DOWNLOAD PDF BIOLOGY AND BIOTECHNOLOGY OF THE PLANT HORMONE ETHYLENE II

Chapter 1 : DBT BET- Biotechnology Previous Questions ~ Biology Exams 4 U

The inflorescence of the monoecious maize plant is unique among the Gramineae in the sharp separation of the male and female structures. The male tassel at the terminus of the plant most often sheds pollen before the visual appearance of the receptive silks of th the female ear at a lateral bud.

Production[edit] Global ethylene production was million tonnes in , [6] million tonnes in , [16] million tonnes in and million tonnes in To meet the ever-increasing demand for ethylene, sharp increases in production facilities are added globally, particularly in the Mideast and in China. This process converts large hydrocarbons into smaller ones and introduces unsaturation. When ethane is the feedstock, ethylene is the product. Ethylene is separated from the resulting mixture by repeated compression and distillation. Ethylene permeates the membrane and binds to a receptor on the endoplasmic reticulum. The receptor releases the repressed EIN2. This then activates a signal transduction pathway which activates a regulatory genes that eventually trigger an Ethylene response. The activated DNA is transcribed into mRNA which is then translated into a functional enzyme that is used for ethylene biosynthesis. Ethylene serves as a hormone in plants. Commercial ripening rooms use "catalytic generators" to make ethylene gas from a liquid supply of ethanol. Typically, a gassing level of to 2, ppm is used, for 24 to 48 hours. The ancient Chinese would burn incense in closed rooms to enhance the ripening of pears. In , it was discovered that gas leaks from street lights led to stunting of growth, twisting of plants, and abnormal thickening of stems. In , Frank E. Denny discovered that it was the molecule ethylene emitted by the kerosene lamps that induced the ripening. Ethylene production is regulated by a variety of developmental and environmental factors. During the life of the plant, ethylene production is induced during certain stages of growth such as germination , ripening of fruits, abscission of leaves, and senescence of flowers. Ethylene production can also be induced by a variety of external aspects such as mechanical wounding, environmental stresses, and certain chemicals including auxin and other regulators. The activity of ACS determines the rate of ethylene production, therefore regulation of this enzyme is key for the ethylene biosynthesis. Ethylene biosynthesis can be induced by endogenous or exogenous ethylene. ACC synthesis increases with high levels of auxins , especially indole acetic acid IAA and cytokinins. Ethylene perception in plants[edit] Ethylene is perceived by a family of five transmembrane protein dimers such as the ETR1 protein in Arabidopsis. The genes encoding ethylene receptors have been cloned in the reference plant Arabidopsis thaliana and many other plants. Ethylene receptors are encoded by multiple genes in plant genomes. Dominant missense mutations in any of the gene family , which comprises five receptors in Arabidopsis and at least six in tomato, can confer insensitivity to ethylene. Globally, the total area of saline soil was ,, ha and in continents like Africa, it makes up 2 percent of the soil. The osmotic pressure in the plant is what maintains water uptake and cell turgor to help with stomatal function and other cellular mechanisms. The plant hormone ethylene is a combatant for salinity in most plants. Ethylene is known for regulating plant growth and development and adapted to stress conditions. ETO2, Ethylene overproducer 2, is a protein that when mutated it will gain a function to continually produce ethylene even when there is no stress condition, causing the plant to grow short and stumpy. ERS1, Ethylene response sensor 1, is activated when ethylene is present in the signaling pathway and when mutated, it loses a function and cannot bind to ethylene. This means a response is never activated and the plant will not be able to cope with the abiotic stress. EIN2, Ethylene insensitive 2, is a protein that activates the pathway and when there is a mutation here the EIN2 will block ethylene stimulation and an ethylene response gene will not be activated. Mutations in these proteins can lead to heightened salt sensitivity and limit plant growth. Environmental and biological triggers of ethylene[edit] Environmental cues such as flooding, drought, chilling, wounding, and pathogen attack can induce ethylene formation in plants. In flooding, roots suffer from lack of oxygen, or anoxia , which leads to the synthesis of 1-aminocyclopropanecarboxylic acid ACC. ACC is transported upwards in the plant and then oxidized in leaves. The ethylene produced causes nastic movements epinasty of the leaves, perhaps helping the plant to lose water. Corolla development in plants is broken into phases from anthesis to corolla wilting. The development of the corolla is directed in part by ethylene, though its concentration is highest when the plant is fertilized and no longer requires the production or maintenance of structures and compounds that attract pollinators. This is evident as ethylene production and emission are maximized in developmental phases post-pollination, until corolla wilting. At the chemical level, ethylene mediates the reduction in the amount of fragrance volatiles produced. Fragrance volatiles act mostly by attracting pollinators. Ethylene production in corolla tissue does not directly cause the senescence of corolla tissue, but acts by releasing secondary products that are consistent with tissue aging. While the mechanism of ethylene-mediated senescence are unclear, its role as a senescence-directing hormone can be confirmed by ethylene-sensitive petunia response to ethylene knockdown. Knockdown of ethylene biosynthesis genes was consistent with increased corolla longevity; inversely, up-regulation of ethylene biosynthesis gene transcription factors were consistent with a more rapid senescence of the corolla. Stimulation of Arabidopsis hypocotyl elongation [38] In pollination , when the pollen reaches the stigma, the precursor of the ethene, ACC , is secreted to the petal, the ACC releases ethylene with ACC oxidase.

Chapter 2 : BIOLOGY Selected References on Plant Hormones and Phermones

Biology and Biotechnology of the Plant Hormone Ethylene II Edited by A.K. Kanellis Department of Pharmaceutical Sciences, Aristotle Vniversity of Thessaloniki.

In this article we will discuss about: History of Ethylene 2. Functions of Ethylene 3. It is a gaseous hormone which stimulates transverse or isodiametric growth but retards the longitudinal one. Businessmen dealing with storing and shipping of fruits had known quite early that a rotten or ripe fruit could trigger early ripening of other fruits present nearby. Cousins found that ripe oranges produced a volatile substance that hastened ripening of unripe bananas nearby. With the help of gas chromatography, R. Gane found that the ripening causing volatile substance was ethylene. Ethylene was recognised as a plant hormone by Crocker Ethylene is produced in plants from the amino acid methionine. It is formed in almost all plant partsâ€" roots, leaves, flowers, fruits, seeds. Maximum synthesis occurs during climacteric ripening of fruits and tissues undergoing senescence. Excess of auxin also induces ethylene synthesis. Many effects of excess auxin are actually the effects produced by ethylene. Ethylene inhibits longitudinal growth but stimulates transverse or horizontal growth and swelling of axis. It decreases the sensitivity to gravity. Roots become Apo-geotropic while stems turn positively geotropic. Leaves and flowers undergo drooping. The phenomenon is called epinasty. Seedlings develop tight epicotyl hook. It hastens the senescence of leaves and flowers. Abscission of various parts leaves, flowers, fruits is stimulated by ethylene which induces the formation of hydrolases. Ethylene promotes apical dominance and prolongs dormancy of lateral buds. It breaks the dormancy of buds, seeds and storage organs. It seems that formation of abscisic acid in the leaves under conditions of water stress is mediated through ethylene. Growth of Rice Seedling: Ethylene promotes rapid elongation of leaf bases and internodes in deep water rice plants. As a result leaves remain above water. In low concentration ethylene helps in root initiation, growth of lateral roots and root hairs. This increases the absorption surface of the plant roots. It aids in ripening of climacteric fruits and dehiscence of dry fruits. Climacteric fruits are fleshy fruits which show a sudden sharp rise of respiration rate at the time of ripening respiratory climacteric. They are usually transported in green or unripe stage. Ethylene is used to induce artificial ripening of these fruits, e. It stimulates flowering in Pineapple and related plants as well as mango though in other cases the gaseous hormone causes fading of flowers. This helps in synchronizing fruit set. Like auxins and cytokinins, ethylene has a feminizing effect on sex expression. The genetically male plants of Cannabis can be induced to produce female flowers in the presence of ethylene. The number of female flowers and hence fruit is enhanced in monoecious plants like Cucumber. Ethylene regulates a number of physiological processes. Therefore, it is widely used PGR in agriculture. The common compound used for obtaining ethylene is ethophen or ethrel which is 2-chloroethyl phosphonic acid. In aqueous solution, ethophen is readily absorbed and transported to various parts. It releases ethylene slowly. Kerosene lamps and hay were previously used for stimulating colour development and ripening of some fleshy fruits, e. The effect is due to ethylene. Ethylene lamps are now specifically used for this purpose. External supply of very small quantity of ethylene increases the number of female flowers and hence fruits in Cucumber. Sprouting of Storage Organs: Rhizomes, corms, tubers, seeds e. Excess flowers and young fruits are thinned with the help of ethylene, e. It allows better growth of remaining fruits.

Chapter 3 : Ethylene signaling : more players in the game

The inflorescence of the monoecious maize plant is unique among the Gramineae in the sharp separation of the male and female structures. The male tassel at the terminus of the plant most often.

Abstract Ethylene gas is a major plant hormone that influences diverse processes in plant growth, development and stress responses throughout the plant life cycle. Responses to ethylene, such as fruit ripening, are significant to agriculture. The core molecular elements of the ethylene-signaling pathway have been uncovered, revealing a unique pathway that is negatively regulated. Practical applications of this knowledge can lead to substantial improvements in agriculture. What is the plant hormone ethylene? The simple hydrocarbon ethylene C2H4 is a tiny gaseous molecule of great significance. In addition to being the most widely produced organic compound in the world used in manufacturing numerous products such as rubber, plastics, paints, detergents and toys , ethylene is a major hormone in plant biology. This volatile molecule mediates many complex aspects of plant growth, development and survival throughout the plant life cycle, including seed germination, root development, shoot and root growth, formation of adventitious roots, abscission of leaves and fruits, flowering, sex determination, and senescence of flowers and leaves [1 , 2]. Ethylene also mediates adaptive responses to a variety of stresses, such as drought, flooding, pathogen attack and high salinity. During flooding, for instance, ethylene induces the formation of aerenchyma tissue consisting of air-filled cavities for oxygenation. Ethylene is best known, however, for its essential role in the ripening of climacteric fruits, such as tomatoes, bananas, pears and apples. Placing a ripe banana in a paper bag containing unripe avocados, for instance, will hasten ripening of the avocados due to the accumulation of ethylene produced by the banana. Why is ethylene important to agriculture? Controlling ethylene responses is a major commercial enterprise due to the wide-ranging effects of ethylene on plants of agronomic and horticultural value [1]. Interestingly, responses to ethylene can be either harmful or desirable, depending on the species, developmental stage and concentration of ethylene. Costly methods are therefore employed to prevent the spoilage of fruits, vegetables and flowers during their transport and storage. These methods include the use of adsorbents and scrubbers to remove external ethylene, the use of chemical inhibitors to prevent ethylene biosynthesis and the use of chemical inhibitors e. Blocking ethylene perception during crop growth can also prevent abscission of leaves and flowers and yellowing of vegetables. On the other hand, ethylene is intentionally applied in situations where ethylene responses are desirable. Fruit ripening is typically induced pre- or post-harvest using ethylene or ethephon, which is a commercial liquid formulation of ethylene. Ethephon is also sprayed on pineapple plants to induce flowering and sprayed on wheat plants to prevent lodging bending over. How was the ethylene hormone discovered? Interestingly, the discovery of ethylene as a plant hormone came about due to the unintended presence of ethylene in the environment [1 , 3]. In the s, illuminating gas coal gas was widely used for lighting, and its leakage from gas lines was known to cause extensive damage to plants, such as the defoliation of trees around streetlamps. Near the end of the s, Dimitry Neljubow observed that etiolated pea seedlings exhibited a peculiar growth consisting of a shortened and thickened epicotyl and horizontal bending due to leaking illuminating gas in his laboratory. Neljubow determined that ethylene was the biologically active component of illuminating gas. This finding led to numerous studies on the wide-ranging effects of ethylene. In , Richard Gane discovered that plants synthesize ethylene; the correlation of ethylene biosynthesis with biological activity was a major step toward convincing researchers that a gas could be a plant hormone. In fact, ethylene was the first gaseous signaling molecule to be identified in any organism [4]. Is there anything different about a gaseous hormone? Ethylene is different from non-gaseous hormones in several ways. Ethylene moves within the plant by diffusion and is thought to be synthesized at or near its site of action, similar to the gaseous signal nitric oxide in mammals. Because ethylene can diffuse across membranes into nearby cells, there is no requirement for transporter proteins to deliver ethylene to target cells, and, in fact, no such transporters have been identified, though there is transport of the immediate precursor to ethylene, 1-aminocyclopropanecarboxylic acid ACC [5]. Ethylene is also not known to be conjugated or broken down for storage or deactivation; ethylene simply diffuses away from the plant. While managing a gaseous hormone is simpler for plants, it is more complicated for researchers. Ethylene experiments are generally carried out in contained environments, such as airtight chambers, although in some situations this can be circumvented by treating plants with ACC instead of ethylene. How do plants synthesize ethylene? Plants synthesize ethylene using a two-step biochemical pathway starting from S-adenosyl-L-methionine SAM [5 , 6] Fig. The ACS and ACO enzymes are each encoded by a multigene family whose members are differentially expressed in response to internal developmental cues and environmental stresses, such as wounding, flooding, drought, mechanical pressure and pathogen attack [6]. Ethylene biosynthesis is also controlled by ACC synthase turnover, which is regulated by phosphorylation [6].

Chapter 4 : Effects of copper and zinc on the ethylene production of Arabidopsis thaliana

The inflorescence of the monoecious maize plant is unique among the Gramineae in the sharp separation of the male and female structures. The male tassel at the terminus of the plant most often sheds p.

Ethylene in Plant Biology. The role of calcium in metabolic control. Synthesis and Chemistry of Agrochemicals, V. Chemical changes rapidly induced by folivory. Second Messengers in Plant Growth and Development. Signals in the wounded plant. Plant Responses to Foliar Attack. Hormones, Receptors and Cellular Interactions in Plants. Alarm systems in higher plants. Chemistry and physiology of the bound auxins. Veterans and Agent Orange: National Academy Press, Washington, D. Biochemistry of the phosphoinositides. Preparation and Mode of Action. John Wiley and Sons, Chichester, England. The Biochemistry and Physiology of Gibberellins. Physiology, Biochemistry, and Molecular Biology, 2nd ed. Kluwer Academic, Dordrecht, The Netherlands. Bios Scientific Publishers Ltd. Covers a wide range of topics related to the physiology and biochemistry of ABA including purification and measurement. Orobanche and other plant factors, pp. Do polyamines have roles in plant development? Growth regulating substances of plant origin, Phytochem. Molecular Mechanisms of Herbicide Selectivity. Isolation of Plant Growth Substances. Cambridge University Press, Cambridge. Amino Acids, Proteins and Nucleic Acids. Naturally occurring auxin transport regulators. Signals in the development of cryptogams. Biology and Biotechnology of the Plant Hormone Ethylene. Van Loon and D. Progress in Plant Growth Regulation. A New Class of Plant Hormones. Molecular genetic approaches to plant hormone biology. Target Sites for Herbicide Action. Sexual phermones in algae and fungi. Phillips Host plant influences on sex pheromone behavior of phytophagous insects. Annual Review of Entomology Plant Growth and Development. Hormonal regulatory systems in plants. Encyclopedia of Plant Physioloyy, N. Phytohormones and Related Compounds: A Comprehensive Treatise, Vol. The Biochemistry of Phytohormones and Related Compounds. Separate chapters cover not only the individual hormones and physiologically active substances but the control of major developmental processes. The biosynthesis and metabolism of cytokinins. Phenolic signals in cohabitation: Implications for plant development. Signals mediating symbioses Rhizobium and parasitism Agrobacterium, witchweed are discussed. Hormonal Regulation of Development I. Molecular Aspects of Plant Hormones. Phospholipids and Signal Transmission. The Plant Hormone Ethylene. Genetic analysis of hormone signaling. Chemistry, Activity and Function. Biochemistry and Physiology of Plant Hormones. Press, Milton Keynes, UK. Comprehensive Natural Products Chemistry. Integration of organismal development. Sexual Interactions in Eukaryotic Microbes. Plant Growth Substances Calcium and signal transduction in plants. Critical Reviews in Plant Sciences Various pheromones here called hormones are discussed in connection with the individual groups of organisms. Signal Perception and Transduction in Higher Plants. A new plant hormone. Role of salicyclic acid in plants. A natural inducer of heat production in Arum lilies. Signals and regulation in the development of Striga and other parasitic angiosperms. Principles and Practice of Plant Hormone Analysis. Oligosaccharide signals in plants: Turgorins--new chemical messengers for plant behaviour. Portrait of an "environmental hormone". An excellent summary of an emotionally charged topic. Plant Signals in Interactions with Ohter Organisms. Plant Physiologists, Rockville, MD. Experimental Morphogenesis and Integration of Plants. The biochemistry and the physiological and and molecular actions of jasmonates. Proceedings of the Phytochemical Society of Europe, Vol. Plant Physiology, 2nd ed. Chemistry of Plant Hormones. The development of plant hormone research in the last 60 years. Natural regulators of fungal development. Wiley and Sons, NY. Van den Ende, H. When is a hormone really a hormone? Signal transduction in vascular plants. Plant Growth Regulation Plant Growth Substances in Agriculture. Immunoassay of plant growth regulators. Antheridiogens of schizaeaceous ferns: Structures, biological activities, and biosynthesis. Fundamentals of Weed Science, 2nd ed.

Chapter 5 : Commercial Uses of Ethylene in Plants

As the plant develops, there is a phase transition [\3, 16] from the vegetative lateral buds to the reproductive lateral buds. This change in phase has been ascribed to genotypic control as evidenced in the differences among different genotypes in the initiation of the reproductive [I].

Determine the roles of phytochrome in detecting light and regulating the shade avoidance behavior of grasses. Screen for phytochrome A and B alleles which differ in their response to shade. Determine the effect of phasing of thermoperiods and photoperiods of floral initiation and function of the biological clock. Identify the mechanism or genes involved in perception of temperature signals. Test for an interaction between ethylene and gibberellins in the control of shoot growth, tillering and floral initiation. Give specific attention to rhythms in abundance or content of both ethylene and gibberellins. Determine the signal transduction pathway in programmed cell death leading to aerenchyma formation in maize and sorghum roots. Concentrate studies down stream from ethylene biosynthesis. Project Methods We will use the milo maturity genotypes of sorghum in experiments to determine whether night breaks or day length extensions influence flowering time uniformly regardless of the differences in flowering time gene activity. We will conduct experiments to alter phytochrome A and phtochrome B levels in wild type and a phyB null mutant. In addition we will quantify the mRNA and protein levels of the phytochromes and effects of treatments on ethylene biosynthesis and shoot development. Clues from these studies will direct us in screening alleles of phytochrome genes to identify the most useful variants to use in breeding programs to minimize shade avoidance and maximize root aerenchyma development. We will determine the effect of non-synchronous photo- and thermoperiods and temperature pulses at various times of the day, especially near the light dark transition times dawn, dusk , on seedling development, rhythmic ethylene production and floral initiation. After these responses are fully characterized, we will seek to identify the temperature sensing mechanism. Identification will involve screening microarrays against gene expression from control and temperature-signaled plants. We will also screen a sorghum genome mapping population and its parents for variability in response to temperature signals in order to recognize the major regulatory loci and locate them on the sorghum genetic map. These approaches should identify the number of major genes involved and give us an idea of their location. The microarray may, by chance, identify one or more genes involved in perception or subsequent signal transduction. Since constitutive aerenchyma development aids deep root penetration, we will extend studies to trace the signal transduction pathway leading to programmed cell death in grass roots. We will initially concentrate on enzymes involved in phospholipid metabolism and protein breakdown. We will apply treatments which promote programmed cell death and examine the time course of expression of key enzymes in the classes mentioned. The recessive allele, ma3R encodes a shortened version of the phytochrome B protein, and the protein is not detected in plant extracts. Initial experiments showed that the mutant plants strongly over-express phytochrome A; thus, in normal non-mutant plants, phytochrome B must regulate the phytochrome A gene. During , we conducted several experiments in which the photoperiods and thermoperiods were shifted strongly out of phase with each other. With phase shifts photoperiod forward of 3, 6, 9, and 12 hours, there was a progressive inhibition of shoot height and promotion of tillering for several milo genotypes. Additionally, severe phase shifts caused downward bending of the shoot. Three-hour phase shifts generally hastened floral initiation and longer phase shifts delayed it. In general, the phy B mutant was insensitive to phase shifts, although modest growth inhibition occurred. This project, over its life time, has made major discoveries in the roles of gibberellins, ethylene, and phytochromes in the growth and development of sorghum. Impacts This project has opened up the potential to significantly alter plant phenotype and responsiveness to the environment through alterations in the phytochrome system and the circadian clock. Approaches, which now appear feasible, include identifying alleles of the major phytochrome genes and genes in the branch pathways controlled by phytochrome action. These allelic genes can then be used in breeding programs or transformation experiments to produce genotypes with improved characteristics. The long term impact of this project will be to help move plant physiology from its focus on a few end products with regulatory activity hormones to focus more attention on plastic, interactive systems whose pathways relate to one another in ways previously obscure. Use of the phytochrome B mutant and circadian treatment have been unique features of this project which have revealed dramatic growth and developmental variability in grasses. Circadian ethylene synthesis in Sorghum bicolor. Expression and control of the system at the whole plant level. These experiments confirm and extend previous findings and a manuscript is being revised to include the new data. We also conducted plant growth chamber experiments comparing the effects of shifting the thermoperiod out of phase with the photoperiod. These experiments are still in progress. The results supported the hypothesis that in the phyB mutant line, phytochrome A perceives shade and regulates ethylene biosynthesis. The source of the substrate for the rhythmic production of ethylene was investigated by graduate student H. Gohil who found that rhythmicity persists in detached shoots but not roots. Substrate did not accumulate with time in roots nor was it depleted in shoots, all of which indicates that roots are not the sole or major source of ACC converted to ethylene in the shoot. A manuscript is in preparation. Such cultivars should have improved yield and improved drought resistance. Opportunities to improve adaptability and yield in grasses: Phytochrome A levels are higher in the phytochrome B-deficient sorghum line 58M than the wild-type M and treatments which elevate ethylene production and shoot growth elevate the levels of phytochrome A. This is the first report indicating a role of Phytochrome A in shade detection or circadian ethylene production. Impacts Overgrowth of shoots at the expense of root development and yield usually occurs in all grain crops. Understanding the role of the three monocot phytochromes and circadian ethylene production may uncover means to minimize shade avoidance in cultivars designed for modern production systems. Physiology and genetics of maturity and height. Origin, History, Technology and Production. John Wiley and Sons, Inc. Phytochrome A expression is regulated by phytochrome B and it may play a direct role in shade perception. In wild-type sorghum M dim, FR-enriched light will promote ethylene biosynthesis strongly if given at dawn but not so if given 3 hr later. The phytochrome B-deficient line responds similarly whether given the same light treatment at either time. These results suggest that phytochrome A, which disappears during the day in wild type plants, detects the "shade light" and signals increased ethylene production. We have found that the phy A genes are over expressed in 58M and not so in M. We have tentative evidence for higher levels of phy A in 58M than in M. A line of sorghum with phenotypic features basically opposite of those of M was discovered, and it fails to make detectable levels of ethylene in the shoot. Studies are underway to characterize ACC oxidase gene expression and ABA signal transduction to determine if either is responsible for the observed phenotype. Impacts Rhythmic ethylene biosynthesis is associated with shade avoidance behavior which maximizes shoot and leaf growth at the expense of root development and yield. If this study can provide effective options for managing these processes, the result could increase grain yields world wide. The mechanism of rhythmic ethylene production in Sorghum bicolor: Phytochrome B and ethylene rhythms in sorghum: Biosynthetic mechanism and developmental effects. Kluwer Academic Publishers, Dordrecht. Physiology and Genetics of Maturity and Height. Evolution, History, Production, and Technology. When wild-type is caused to produce peaks of ethylene due to dim, far-red light, it does not show peaks of ACC oxidase enzyme activity, but rhythmic peaks of ACC concentrations occur. Thus, the mechanisms are different, being ACC oxidase-based in the former case and ACC synthase-based in the latter case. Phytochrome B and the regulation of circadian ethylene production in Sorghum bicolor. Photoperiodic control of gibberellin metabolism and flowering in sorghum. Effect of gibberellin biosynthesis inhibitors on native GA content, growth and floral initiation in Sorghum bicolor. Plant Growth Regulation Annals of Botany The mechanism of rhythmic ethylene production in sorghum bicolor: Plant Physiology in press, due publication in March. Both manuscripts are in press and a third, detailing the effects of GA biosynthesis inhibitors on growth and flowering of sorghum is in an advanced draft. Rhythmic ethylene biosynthesis parallels expression of one circadian ACC Oxidase gene family member. Although no ACC synthase clone which cycles has been found, daily cycles in ACC concentrations have been observed suggesting either that ACC synthesis or conjugation is being regulated. Work on the linkage between ethylene biosynthesis and phenotype is underway. Nitrogen fertility and leaf age effects on ethylene production of cotton in a controlled environment. Plant Growth Regulation J. Effects of ring D-modified gibberellins on gibberellin levels in development and in selected Sorghum bicolor maturity genotypes. Plant Physiology In Press. Photoperiodic control of gibberellin metabolism and flowering in a phytochrome B mutant of Sorghum bicolor. Regulation of circadianly rhythmic ethylene production by phytochrome B in sorghum. Gibberellin GA biosynthesis inhibitors which act before ent-kaurene and GA12 were shown to promote tillering, inhibit shoot growth and delay flowering in maturity genotypes varying at the Ma3 loci. These effects were reversed by GA3. Inhibitors of the GA20 GA1 step had differential effects on 58M and non-ma3R genotypes, delaying flowering in the latter and not delaying or actually promoting flowering in the former. These compounds also failed to promote tillering in 58M. Extremely short 10h or long 18, 20h days altered rhythmic patterns of GA1 concentrations in non-ma3R and ma3R genotypes, respectively. The maturity genotypes produce ethylene in rhythmic, circadian peaks during the day mainly from shoot tissue. Ethylene peaks in 58M are usually 10X larger than non-ma3R genotypes. Establishing rhythmic ethylene production requires both photoperiod and thermoperiod signals. Effects of ring D-modified gibberellins on gibberellins levels in development and in selected Sorghum bicolor maturity genotypes. Plant Growth Regulation accepted. In vivo response to CO2 and in vitro characterization.

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Chapter 6 : The Seed Biology Place - Plant Hormones

The rapid advances in elucidating the mechanisms of ethylene perception and synthesis by plants, the signal transduction pathway, and ethylene control in transgenic plants have made the organization of a series of conferences dedicated to the plant hormone ethylene imperative.

Current status and future directions using transgenic plants to improve flower longevity of ornamental crops. Journal of Crop Improvement. Breeding new Coleus cultivars at The University of Florida. Regulation of volatile benzenoid biosynthesis in petunia flowers. Trends in Plant Science Making coleus better and brighter. Greenhouse Product News Ethylene-sensitivity regulates proteolytic activity and cysteine protease gene expression in petunia corollas. Journal of Experimental Botany Ethylene-regulated floral volatile synthesis in petunia corollas. The Plant Cell Ethylene signal transduction in fruits and flowers. Physiology, Biochemistry and Molecular Biology 3rd ed. Applications of Plant Biotechnology to Ornamental Crops. In Handbook of Plant Biotechnology - Volume 2: Chalcone synthase as a reporter in virus-induced gene silencing studies of flower senescence. Plant Molecular Biology Circadian regulation of the PhCCD1 Carotenoid Dioxygenase controls emission of beta-ionone, a fragrance volatile of petunia flowers. The central role of PhEIN2 in ethylene responses throughout plant development in petunia. Klee and A Dandekar Despite benefits, commercialization of transgenic horticultural crops lags. Factors affecting seed production in transgenic ethylene-insensitive petunias. Regulation of floral scent emission after pollination in snapdragon and petunia flowers. Microarray Analysis of Floral Senescence in Petunia. IOS Press, Amsterdam pp. Increased flower longevity in petunia through manipulation of ethylene signaling genes. Plant Biotechnology and Beyond: Kluwer Academic Publishers, Dordrecht pp. Manipulation of ethylene synthesis and perception in plants: The ins and outs. Ethylene biosynthesis and sensitivity varies among geranium Pelargonium Xhortorum Bailey cultivars. Leaf senescence in a non-yellowing cultivar of chrysanthemum Dendranthema grandiflora. Effect of pollination and exogenous ethylene on accumulation of ETR1 homolog transcripts during flower petal abscission of geranium Pelargonium x hortorum L. Horticultural performance of transgenic ethylene insensitive petunias. Root formation in ethylene insensitive plants. Horticultural performance of ethylene insensitive petunias. Kluwer Academic Publishers, Dordrecht. Influence of pine bark on the efficacy of different growth retardants applied as a drench. Influence of media components on efficacy of paclobutrazol in inhibiting growth of broccoli and petunia. A dominant mutant receptor from Arabidopsis confers ethylene insensitivity in heterologous plants.

Chapter 7 : Ethylene: History, Function and Uses

Biology and Biotechnology of the plant hormone ethylene II Biology and Biotechnology of the plant hormone ethylene II Bouzayen, Mondher The major role the plant hormone ethylene plays in a variety of plant developmental processes has made it the focus of intense research during recent decades.

Hormonal interactions during seed dormancy release and germination Figure 2. Schematic representation of the interactions between the gibberellin GA , absisic acid ABA and ethylene signaling pathways in the regulation of seed dormancy and germination. The model is mainly based on Arabidopsis hormone mutant analyses, the positions of some components are speculative, and details are explained in the text. Promotion or inhibition is indicated by thick arrows and blocks, respectively. Interactions based on extragenic suppressor or enhancer screens are indicated by thin grey lines. Small black arrows indicate enhancement up-arrow or reduction down-arrow of seed dormancy and small blue arrows indicate enhancement or reduction of seed ABA sensitivity upon mutation of the corresponding protein. Corresponding hormone mutants of Arabidopsis thaliana: Ethylene and pea seed germination Pea seeds are non-endospermic: The embryo of mature seeds of Pisum sativum consists of the embryonic axis and the cotyledons. References on pea seed development: Drawing of a mature pea Pisum sativum seed, a typical non-endospermic seed with storage cotyledons and the testa as sole covering letters. LeubnerDrawing Ethylene and pea seed germination: Increased ethylene evolution accompanies seed germination of many species including P. We found that Ethylene promotes ethylene biosynthesis during pea seed germination by positive feedback regulation of 1-aminocyclopropanecarboxylic acid oxidase ACC oxidase; ACO. Ethylene-independent signalling pathways regulate the spatial and temporal pattern of ethylene biosynthesis, whereas the ethylene signalling pathway regulates high-level ACO expression in the embryonic axis, and thereby enhances ethylene evolution during seed germination. Ethylene-biosynthesis and -responsiveness are localized to the elongation and differentiation zones of the pea radicle. We found a calcium requirement for ethylene-dependent responses involving ACO in radicle tissues of germinated seeds. Tissue-specificity of Ethylene biosynthesis in germinating pea seeds. An early onset and sequential induction of ACC biosynthesis, Ps-ACO1 mRNA and ACO activity accumulation and ethylene production were localized almost exclusively in the embryonic axis, but not in the cotyledons of germinating pea seeds. Within the embryonic axis ethylene-biosynthesis and -responsiveness are localized to the elongation and differentiation zones of the radicle.

Chapter 8 : - NLM Catalog Result

Request PDF on ResearchGate | Biology and Biotechnology of the Plant Hormone Ethylene II | Selenium is an essential element for animal nutrition [3], but the metabolic significance of Se in plants.

Chapter 9 : Ethylene - Wikipedia

Floriculture Biotechnology Publications. Shibuya, K. and D.G. Clark in press. Ethylene: Current status and future directions using transgenic plants to improve flower longevity of ornamental crops.