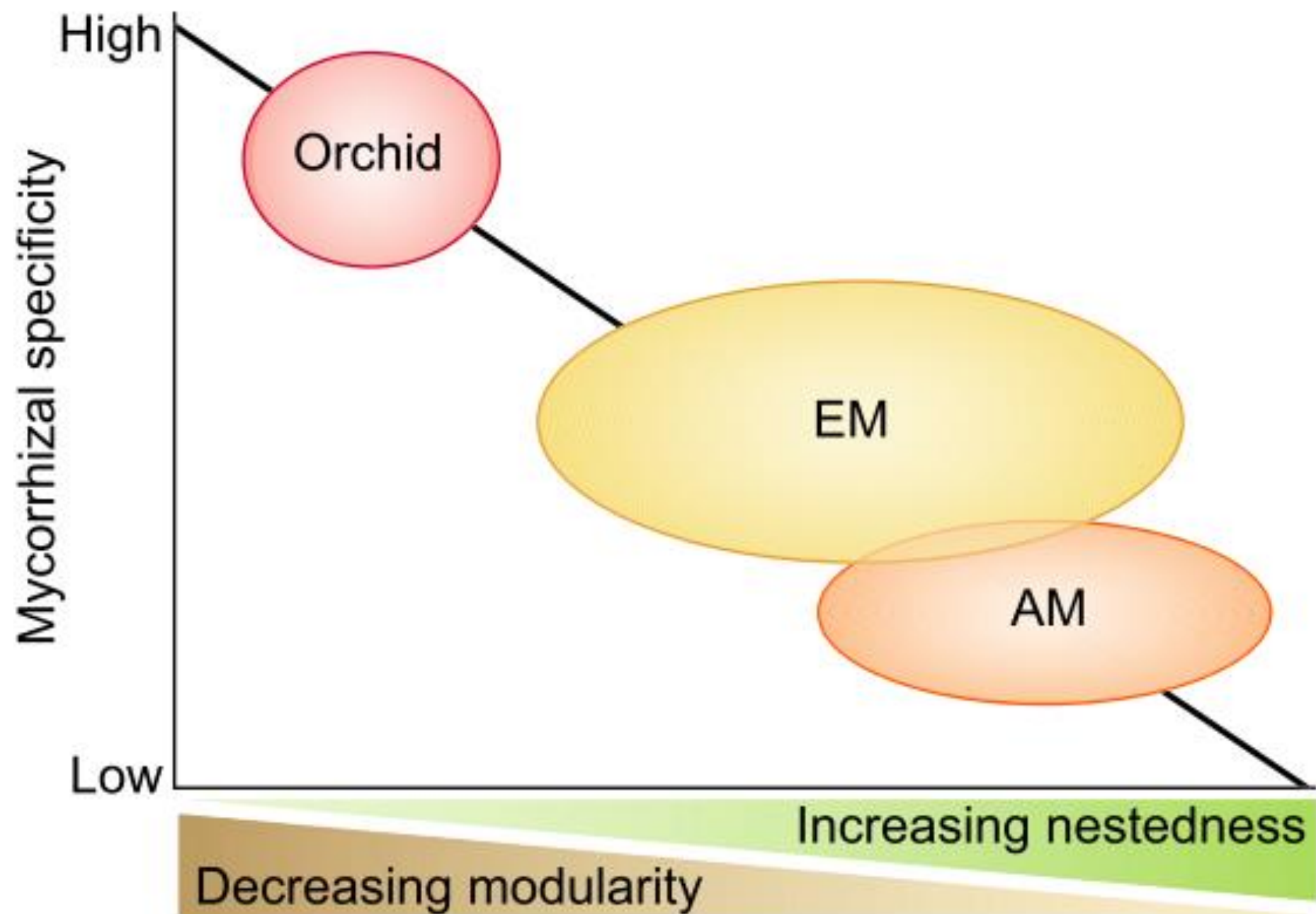
- AMF networks: nested
 - Generalists associate with almost all plants present in a particular ecosystem, while other fungi are more specific and interact with a subset of the plant species that interact with the widespread generalists
 - Orchid networks: modular
 - subsets of species that interact more with a group of partners than with other groups
 - EMF networks: intermediate
- A. Montesinos-Navarro etc, 2012



Network structure

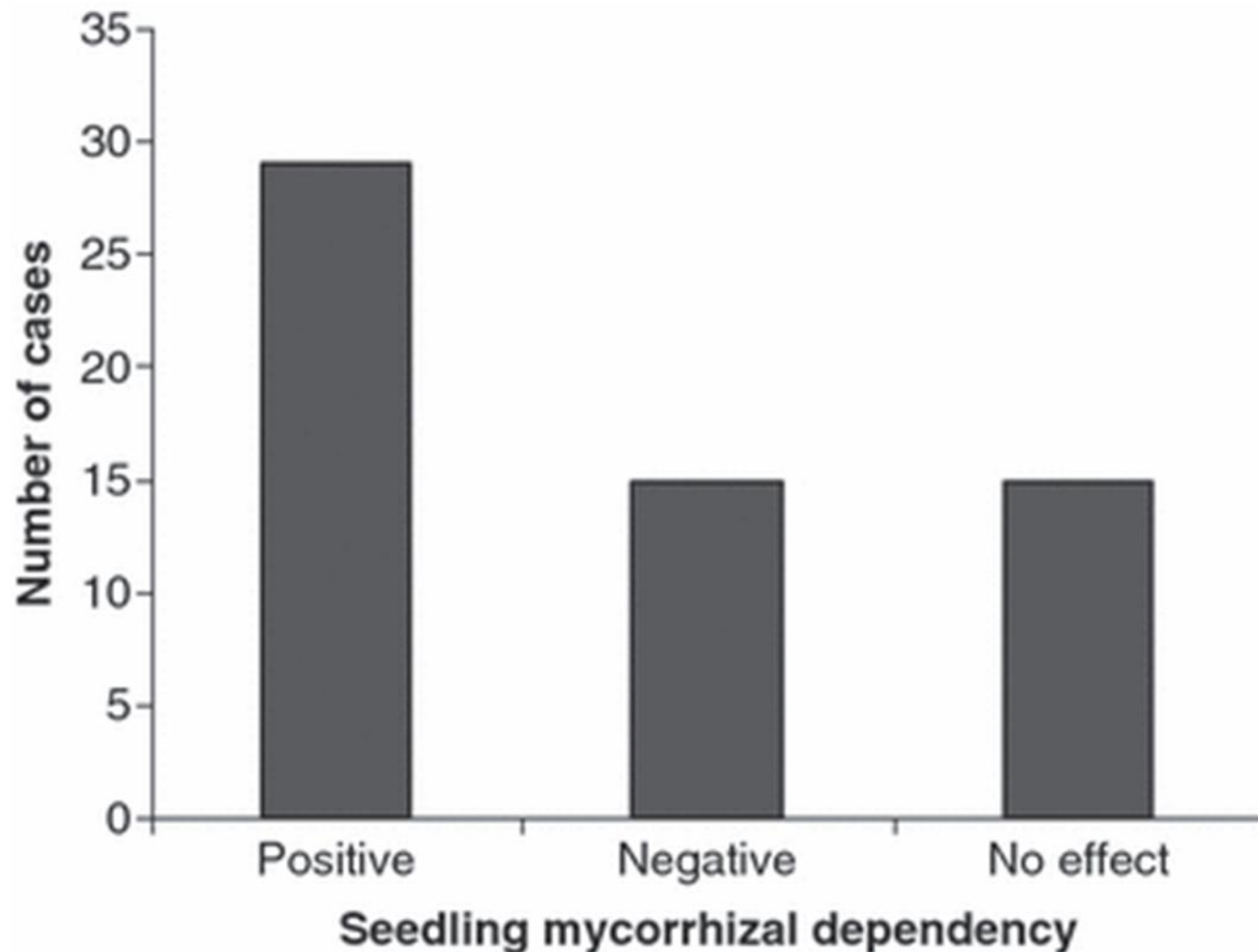


- Kevin J. Beiler Daniel M. Durall 2009



网络社会关系

- 社会主义？
 - 个体平等——促进幼苗的定殖
- 资本主义？
 - 幼苗并不一定得到最大利益，少数植物占领大多数资源



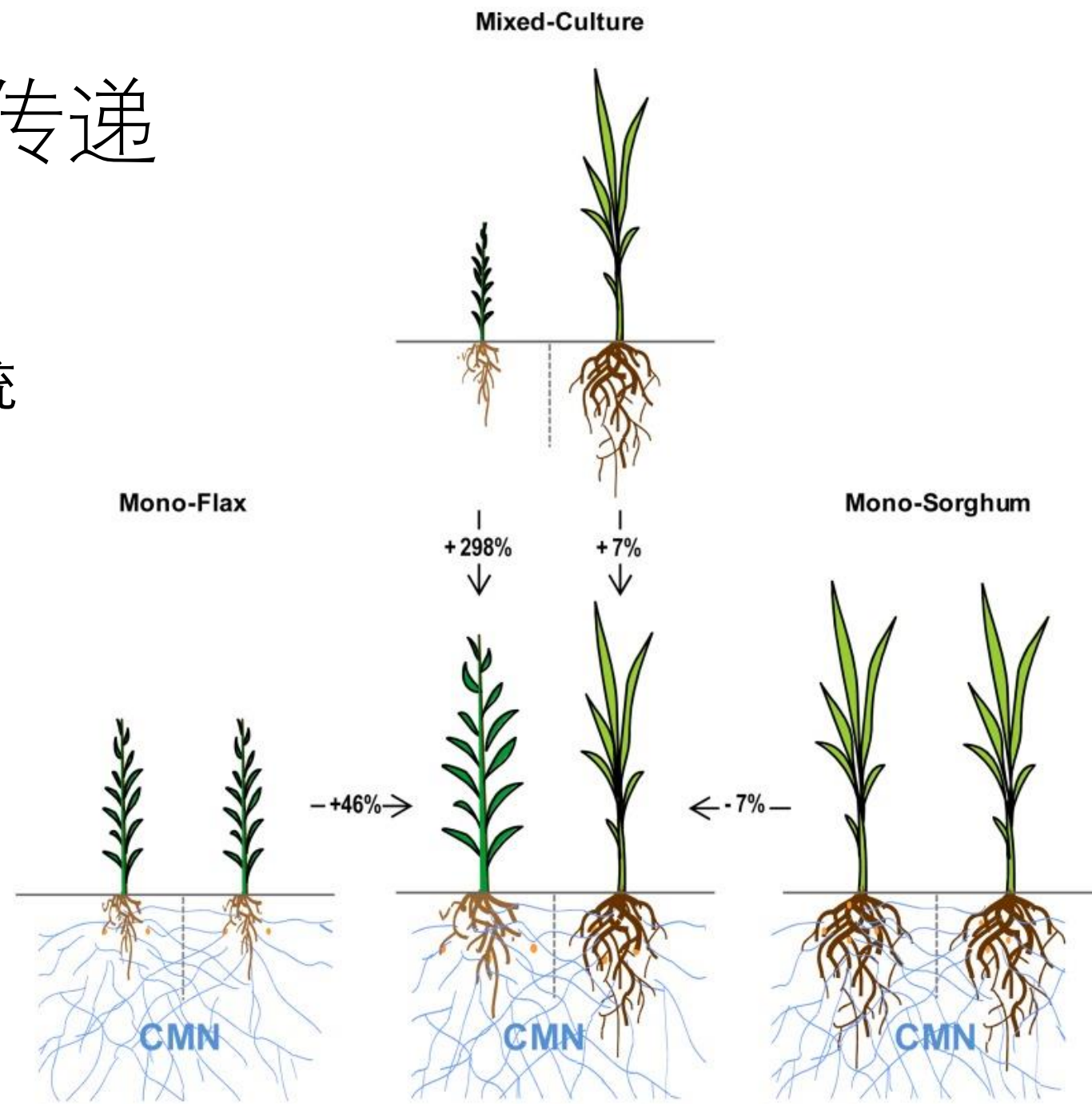
Van Der Heijden etc, 2009

菌根网络的功能

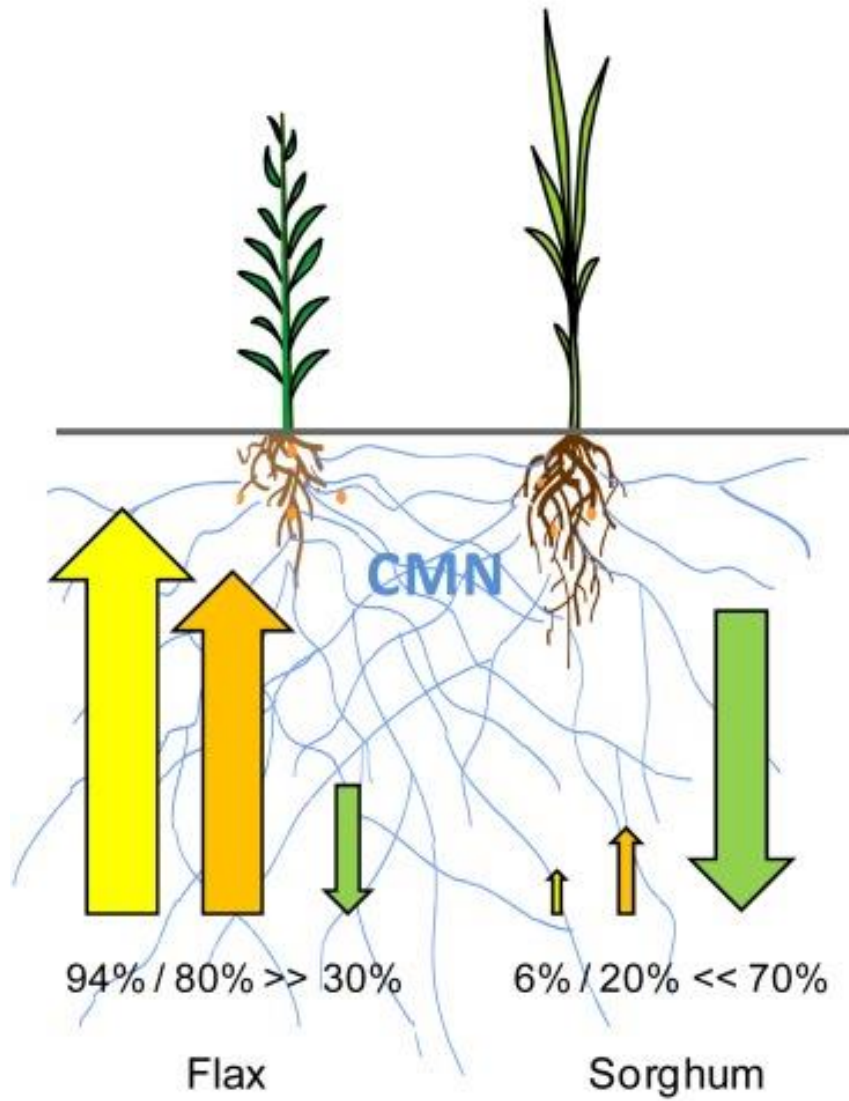
- 传递与再分配
 - 水, N, P
 - C (光合产物)
 - 信号 (防御物质)
 - 化感物质

营养物质的传递

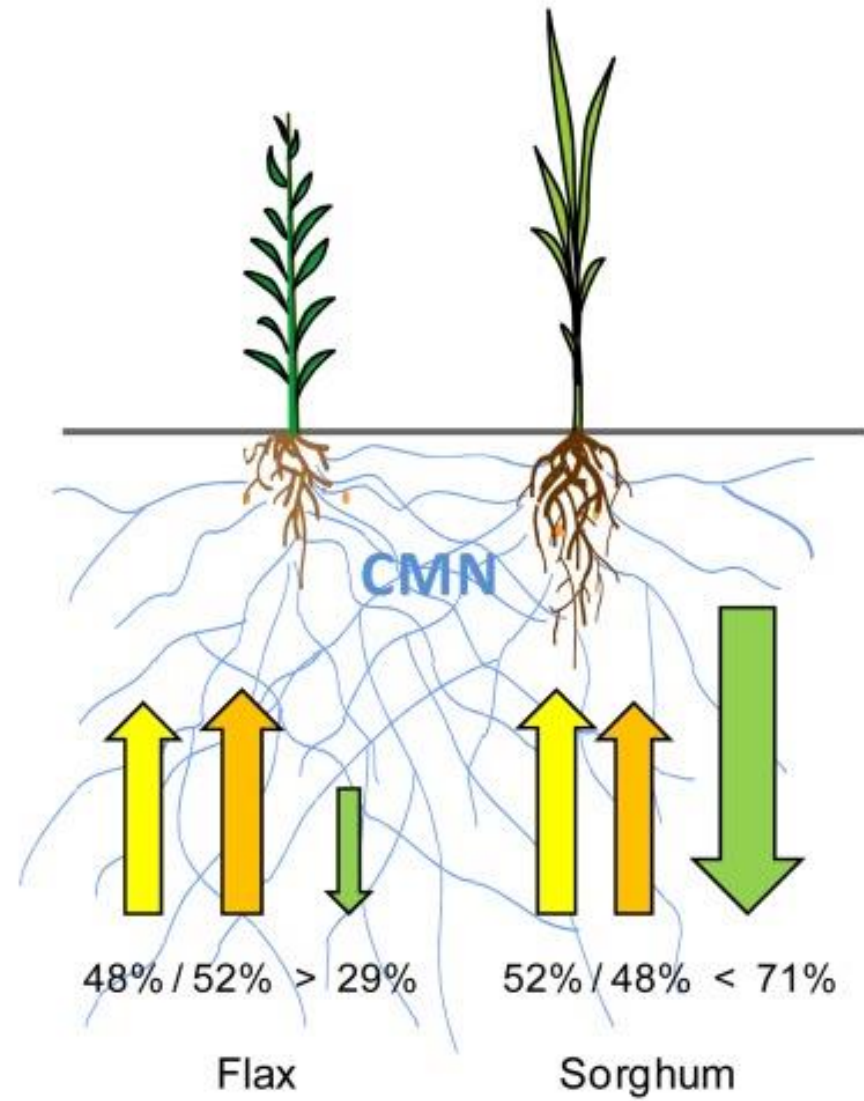
- 高粱和亚麻
- 农业中的间作系统
- $1+1 > 2$



Glomus intraradices



Glomus mosseae



■ P Uptake ■ N Uptake ■ Carbon Investment

作为植物资本的C——也可以转移



mycoheterotrophic plants

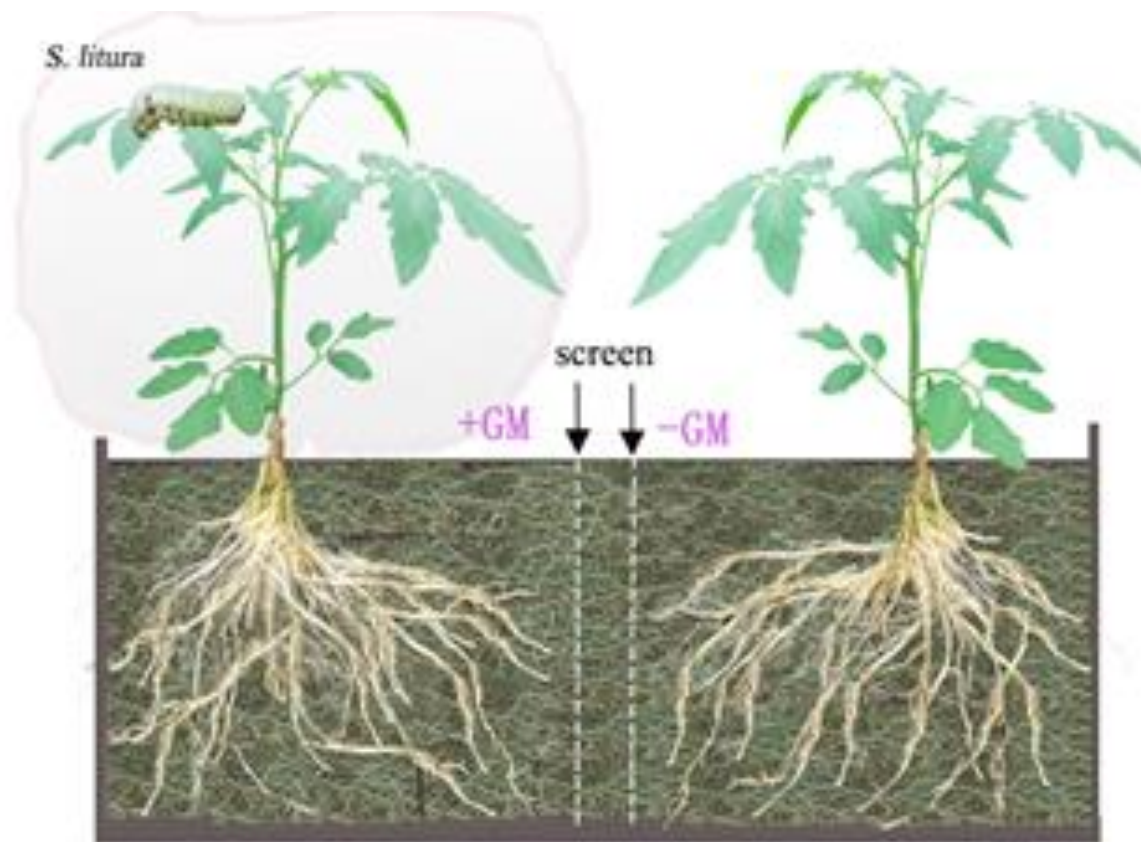


三者关系

- 1. **the mycorrhizal fungus** acquires carbon from the tree (or multiple trees) and may use the mycoheterotroph as the staging ground for long-distance exploration and colonization,
- 2. **the mycoheterotroph** acquires carbon from the fungus and
- 3. **the tree gains** access to a wider pool of soil resources, and potentially connection to other trees facilitating the detection of defence signals.

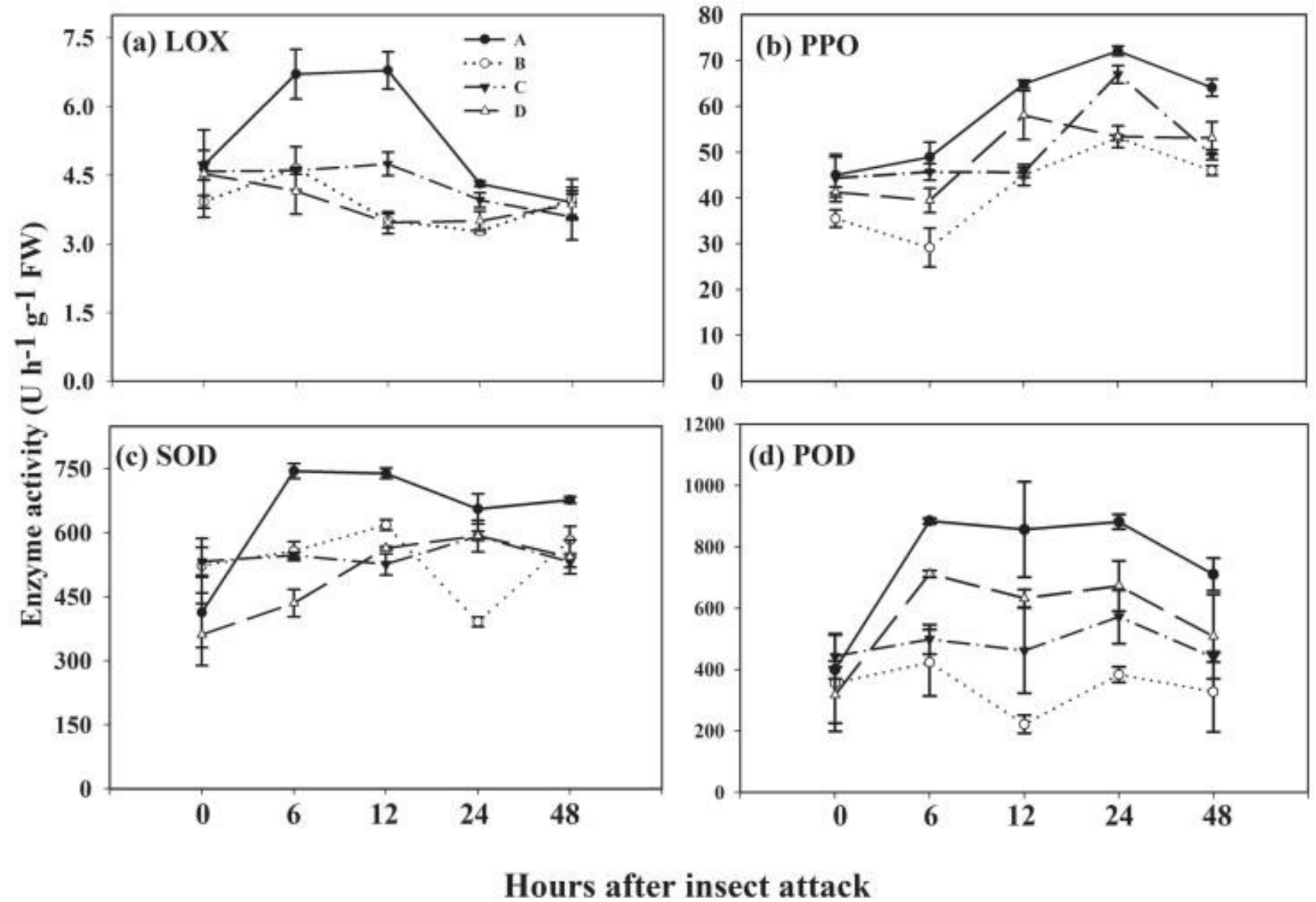
防御信号的传递

- 斜纹夜蛾3龄幼虫
- 番茄幼苗
- 诱导防御物质的传递和相关基因表达的上调

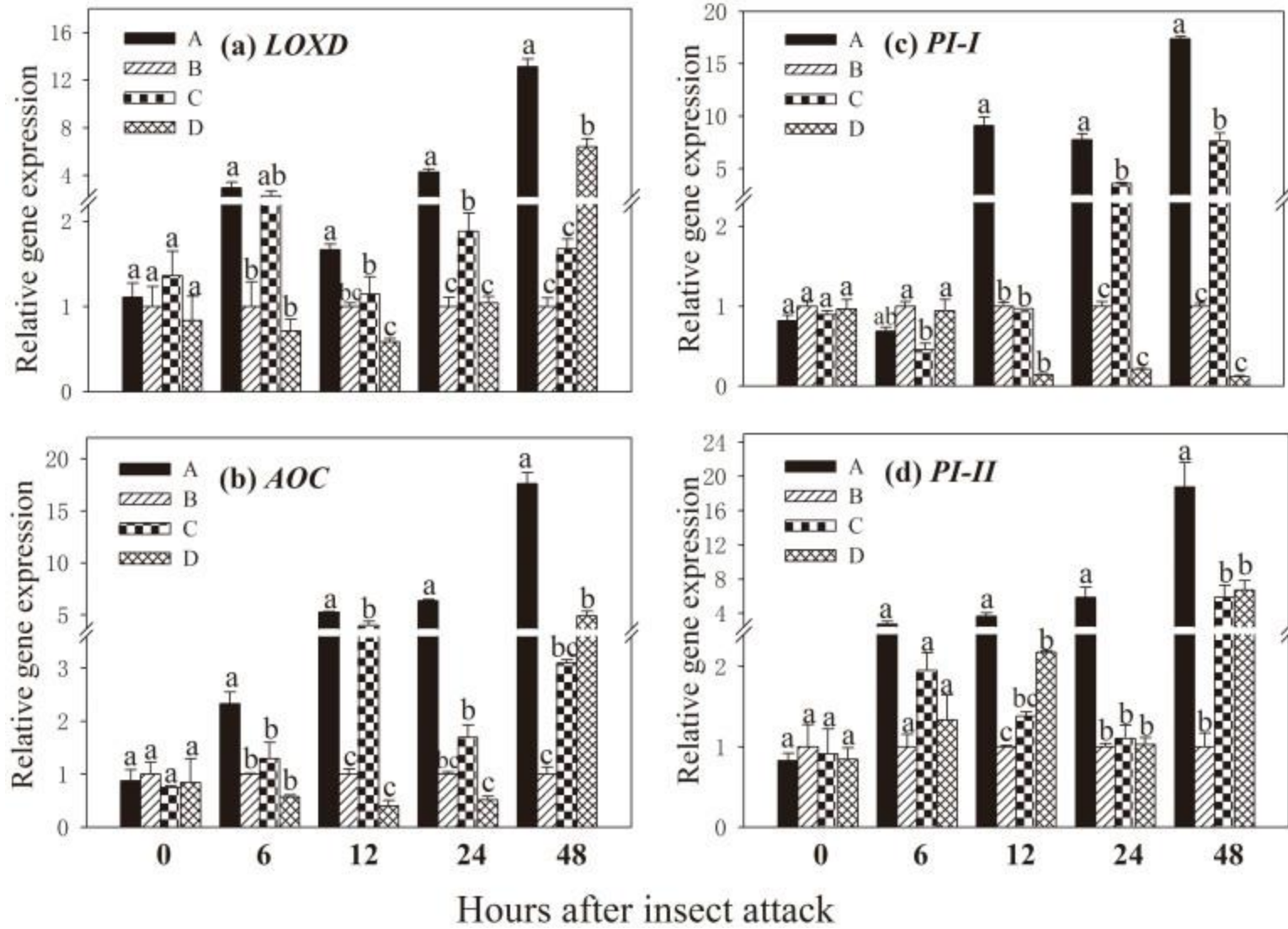


- Song *etc* (2014)

- 脂氧合酶 (LOX)
- 多酚氧化酶 (PPO)
- 超氧化物歧化酶 (SOD)
- 过氧化物酶 (POD)



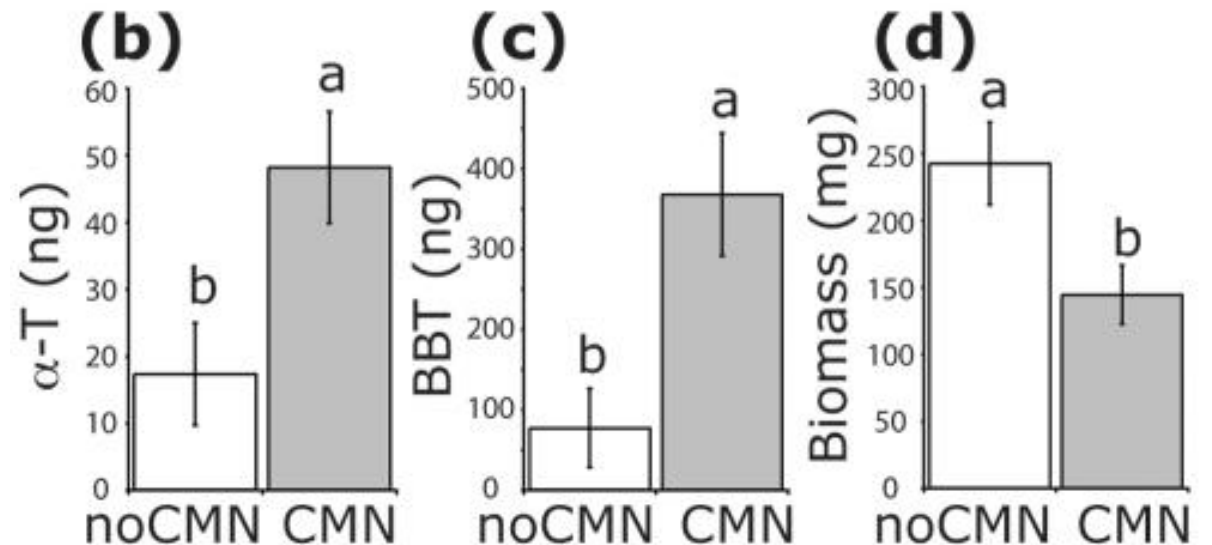
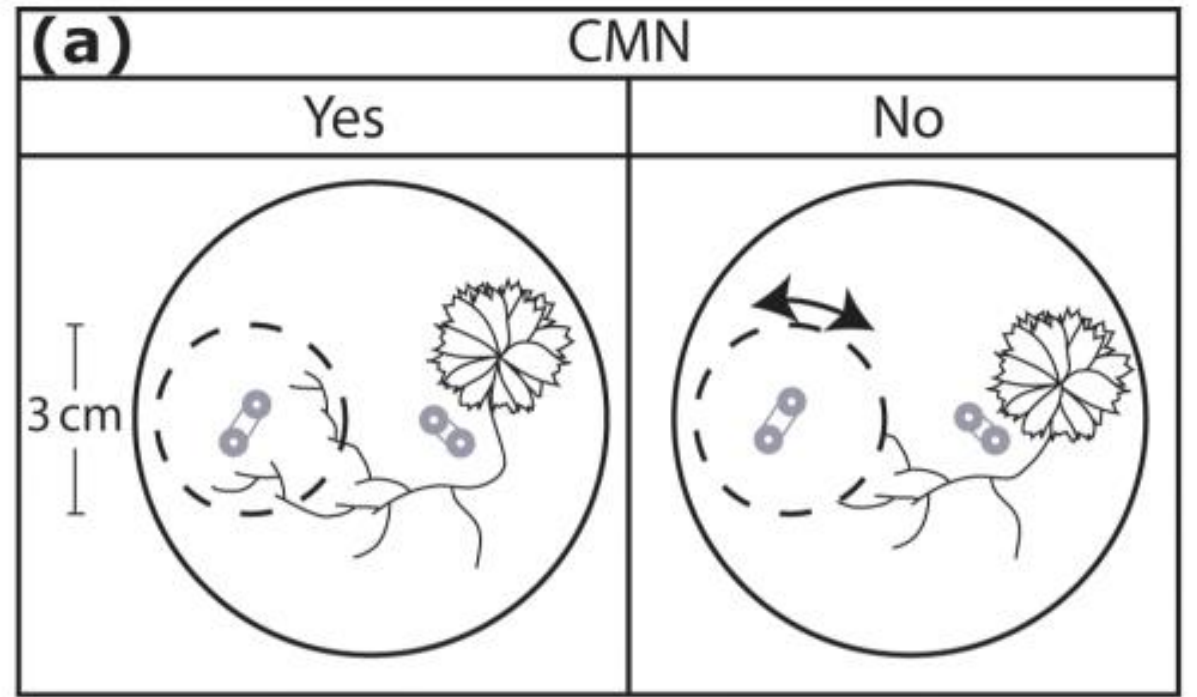
• Song *etc* (2014)

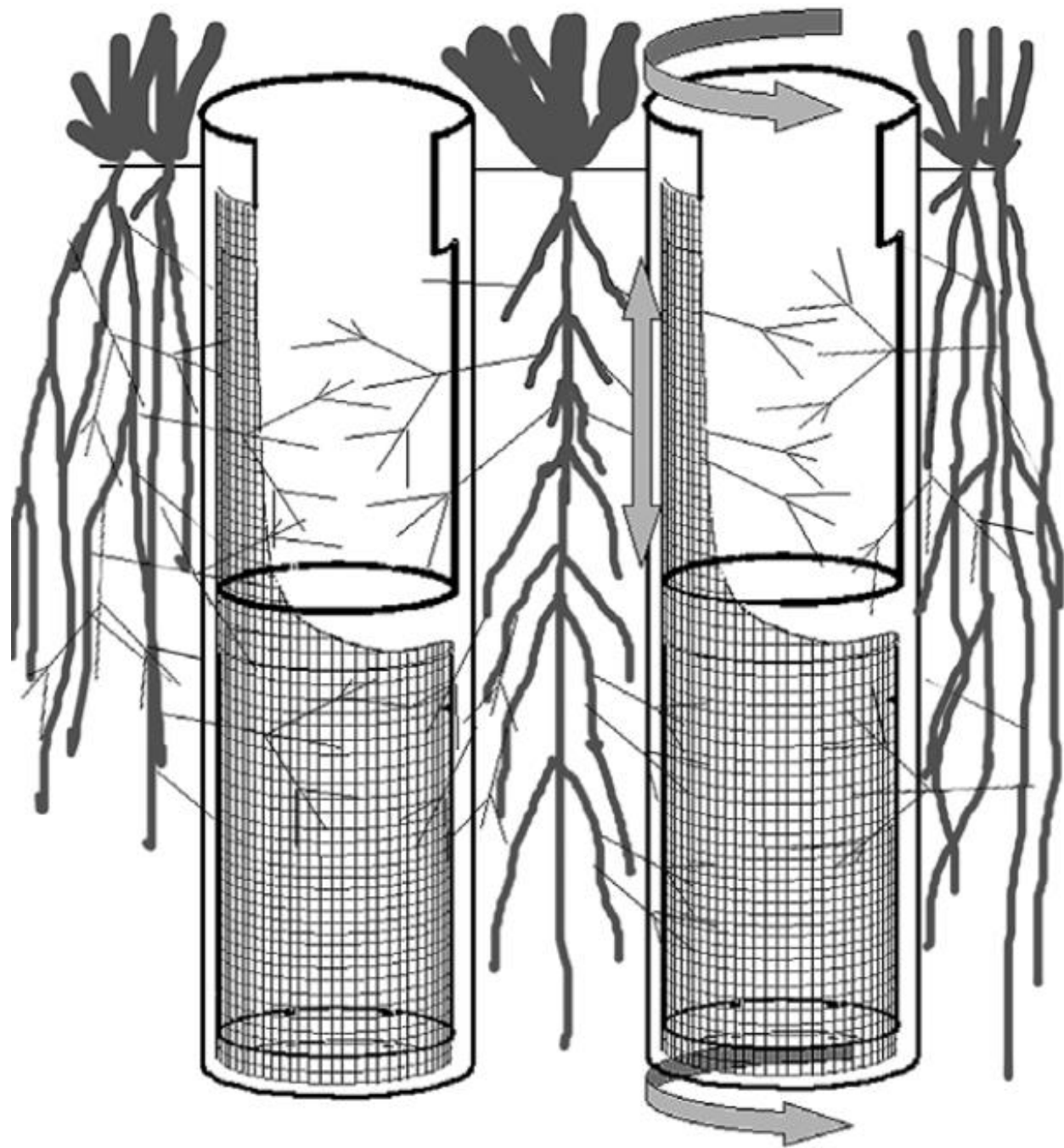


- Song *etc* (2014)

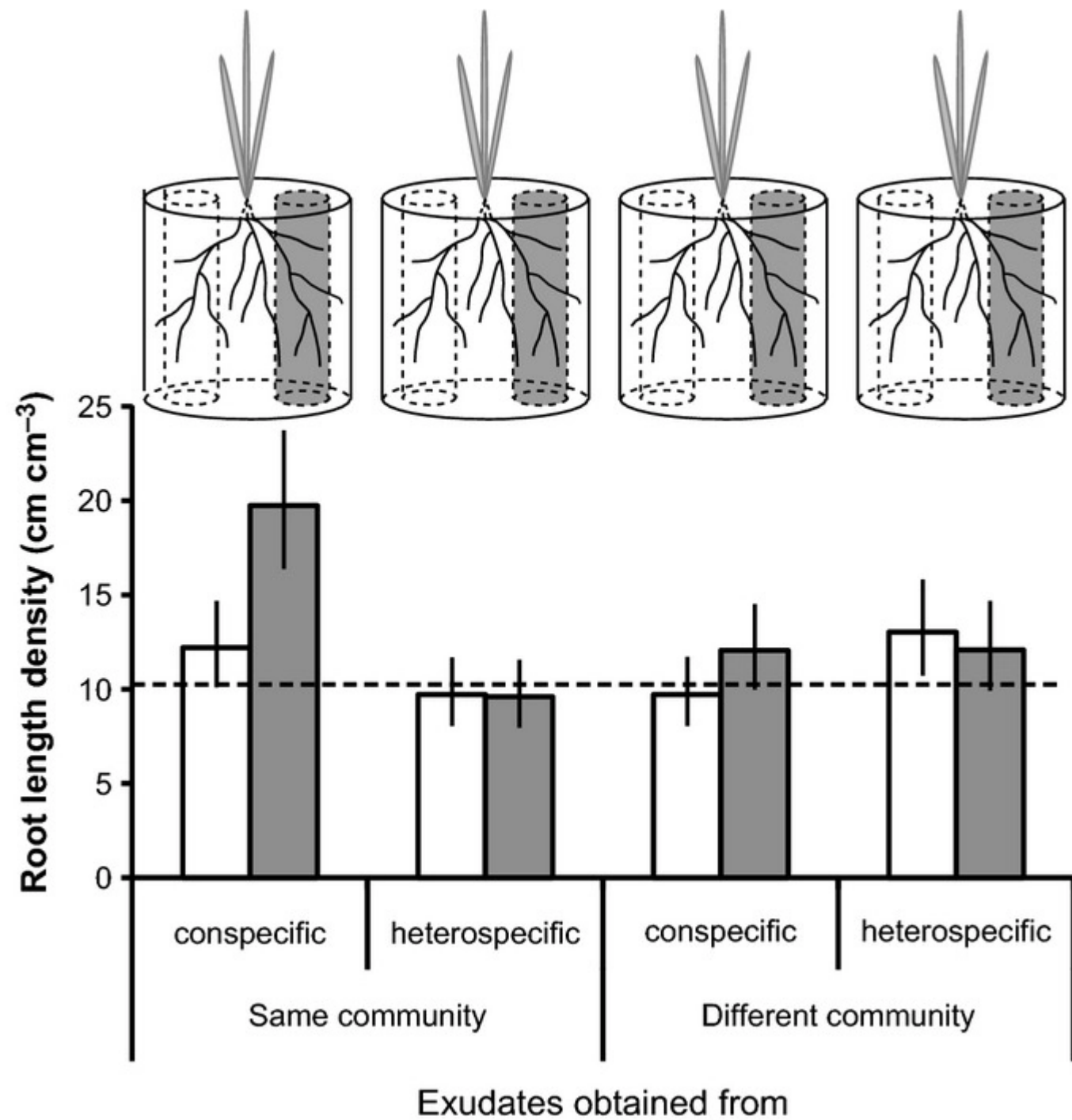
化感物质的传递

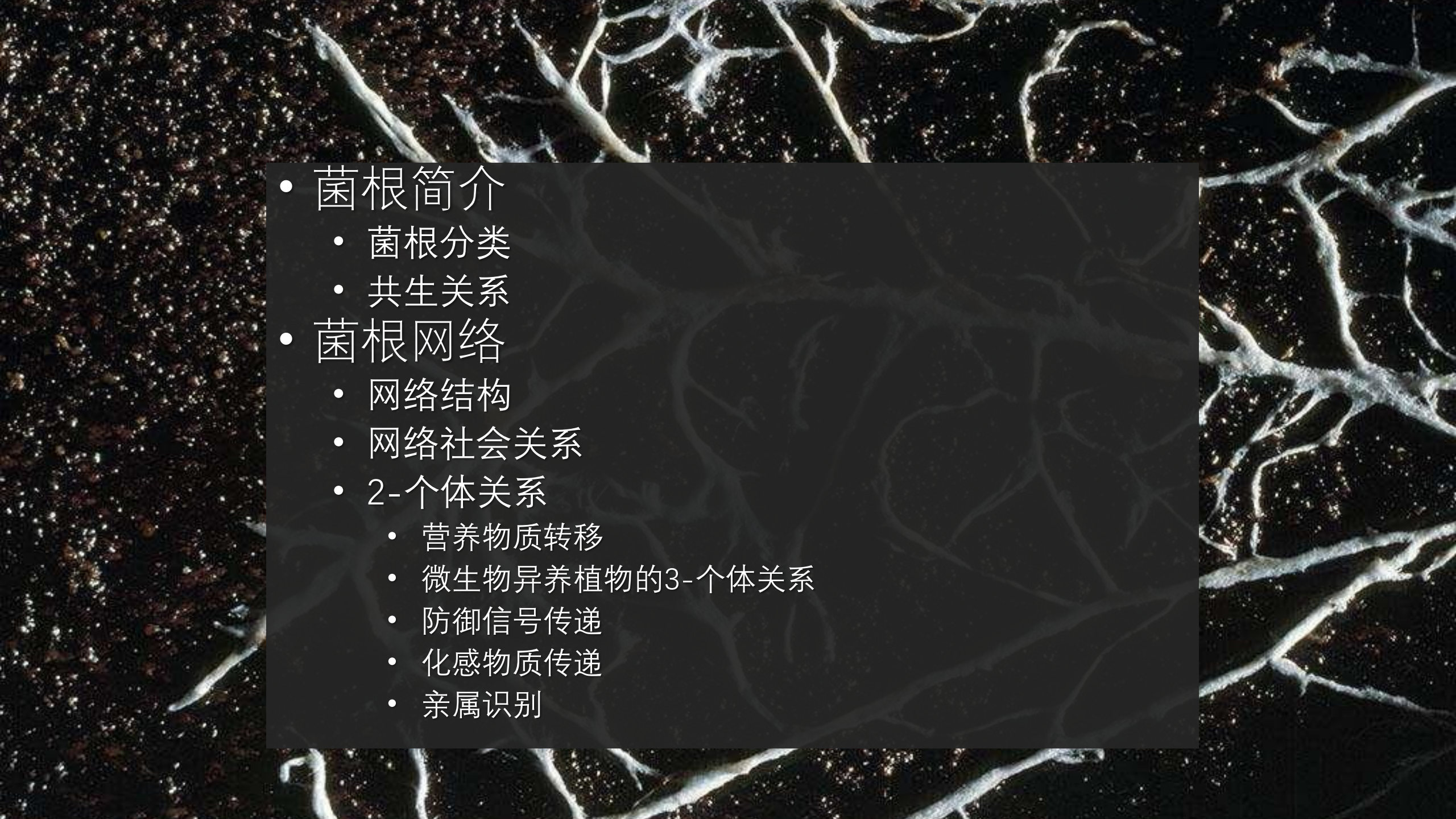
- 细叶万寿菊
- *Tagetes tenuifolia* cultivar “Lemon Gem”
 - 5-(3-buten-1-ynyl)-2,2'-bithienyl (BBT)
 - α -terthienyl (α -T)





亲属识别



- 
- 菌根简介
 - 菌根分类
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END