

Comparison of Late Embryogenesis Abundant proteins, WHy domain and Hydrophilins



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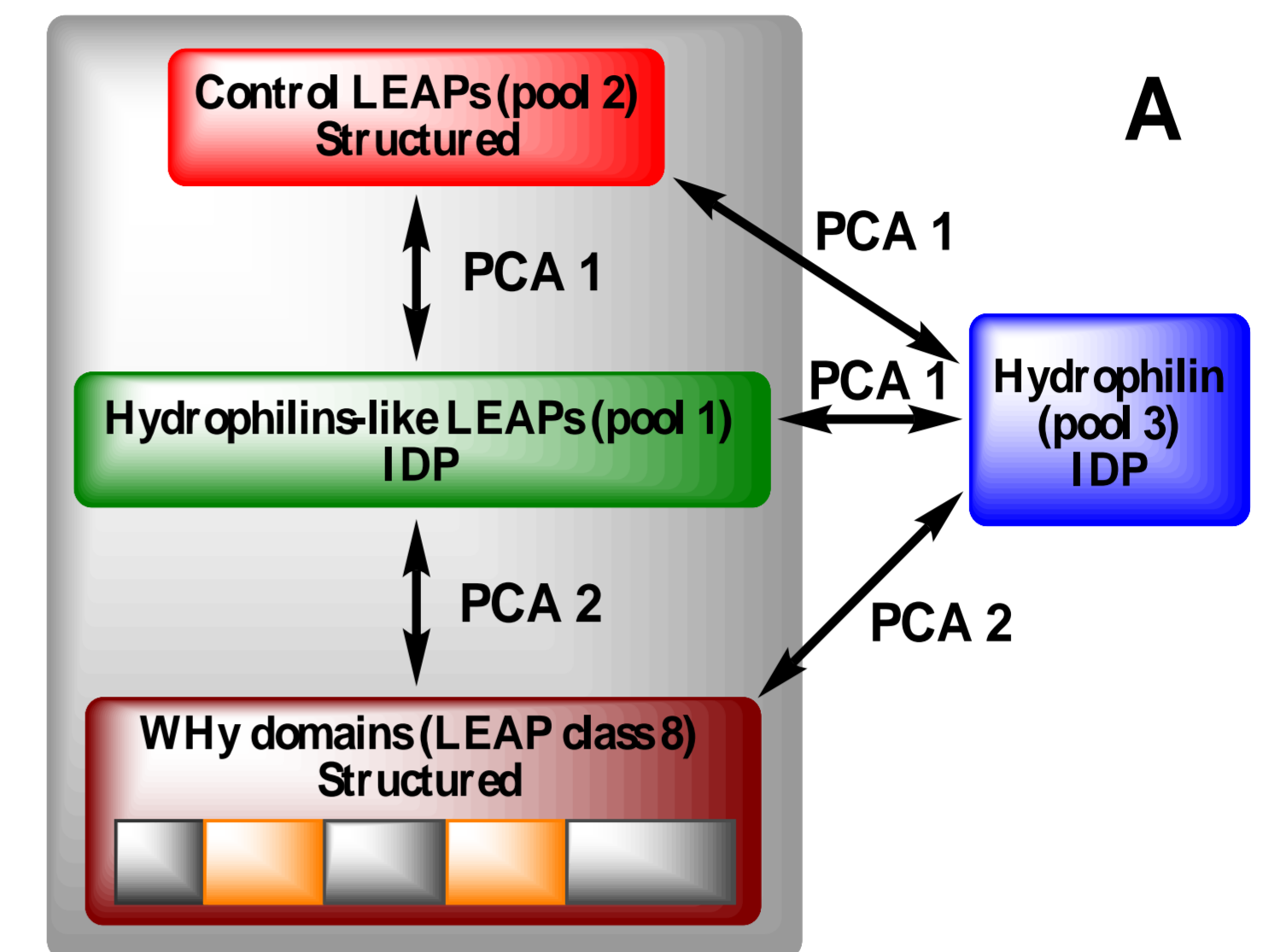
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Late Embryogenesis Abundant proteins (LEAPs) are associated with abiotic stress tolerance, in particular dehydration. They have been classified on the basis of sequence motifs into 12 classes displaying specific physico-chemical properties (LEAPDB database @ <http://forge.info.univ-angers.fr/~gh/Leadb/index.php>).

Hydrophilins are a group of ubiquitous proteins, highly hydrophilic and rich in glycine, which were expected to play important roles in cellular dehydration and freezing tolerance. LEAPs have been previously considered as a subset of Hydrophilins.

The **Water stress and hypersensitive response (WHy)** domain is a region of unknown function found in several plant proteins involved in either the response to water stress or response to bacterial infection. The WHy domain is found in LEAP class 8.

To examine the possible functional relationships between these water stress related protein families, the amino acids usage and physico-chemical properties of LEAPs were compared to those of Hydrophilins and WHy domains.



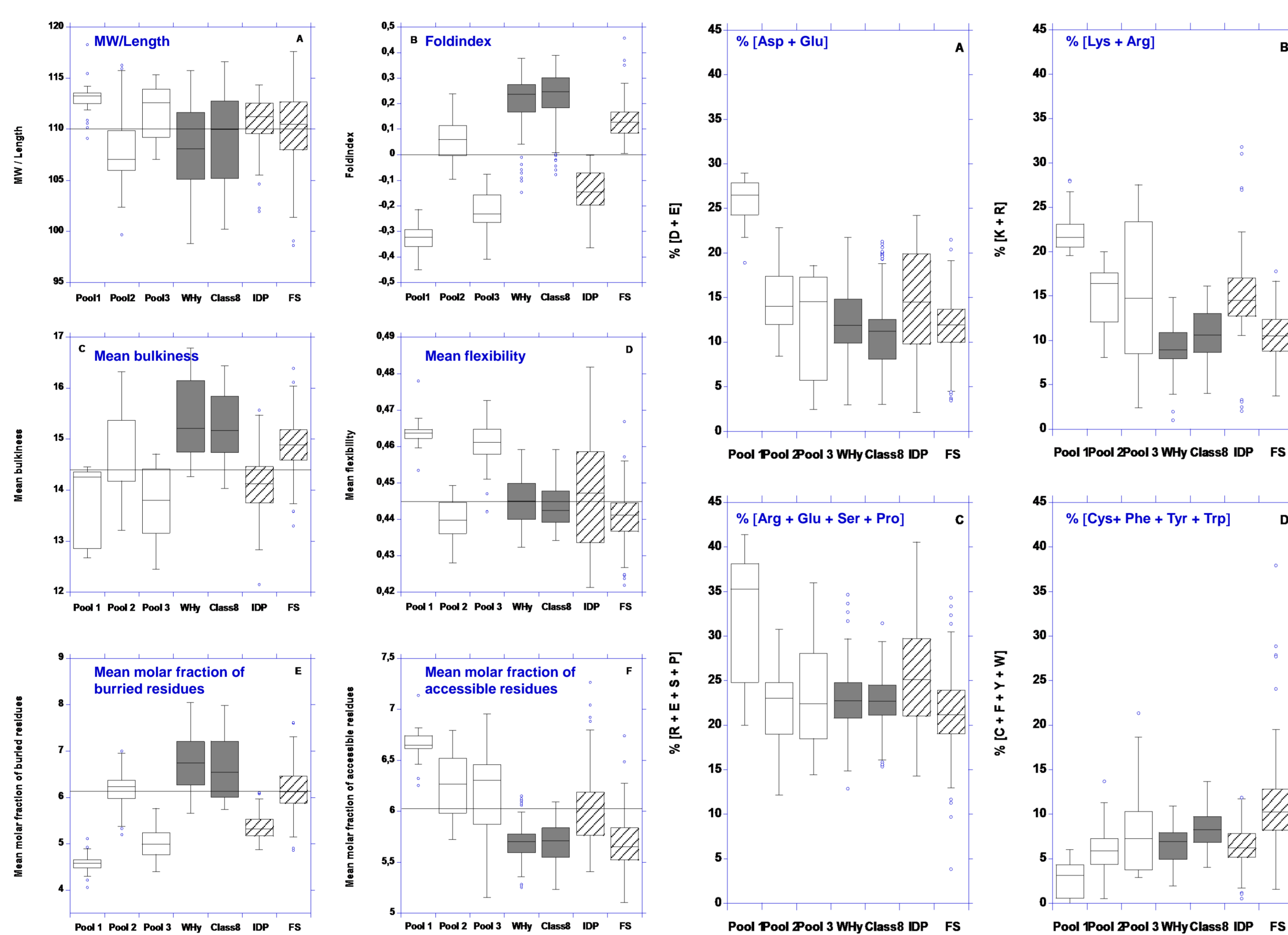
Protein sequences sets used for the analysis

Pool 1 : Hydrophilins-like LEAPs,, corresponding to 24 LEAPs with % GLY > 6 % and GRAVY < -1. Sequences extracted from LEAPDB.

Pool 2 : Control LEAPs, extracted from LEAPDB, corresponding to 47 LEAPs with % GLY < 6 % and GRAVY > -1. Sequences extracted from LEAPDB.

Pool 3 : Hydrophilins, 31 proteins selected from a keyword and blast search using NCBI database;

Why domain (LEAP class 8): 146 sequences of the domain manually extracted from LEAPs in LEAPDB.



Comparison of amino acids physico-chemical properties and amino acids usage

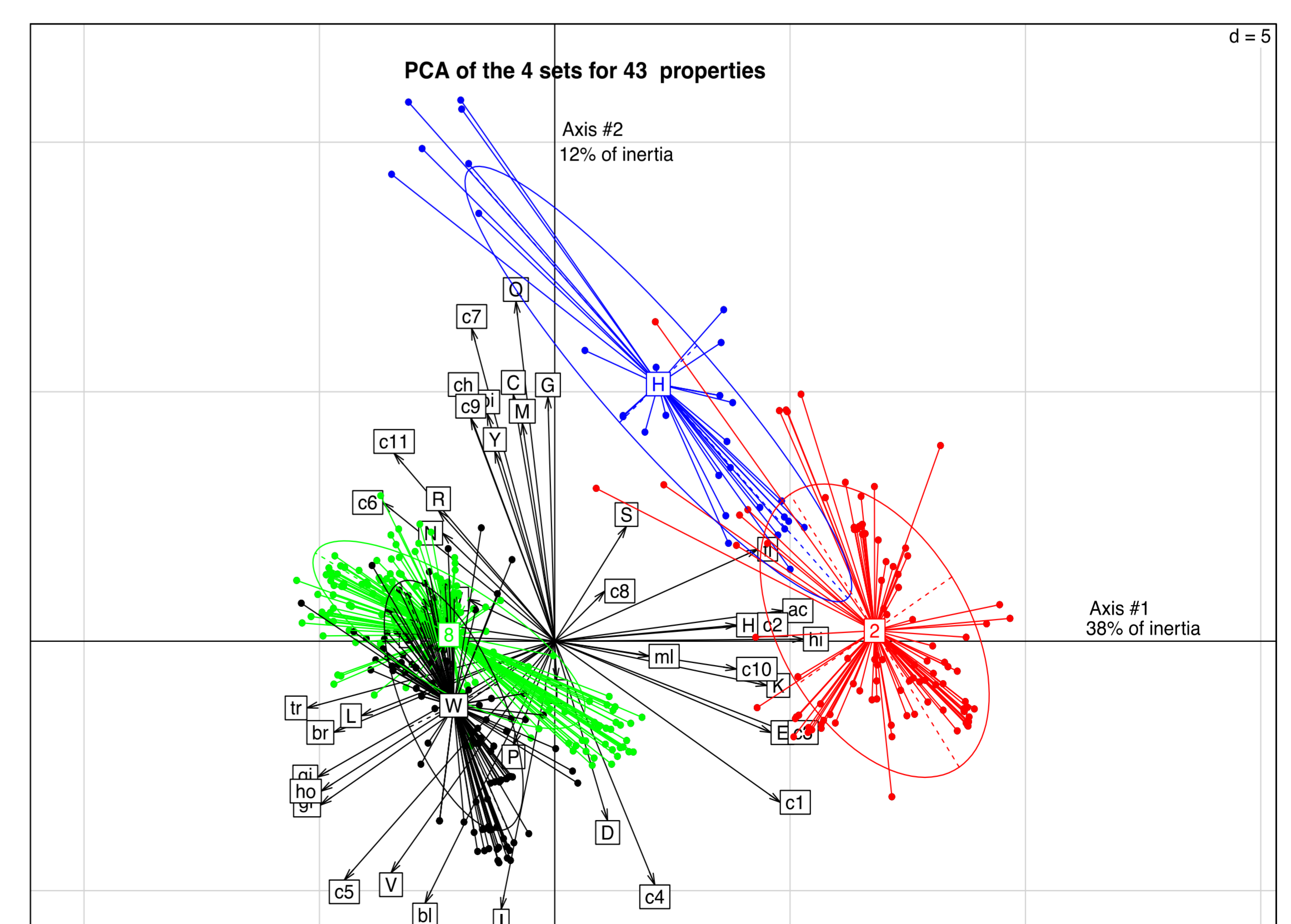
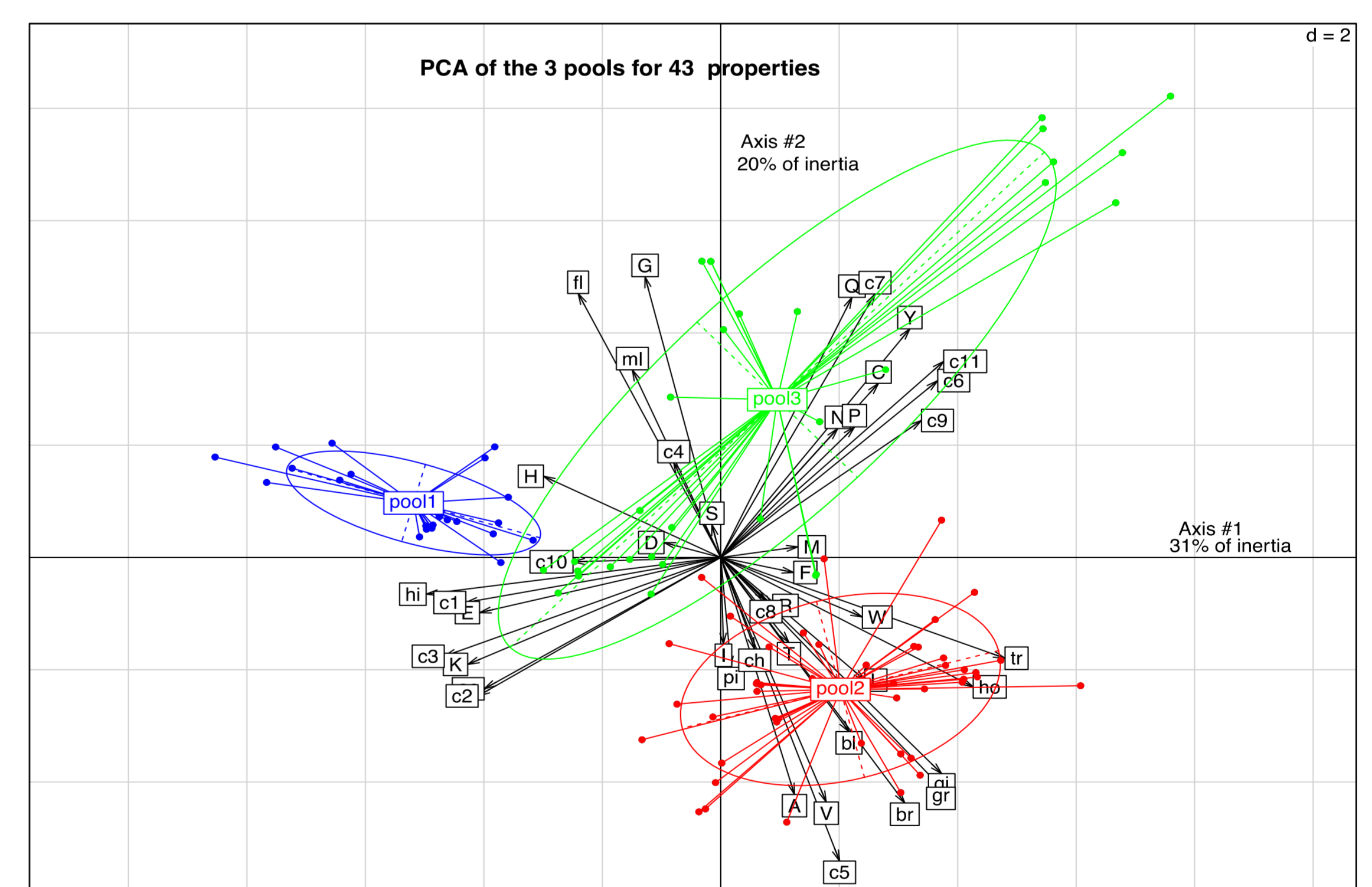
The computational analysis illustrates the common features and specificities of each pool for 10 different parameters.

Two sets of proteins have been included in the analysis as controls: IDP, 72 intrinsically disordered proteins (IDP); FS, 158 fully structured proteins.

Principal component analysis

The graphs show the PCA analysis for 43 different physico-chemical properties.

Pool 1 (hydrophilins-like LEAPs) and pool 3 (hydrophilins) appear rather close, while pool 2 (control LEAPs) is separated. Hydrophilins and LEAPs class 2 can be considered as close, as can be LEAPs class 8 and the WHy domain.



Red : LEAP class 2 ; Blue : Hydrophilins ; Green : LEAP class 8 ; Black : Why domain

Main conclusions

- LEAPs are not a protein subset of Hydrophilin family.
- Hydrophilins are related to LEAP class 2 (dehydrins).
- Hydrophilins, LEAP class 2 and WHy domain may have a common molecular function in interacting with water or other polar/charged small molecules, thus preventing from dehydration.