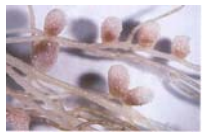
Plant Genomics: Legumes for the future

Legumes provide rich protein sources for food and feed

Legumes belong to the large and economically important Leguminosae family. They are widely used for human consumption and as forages and green manures. The seeds of Legumes (such as beans, soya, lentils, peas and chickpeas) are rich in high quality protein. Legumes also synthesise a wide range of natural products.

Nitrogen Fixation

Legumes in symbiosis with Rhizobium bacteria form nitrogen fixing root nodules where atmospheric nitrogen is converted into nitrogenous compounds (NO_3 or NH_3) that are usable to the host plant



Nitrogen fixing root nodules.

Nitrogen fixation provides plant growth in nitrogen poor soil.

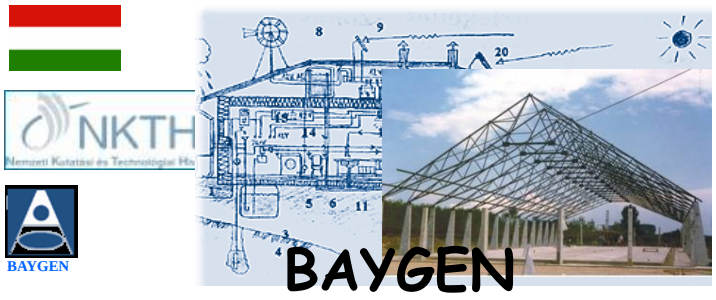
Treasure-troves of biological active peptides

>70000 genes in *M. truncatula* versus 30000 genes in other organisms. Most novel genes encode peptides and expressed in nitrogen fixing nodules.

The model legume: Medicago truncatula

The cultivated Medicago sativa : Alfalfa/Lucerne

French-Hungarian partnership



BAYGEN aims at exploring natural diversity of the *M. truncatula* peptides to discover large sets of new bioactive molecules.

There is an urgent need for potent new antibiotics both for human and animal therapies and for plant protection. Antimicrobial peptides, effectors of the innate immunity, provide broad-spectrum activity against microorganisms (Gram⁺ and Gram⁻ bacteria, protozoa, yeast, fungi and viruses) and a range of non-antimicrobial activities related to defence, inflammation and wound healing or cytotoxicity to tumor cells.

Nodule-specific peptides were discovered at the Institut des Sciences du Végétale, CNRS UPR 2355. The resent and future studies are focused on the regulation and role of peptides in symbiosis

The nitrogen reserve of agricultural soils is limited and must be replenished by inorganic nitrogen fertilizers or by biological nitrogen fixation. Symbiotic nitrogen fixation occurs in plants that harbour nitrogen-fixing bacteria within their tissues.

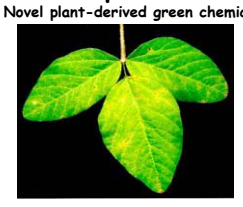
Medicago truncatula Genomics

Identification and isolation of 1000 peptides

Drug discovery

Applications

Plant protection
Novel plant-derived green chemicals



Combatting multidrog resistance

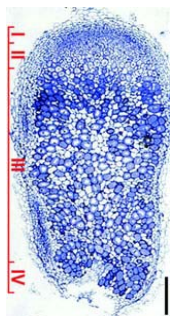
Use in diverse human/animal therapies

Rhizobium-legume symbiosis

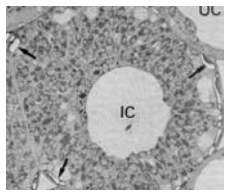
Rhizobium-legume symbiosis is the most important form of biological nitrogen fixation. In root nodules, plant cells host an altered form of Rhizobium bacteria that are capable of nitrogen fixation (the bacteroids). Nodules are complex organs. In Medicago and related legumes, bacteroids and host cells undergo strikingly similar differentiation processes involving genome amplification, cell enlargement and loosing cell division ability.

Nitrogen fixing Medicago root nodules

Nodules on *Medicago truncatula* roots



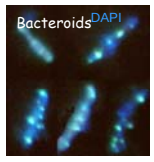
Different nodule zones in a nodule cross section



$N_2 \longrightarrow NH_3$

In zone III, plant cells are filled with nitrogen fixing rhizobium bacteria

Bacteroids are different from free living bacteria



Bacteroids are enlarged, polynucleoid, non-diving cells

Bacteroid differentiation is linked to evolution of high diversity of nodule-specific peptides in the host plant