

# Quantifying barley morphology

using Euler characteristic curves

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# Barley across the world

Tjøtta  
(Nordland,  
Norway)

Kiliskoye  
(Chelyabinsk,  
Russia)

Marchouch  
(Rabat,  
Morocco)

Bagdad  
(Iraq)

Aksum  
(Tigray,  
Ethiopia)

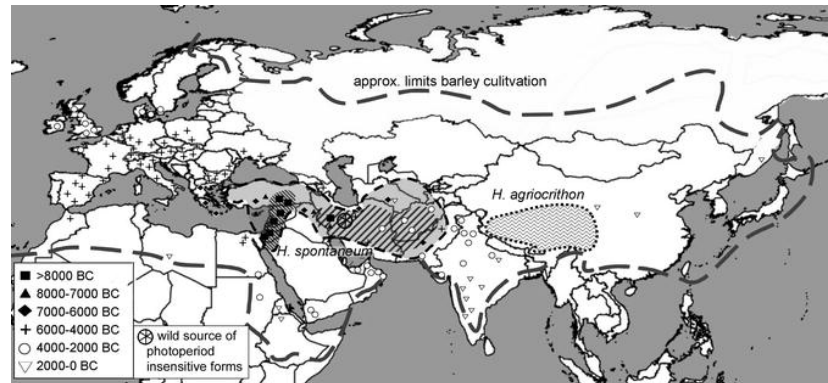
Hanumangarh  
(Rajasthan,  
India)

Click on any  
picture for  
more  
details and  
credits





# Morphological seed diversity of lines

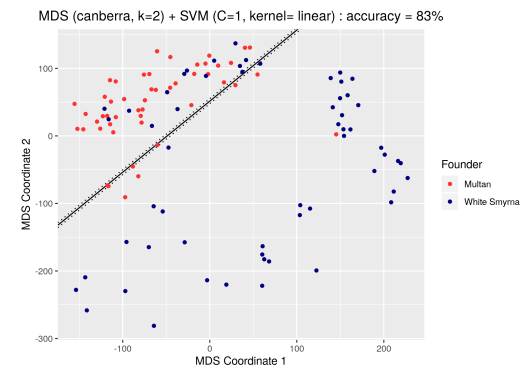
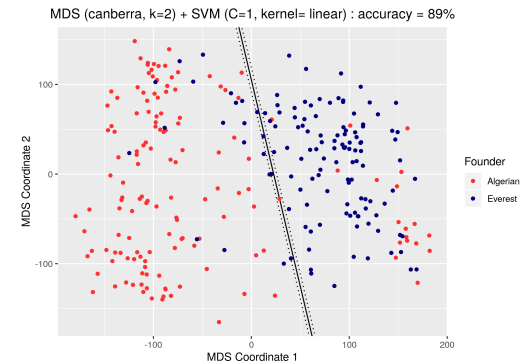
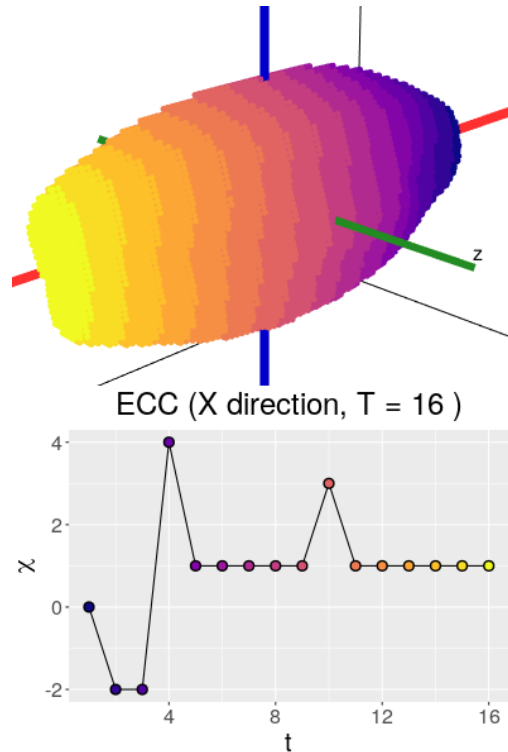


Barley seeds from Scotland and Tibet.

Historical expansion of the barley as a crop.

Click on any picture for more details and credits

# Topological Data Analysis



## Raw Data

- X-ray CT
- Point clouds
- Time series

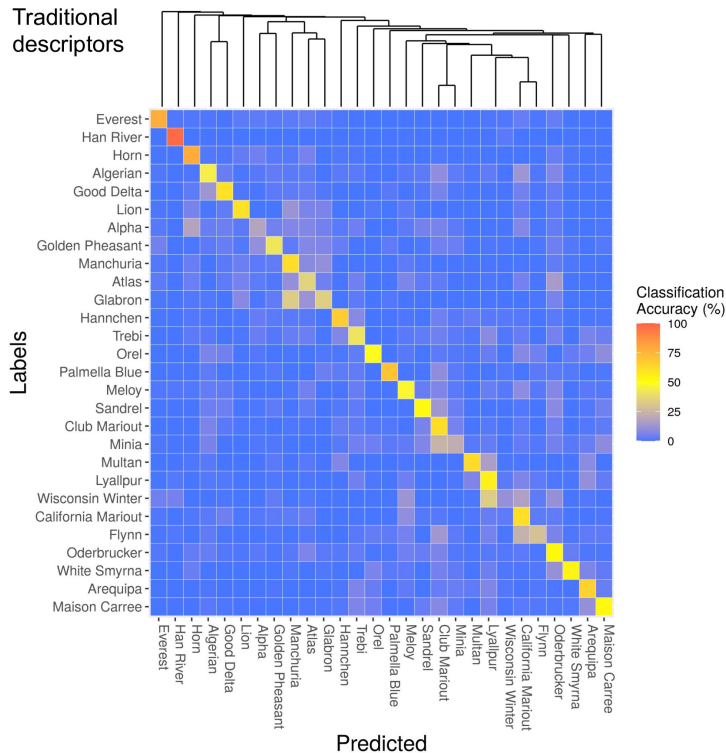
## Topological Summary

- Euler Characteristic
- Persistence diagrams
- Mapper/Reeb graphs

## Analysis

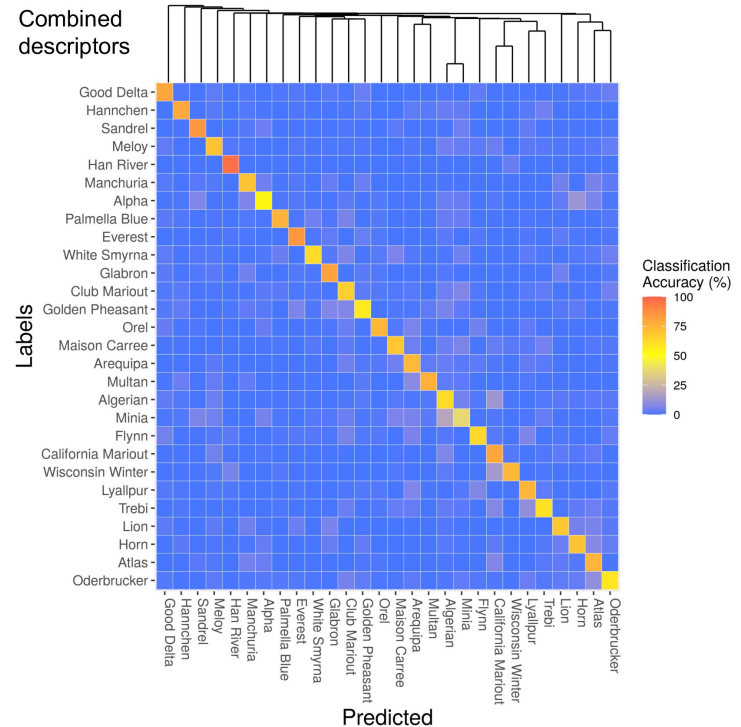
- Statistics
- Machine learning
- Classification/prediction

# Classification of 28 lines with SVM



Average classification accuracy: 53%.

- Length
- Surface area
- 11 traditional shape descriptors in total



Average classification accuracy: 70%.

- 11 traditional shape descriptors
- ECT reduced to 12 dimensions with KPCA
- 23 shape descriptors in total

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