# Soil Water Retention Curve and Hydraulic Conductivity of Fungi-Treated Sand

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## 1 – Introduction

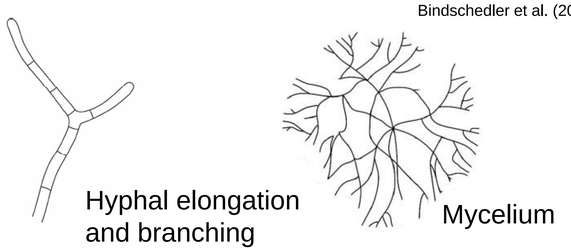
Research on bio-mediated soil improvement has focused on bio-mineralization (e.g., MICP), bio-gas generation, and biofilm accumulation using bacteria.

However, applications of fungal processes for soil improvement are relatively unexplored.

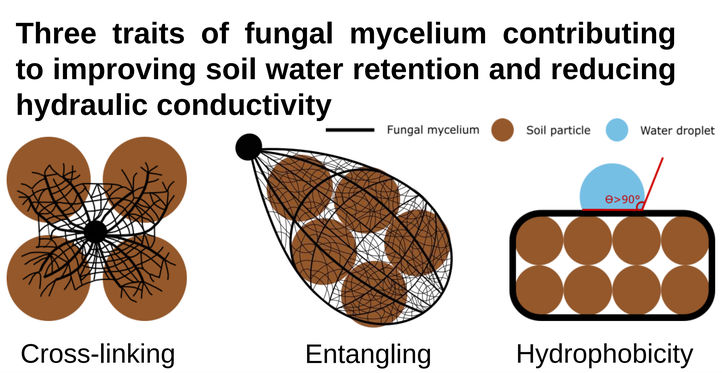
## 2 - Background

### Fungal mycelium network

Bindschedler et al. (2016)




**Three traits of fungal mycelium contributing to improving soil water retention and reducing hydraulic conductivity**




## 3 – Research Goal and Tasks

### Research Goal

Investigation of the effect of fungal mycelium on soil water retention curve and hydraulic conductivity of sand.

### Tasks

1. Water repellency
2. Soil water retention curve (SWRC)
3. Hydraulic conductivity
4. SEM imaging

## 4 – Materials

- Fungi – *Trichoderma virens*

(Commonly existing in soil and not harmful to human)

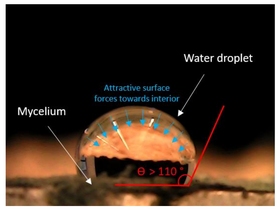
- Sand – Ottawa 50/70 sand
- Nutrition solution – Potato Dextrose Broth

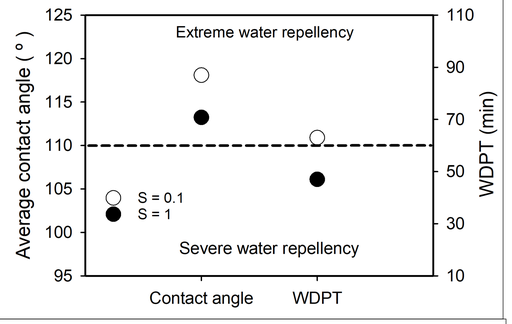
Fungi-treated sand

## 5 – Test Results

### Water Repellency

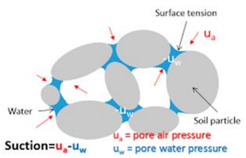
- Contact angle
- Water drop penetration time (WDPT)



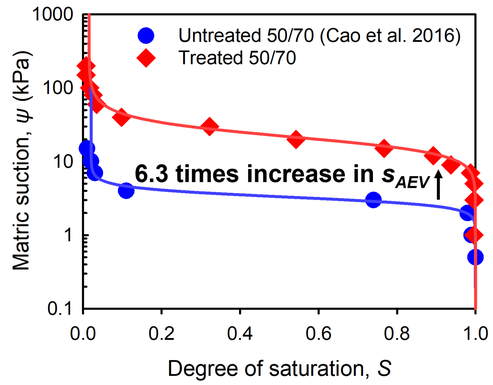




### Soil Water Retention Curve

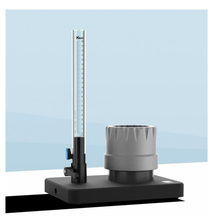
$$\psi = u_a - u_w$$




Chen (2020)



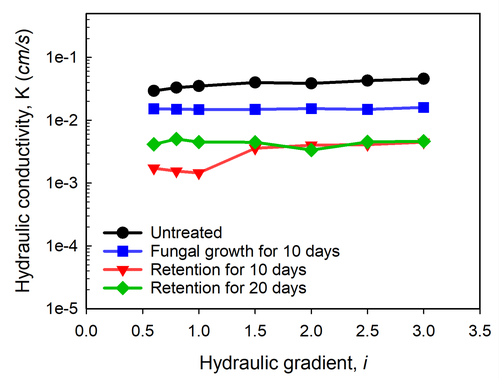

### Hydraulic Conductivity



after growth for *10 days*

after *retention for 10 days*

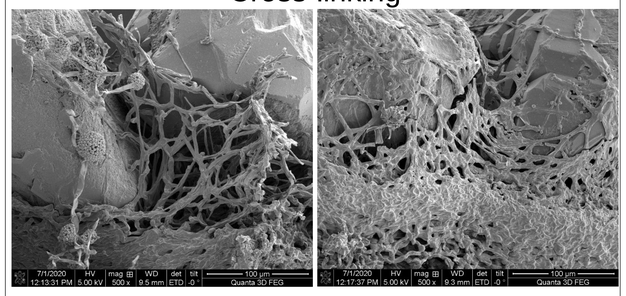
after *retention for 20 days*



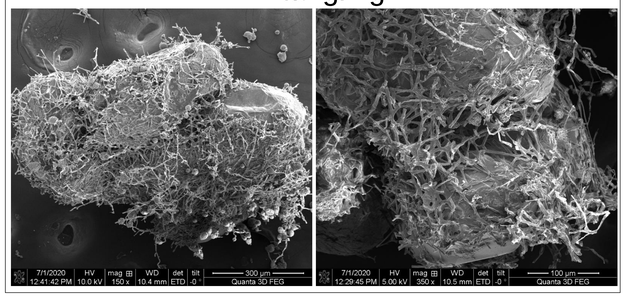

## 5 - Test Results (Continued)

### SEM Images

Cross-linking



Entangling



## 6 - Conclusion

1. Fungal mycelium changed sand to be extremely or severely water repellent.
2. Fungal mycelium modified pore structure of sand, improving soil water retention with 6.3 times increase of air entry suction.
3. Fungal mycelium reduced hydraulic conductivity up to 25 times.
4. SEM images clearly captured mycelium cross-linking and entangling sand particles.

## Acknowledgement

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