Dr **Bruno MOULIA**

Ressearch Director at INRA

20 years experience in research on
Plant Bio-Mechanics and Plant Developmental Biology

- **Scientific interest:** My scientific work has been mainly dedicated to the control by the physical environment of plant growth and 3D spatial development. My PhD thesis was on mechanical engineering, but I also have a Master Sc in ecophysiology. I have thus put a special research effort toward a bio-mechanical approach of the morphogenesis of plant, including works on leaf and stem display and on the process of mechanosensing and its relevance to adaptation to wind and gravity . This is due both to the conviction that solid and fluid mechanics are very helpful when studying the shaping of plant organs and the relationships between structures and functions, and to a personal equal inclination toward physics and plant sciences. But also to the conviction that physical, ecophysiological and molecular biology have to be combined together, through a continous interplay between system biology modelling and experiments. Major findings from these works involve i) the biomechanical analysis of leaf rolling and unrolling in grasses and the importance of morpho-structural aspects in driving rolling phenotypic variability, ii) system analysis of mechanosensing in various organisms, and the demonstration that strain-sensing rather than stress-sensing was involved in the process of mechanoperception in plants, iii) the rencent validation of an integrative model of mechanosensitive control over tree growth using quantitative expression of primary mechanosensitive genes, and iv) the recent discovery of the role of strain-proprioception in the control of active tropic movement, as well v) a novel method for the spatio-temporal analysis of the regulation of quantitative expression of genes in growing tissues This also led me to be co-organisator of the first international Interdisciplinary Congress on Plant Biomechanics (Montpellier, FRA, Sept. 94), of a symposium on Plant Biomechanics in the XVI International Botanical Congress (St Louis USA, July 99), and to be the Chaiman of the 7th International Plant Biomechanical Conference, held in August 2012. And in 2013 I acted as guest-editor for a special issue of the Journal of Experimental Botany (IF= 5.8) dedicated to Plant Biomechanics and Mechanobiology. I have also carried on an interest on the architectural development of plant (that underlies the developmental control on the biomechanical processes of morphogenesis and growth) and on the significance of the biomechanical traits under concern for agronomy, forestry and plant breeding. And over the last 10 years I have being leading the interdisciplinary research group MECA (8 permanent scientists) that investigates the mechanoperceptive and graviperceptive control of plant growth from a physical and biological integrative perspective.

Keywords: *plant, biomechanics, mechanobiology, growth and development, architecture, modelling, Ecophysiology of environemental signals (mechanical disturbances ,light, gravity), integrative & system biology.*

- **Personal data :**

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- **Education**

  - 1981 Baccalauréat C (mathematics, physics), (cum laude)
  - 1986 Ingénieur des Techniques Agricoles, ENITA Bordeaux (1rst rank)
  - 1987 CES “Computer sciences applied to agronomy”, with award
    1988 MSc (DEA) **"Environmental physics and ecophysiology**. Univ. Paris Sud-Orsay, with award .(1rst rank)
  - **1993 Docteur de l'Université de Bordeaux I** (Department of **Physics and Mechanical Engineering**) (i.e cum laude, given to the 10% best PhD doctoral dissertations in the discipline)
  - **2007 Habilitation à Diriger des Recherches** Univ Blaise Pascal Clermont-Ferrand (post-doctoral degree see http://en.wikipedia.org/wiki/Habilitation)

- **Professional experience**

-Database Designer in an Institut National de la Recherche Agronomique (INRA) -Cap Sogeti program [1988]
-Assistant Scientifique Contractuel INRA (competitive award for a national PhD grant) Rhéologie du Bois , Bordeaux [1990-93])
-Chargé de Recherches INRA (Permanent Research Position in the French State system of scientific research) [1993-2006]
- One year sabbatical in Pr Wendy Sik’s Lab UC Davis CA USA (awarded an INRA Fellowship, 1996)
-Research Director INRA (DR, equivalent to Pr) , leader of the group MECA of Integrative Plant Biomechanics and Mechanobiology [2007….]
-Associate Editor Journal of Experimental Botany (IF 5.8) [2010-2012]
- **Handling Editor Journal of Experimental Botany** [2012…]

- **Tutoring :** I tutored 10 PhDs in ecophysiology or in mechanics. Five now have a permanent position in scientific research..
- **Scientific grants / project management** (funding amounts do not include salaries)

    - 2006-2009 ANR Woodiversity (Diversity of biomechanical strategies in primary forests) . 7 partners: Task Leader ; 570 k€
    - Project Astredhor " Innovation in the production of tree seedlings" 10 partners Task Leader 24 k€
    - 2007-2010 ANR Blanc Chêne-Roseau (Physics of Wind Tree dynamical interactions) 4 partners Task Leader 430 k€
    - Proyecto PNE (Spain) Derepin "Identification of selection traits for stem straightness improvement in *Pinus pinaster* Ait". External participant
    - ANR Blanc Interdisciplinary Senzo (Integrative physics and biology ot the mechanosensing of wind-induced vibrations) 4 partners : General Leader ; 420 k€
    - 2010-2015 ANR Blanc Tropic (Integrative biology of gravi and phototropism in trees) 520 k€
    - 2014-2 018 ANR Blanc Interdiscplinary Grap2 (Physics of GraviPerception in Plants) 370 k€

- **Publications**

In peer-reviewed international scientific journals :

[1] **MOULIA B., VARLET-GRANCHER C., JACQUES R. - 1989.** Phytochrome control of white clover morphogenesis. Description and ecological signification. *Plant Physiol. Life Sci. Adv.*, 8, 105-111.

[2] **SINOQUET H., MOULIA B., GASTAL F., BONHOMME R., VARLET-GRANCHER C. - 1990.** Modeling the radiative balance of the components of a well-mixed canopy : application to a white clover-tall fescue mixture. *Acta Oecol.*, 11 (4), 469-486.

[3] **DURAND J.L., VARLET-GRANCHER C., LEMAIRE G., GASTAL F., MOULIA B. - 1991.** Carbon partitioning in forage crops. *Acta Biotheoretica*, 39, 213-224.

[4] **SINOQUET H., MOULIA B., BONHOMME R. - 1991.** Estimating the three-dimensional geometry of a maize crop as an input of radiation models : comparison between three-dimensional digitizing and planr profiles. *Agric. For. Meteorol.*, 55, 233-249.

[5] **CRUZ P., SINOQUET H., GASTAL F., MOULIA B., VARLET-GRANCHER C., LEMAIRE G., 1991**. Efecto del nitrogeno y de la presencia de trebol blanco sobre festuca alta. *Turrialba*, 41, 4, 475-481

[6] **MOULIA B., FOURNIER M. and GUITARD D. -1994.** Mechanics and form of the maize leaf : in vivo qualification of the flexural behaviour. *J. Mater. Sci.*, 29:2359-2366.

[7] **MOULIA B - 1994.** The biomechanics of leaf rolling. *Biomimetics*, 2(3): 267-281

[8] **MOULIA B. , FOURNIER M. 1997** Mechanics of the maize leaf: a composite beam model of the midrib. *J. Materials Sciences* 32 : 2771-2780.

[9] **DROUET J-L, MOULIA B. 1997** Spatial re-orientation of maize leaf affected by initial plant orientation and density. *Agric. For. Meteor*. 88: 85-100.

[10] **SIERRA DE GRADO R, MOULIA B. FOURNIER M., ALIA R. DIEZ BARRA R. 1997** Genetic control of stem form in Pinus pinaster Ait. seedlings exposed to lateral light. *Trees* 11: 455-461.

[11] **MOULIA B, LOUP C., JEUFFROY M.H., EDELIN C. 1999** Architectural analysis of herbaceous crop species : a comparative study of maize (Zea mays L.) and garden pea (Pisum sativum L.) *Agronomie* : 19 : 305-312.

[12] **DROUET J.L. , MOULIA B., BONHOMME R. 1999.** Do changes in the azimuthal distribution of maize leaves over time affect canopy light absorption? *Agronomie* : 19 :281-294.

[13] **MOULIA B., LOUP C. CHARTIER M., ALLIRAND J.M. EDELIN C. 1999** The dynamics of architectural development of maize (Zea mays L.) in a non limiting environment : the branched potential of modern maize. *Ann. Bot : 84 :645-656.*.

[14] **HAY J., MOULIA B., SILK W., LANE B., FREELING M. 2000** Biomechanical analysis of the rolled (Rld) leaf phenotype of maize. *Am. J. Bot. 87(5) :625-633.*

[15] **MOULIA B., 2000** Leaves as shell structures : double curvature, auto-stresses and minimal mechanival energy constraints on leaf rolling in grasses . *J. Plant Growth Regulation 19 :19-30.*

[16] **COUTAND C., JULIEN JL, MOULIA B, MAUGET JC, GUITARD D. 2000.** A biomechanical study of the effect of a controlled bending on tomato stem elongation : I global mechanical analysis *J. Exp. Bot. 51(352) : 1813-1824.*

[17] **COUTAND C., MOULIA B, 2000**. A biomechanical study of the effect of a controlled bending on tomato stem elongation : II Local mechanical analysis and spatial integration of the mechanosensing *J. Exp. Bot. 51(352) : 1825-1842*

[18] **CHRISTOPHE A., MOULIA B., VARLET-GRANCHER C. 2003** A quantitative analysis of the three dimensional spatial colonization by plant as illustrated by white clover (*Trifolium repens* L.). *Int J. Plant Sci. 164(3) 359–370*

[19] **DOARE O., MOULIA B., DE LANGRE E 2004** Effects of contacts between plants on the motion induced by wind on crop canopies. *Journal of Biomechanical Engineering (Tans ASME). 126 :146-151*

[20] **MOULIA B, COMBES D, 2004** Thigmomorphogenetic acclimation of plants to moderate winds greatly affects height structure in field-gown alfalfa (Medicago sativa L.), an indeterminate herb. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology* : 137 (3-S1): 77. A10-2

[21] **PY C., DE LANGRE E, MOULIA B. 2004** The mixing layer instability over a flexible crop canopy. *CRAS Section Mécanique* 332(8): 613-618

[22] **DÉBARRE D, SUPATTO W, FARGE E, MOULIA B, SCHANNE-KLEIN MC, AND BEAUREPAIRE E, 2004.** Velocimetric third harmonic generation microscopy: in vivo micron-scale quantification of morphogenetic movements in unstained embryos *Optics Letters, .29(24) 2881-2883.*.

[23] **SUPATTO W, DÉBARRE D, MOULIA B, BROUZÉS B, MARTIN JL, FARGE E, AND BEAUREPAIRE E. 2005.** In vivo modulation of morphogenetic movements in Drosophila embryos with femtosecond laser pulses, *PNAS, 102(4) :1047-1052*

[24] **GIROUSSE C , MOULIA B., SILK W.K., BONNEMAIN J.L 2005.** Pea aphid infestation reduces alfalfa stem elongation not only by assimilate withdrawal but also through a thigmomorphogenetic-like response *Plant Physiol 137:1434-1484*

[25] **PY C., DE LANGRE E, MOULIA B. HEMON P 2005** A new experimental approach for the measurement of the wind-induced motion of a crop canopy *Agricultural and Forest Meteorology 130: 223-236.*

[26] **CHRISTOPHE A., MOULIA B., VARLET-GRANCHER C. 2006.** Quantifying BL and PAR photocontrols of aerial morphogenetic responses involved in shade-avoidance: both BL and other PAR wavelengths acted, displaying antagonist effects on leaf production and additive effects on petiole extension in white clover.*J Exp Bot . 57(10):2379-90*

[27] **PY C., DE LANGRE E, MOULIA B. 2006**. Frequency lock-in of shear layer instability in wind-crop interaction. J. Fluid Mech. 568, 425-449.

[28] **MOULIA B., COUTAND C., LENNE C. - 2006.** Posture control and skeletal mechanical acclimation in terrestrial plants. Consequences for the biomechanical modelling of plant architecture. *Am J Bot*, 93 (10) 1317-1329.

[29] **COUTAND C, FOURNIER M, MOULIA B. 2007** . Gravitropic response of polar trunk : key roles of the regulation of wood prestressing and of relative kinetics of cambial growth versus wood maturation. *Plant Physiology*. 144:1166–1180,.

[30] **LEBLANC-FOURNIER N, COUTAND C, CROUZET J, BRUNEL N, LENNE C, MOULIA B AND JULIEN JL-2008** Jr-ZFP2, an early gene in the mecanotransduction pathway of woody plants, encoding a cys2-his2 type transcription factor. *Plant Cell and Environment 31 :715–726*

[31] **SIERRA DE GRADO R., PANDO V., MOULIA B. – 2008.** Genetic control of stem form in *Pinus pinaster* Ait. seedlings exposed to lateral light Biomechanical differences in the straightening process between Pinus pinaster Ait. provenances. A new approach for stem straightness early selection. *Tree Physiol.28: 835-846.*

[32] **RODRIGUEZ M. E LANGRE E, MOULIA B. 2008.** A scaling law for the effects of architecture and allometry on tree vibration modes suggests a biological tuning to modal compartmentalization *Am J Bot, 95(12): 1523–1537*

[33] **MOULIA B. , FOURNIER M. 2009** The power and control of gravitropic movements in plants: a biomechanical and system biology view. *Journal of Experimental Botany (Darwin series invited review) 60:461-486.*

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[36] **MERRET R.† , MOULIA B. †, HUMMEL I.†, COHEN D., DREYER E., BOGEAT-TRIBOULOT M.B. 2010.** Monitoring the regulation of gene expression in a growing organ using a fluid mechanics formalism. BMC Biology, 8:18 († co-first authors **)**

[37] **GOURCILLEAU D.1,†, LENNE C,†,ARMENISE C., MOULIA B. ,JULIEN JL,BRONNER G.,LEBLANC-FOURNIER N. 2011**,Phylogenetic Study of Plant Q-type C2H2 Zinc Finger Proteins and Expression Analysis of Poplar Genes in Response to Osmotic, Cold and Mechanical Stresses *DNA Research* 18 [2] : 77-92

[38] **E LANGRE E ,RODRIGUEZ M. PLOQUIN S, MOULIA B, 2012** The multimodal dynamics of a walnut tree : experiments and models. Journal of Applied Mechanics : 79(4) Article Number: 044505 DOI: 10.1115/1.4005553

[39] **MOREL P, CRESPEL L., GALOPIN, G. MOULIA B.2012** Effect of mechanical stimulation on the growth and branching of garden rose. *Scientia Horticulturae* 135 (2012) 59–64

[40] **R.BASTIEN, T. BOHR, B. MOULIA.† * , S.DOUADY.† , 2013 .** A unifying model of shoot gravitropism reveals proprioception as a central feature of posture control in plant. PNAS 110 (2): 755–760 († co-PI last authors, * corresponding author **) (** paper commented by J Dumais 2013 in PNAS 110 (2) 391–392, and in the generalist press : Le Monde, Le Figaro, La Croix , as well as in popular

science radio program France Inter –La Tête au Carré, Radio Télévision Suisse CQFD, France Culture- Science Publique, and popular science press Pour La Science, Science & Avenir, Science & Vie…)

[41] **A TIXIER, BADEL E, FRANCHEL J, LAKHAL W, LEBLANC-FOURNIER N, MOULIA B, JULIEN JL, 2013** Growth and molecular responses to long-distance stimuli in poplars: bending versus flame wounding. Physiologia Plantarum. On press.

[42] MOULIA, B. 2013 Plant biomechanics and mechanobiology are convergent paths to flourishing interdisciplinary research Journal of Experimental Botany 64 (15): 4617-4633.

[43] BARBACCI, A., DIENER, J., HÉMON, P., ADAM, B., DONÈS, N., REVERET, L., MOULIA, B. 2014 A robust videogrametric method for the velocimetry of wind-induced motion in trees. Agricultural and Forest Meteorology 184 :.220 – 229

[44] **DER LOUGHIAN C , TADRIST L., J M ALLAIN, DIENER, J., MOULIA B , E LANGRE E , 2014** Measuring local and global vibration modes in model plants . *CRAS Mécanique* 342 1–7.

[45] **R.BASTIEN, S.DOUADY†, B. MOULIA.†* , 2014,** A Unifying Modeling of Plant Shoot Gravitropism With an Explicit Account of the Effects of Growth . Frontiers in Plant Sciences (Biophysics) **5**:136. doi: 10.3389/fpls.2014.00136. († co-PI last authors, * corresponding author **)**

[46] **MARTIN L. †, DECOURTEIX M†, BADEL E, HUGUET S., MOULIA B., JULIEN J-L, LEBLANC-FOURNIER N, 2014**, The zinc finger protein PtaZFP2 negatively controls stem growth and gene expression responsiveness to external mechanical loads in poplar. New Phytologist (2014) 203: 168–181 doi: 10.1111/nph.12781

[47] **BASTIEN, R., DOUADY, S†., MOULIA, B †*., 2015.** A Unified Model of Shoot Tropism in plants: Photo-, Gravi- and Propio-Ception. PLOS Computational Biology, logy | DOI:10.1371/journal.pcbi.1004037 1:30 (co PI authors, * corresponding author)

[48] **MOULIA B., COUTAND C. ,JULIEN JL, 2015** Mechanosensitive control of plant growth : bearing the load, sensing, transducing,and responding Frontiers in Plant Sciences (Plant Physiology) 6 (52): 1-20 doi: 10.3389/fpls.2015.00052

Book chapters:

[49] **EDELIN C., MOULIA B. ET TABOUREL F. - 1996.** Notions d'analyse architecturale des plantes. In "Ecole Chercheurs INRA en Bioclimatologie, Tome 1: De la plante au couvert végétal", P. Cruiziat et J.P. Lagouarde (Eds), INRA, Dept Bioclimatologie, Service de Formation Permanente (Pub): 83-106.

[50] VARLET-GRANCHER C., JULIER B., MOULIA B. ET RIPOCHE D. - 1996. Facteurs climatiques et mise en place des structures. In "Ecole Chercheurs INRA en Bioclimatologie, Tome 1: De la plante au couvert végétal", P. Cruiziat et J.P. Lagouarde (Eds), INRA, Dept Bioclimatologie, Service de Formation Permanente (Pub): 41-60.

[51] **MOULIA B, FOURNIER-DJIMBI M. 1997**. Optimal mechanical design of plant stems: the models behind the allometric power laws. In Jeronimidis G , Vincent JFV (Eds) Plant Biomechanics Reading Univ (Pub): 43-55. (ISBN 0 7049 1240 6)

[52] **MOULIA B., EDELIN C., JEUFFROY M.H., ALLIRAND J.M., LOUP C., CHARTIER C. 2000.** Premiers éléments d'analyse du développement architectural des herbacées cultivées. In. Maillard P., Bonhomme R (Eds) « Fonctionnement des plantes sous contraintes environnementales » Les Colloques , n° 93, Editions INRA , Paris pp 149-184.

[53] **FOURNIER M., STOKES A. COUTAND C, FOURCAUD T, MOULIA B. 2005.** Tree biomechanics and growth strategies in the context of forest functional ecology In Herrel A Speck T and Rowe N. (eds) Ecology and Biomechanics. Springer Verlag 54pp

[54] MOULIA B ;, **C. DER LOUGHIAN*, R BASTIEN*, L MARTIN, M RODRÍGUEZ, D GOURCILLEAU, A BARBACCI, E BADEL, J FRANCHEL, C LENNE, P ROECKEL-DREVET, J M ALLAIN, J M FRACHISSE , E DE LANGRE, C COUTAND, N FOURNIER-LEBLANC, J L JULIEN 2011.** Integrative mechanobiology of growth and architectural development in changing mechanical environments. In » P Wojtaszek (ed) « Mechanical Integration of Plant Cells and Plants Springer , Series: Signaling and Communication in Plants, Springer-Verlag GmbH Berlin Heidelberg (pub). Pp 269-302..

Keynotes talks and syntheses published in proceedings / Invited Conferences (15): selected examples :

[55] MOULIA B, FOURNIER-DJIMBI M. 1997. Optimal mechanical design of plant stems: the models behind the allometric power laws. Keynote Conference, 2nd International Congress on Plant Biomechanics Reading 7-12 Sept 97 (Plenary talk 45 min + abstract)

[56] **MOULIA B. 2003** Structural modeling in plant biomechanics. In Telewski F and Ewers F. (eds) Proceedings of the 4th International Plant Biomechanics Conference MSU East-Lansing (MI) USA July 2003 : p 48 (plenary keynote talk+abstract).

[57] MOULIA B. 2005 Growing up in a gravity, windy and crowded environment: biomechanics of regulatory and motor processes involved in plant growth and spatial display. In J Casas and G Jeronimidis (ed) Physico-chemical Ecology of Organisms, Conférence Jacques Monod, Roscoff (France) 24-27 September 2005 p 27. (plenary talk+abstract**).**

[58] **MOULIA B. – 2010.** Biomechanical Structure-Function Modelling of plant growth and habit (Integrative physics and biology) :6th International Conference on Functional-Structural Plant Models Univ California Davis CA , USA 12-17 spet 2010 : Invited keynote lecture

[59] **MOULIA B., 2010** Growing with winds and gravity : How can plants growand stand up for so long ? (Integrative Physics and Biology) Mechanics : Modeling, Experimentation, Computation MMEC Seminar, **M**assachusestts **I**nstitute of **T**echnology, Boston (MA) Sept 2010

[60] **MOULIA B. RUDNICKI M – 2011** Tree Hardening and Adaptation to wind : look forward. "Wind & Trees 6th International Conference IUFRO Section 8.03.06" Chris Petreson (ed) August 1-4 2011 Athens Georgia (USA) (invited "opinion talk"))

[61] **B MOULIA 2011** Plant growth as a wind and gravity driven process Gordon Conference on Soft Matter Physics H Jaeger and C Marchietti (eds) August 15-19 2011 Colby Sawyer Colledge New London, New Hampshire (USA) . (Invited talk)

[62] **B MOULIA 2011** From Shoot Gravitropism to Shoot Posture Control : what our models of Auxin response networks should explain Plant Biology Symposium M Bennett and T Baskin (eds) Oct 8-9 2011 , Univ of Massachusetts, Amherst MA (USA) . (Invited plenary talk)

[63] **B MOULIA 2012** Plant growth as a What are Plant Bio-Mechanics and Mechano-Biology ? Introductory lecture by the chairman of the 7th World conference on Plant Biomechanics PlantBioMech 2012 Clermont-Ferrand 20-24 August 2012

0ral communications and posters: 105

Scientific culture for the general public / selected examples

[64] **Muller X. 2007 Les arbres possèdent un vrai sens de l'équilibre (Trees have au true sense of equilibration)** (interview de B Moulia, Inra Clermont Ferrand France) . *Science & Vie* 1077 : 82-86

[65] **FOURNIER M., MOULIA B., GRIL J. 2008** Comment les arbres tiennent debout : la biomécanique In Hallé F et al. Aux Origines des Plantes,Tome 1 Chapitre 7. Fayard/Arthème. (Paris, France) Pp 228-239.

[66] **LAROUSSERIE D., 2011** Un vent d'équation dans les branches des arbres (a wind-flow of equations in tree branches) (interview of C Eloy, B Moulia, et E de Langre) Le Monde édition du 10/12/2011.
[67] **LAROUSSERIE D., 2012** Arbres : des forces et des formes (la mécanique des arbres**)** Le Monde Cahier des Sciences et Techno, Samedi 1er septembre 2012 pp4 :5
[68] **MOULIA B, 2012** La capacité de perception des plantes est fascinante (Interview by David Larousserie) Le Monde Cahier des Sciences et Techno, Samedi 1er septembre 2012 p 5
[69] **MOULIA B, 2012** Les plantes sont sensibles aussi bien aux informations extérieures qu'à celles, intérieures, qui les renseignent sur leur état. (interview by L Mangin) Pour La Science (French edition of Scientific American) Dossier N°77-Octobre-Décembre 2012 22 :23
[70] **NOTHIAS JL, 2012** Pourquoi les plantes poussent-elles droit ? Les végétaux sont dotés d'une sorte de «sixième sens» qui leur permet de percevoir leur forme et de la corriger. Le Figaro – Sciences - 08/12/2012 p18
[71] **LAROUSSERIE D,** 2012 Les plantes ont un penchant pour la droiture Le Monde Science & Techno - 08/12/2012 p2
[72] **SERGENT DENIS, 2012** Les végétaux ont le sens de leur forme et de leur posture La Croix 18/12/2012 (rubrique Science&Ethique– p16
[73] Interview of B Moulia by **MATHIEU VIDARD** in the popular science program of France Inter (major channel of the French National Broadcasting Corp.) « La Tête au carré " **20/12/2012** http://www.franceinter.fr/emission-la-tete-au-carre-les-arbres (45 min)
[74] **FISCHETTI A. 20**13 La conscience de soi chez la Tulipe Charlie Hebdo 1073 (9/01/2013) (rubriqe L'Empire des Sciences p 6)
[75] **LENNE C, BODEAU O, MOULIA M, 2013** Vrai ou faux :Les plantes communiquent-elles ? Pour la Science - n° 423 - Janvier 2013
[76] Le Tremble est doué de Mémoire. Science et Vie n° 1146 Mars 2013 (n° spécial Plantes : elles sont intelligentes ! ») p 57
[77] Les Arbres possèdent le sens de l'équilibre Science et Vie n° 1146 (n° spécial Plantes : elles sont intelligentes ! ») Mars 2013
[78] Interview of B Moulia by **MICHEL ALBERGANTI**, during the popular science talk-show « Science Publique » of France Cuture (cultural channel of the French National Broadcasting Corp) « Les plantes possèdent elles une véritable intelligence ? » http://www.franceculture.fr/emission-science-publique-les-plantes-possedent-elles-une-veritable-intelligence-2013-03-08