# THE PROSPECT OF MOLECULAR APPROACHES IN FUNDAMENTAL RESEARCH AND MANAGEMENT OF INSECTS

## ROLUL VOLATILELOR EMISE DE PLANTE ÎN „PREGĂTIRE" (PRIMING) LA ATACUL ERBIVORELOR

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***Abstract***. *Jasmonates are the main signals in plant defence against herbivores, also being new weapons in plant defences. Oral secretions of insects are molecular patterns that trigger tritrofic relationships plant-pest-entomophagous, by releasing volatile. Priming plant by influence of volatile or internal signals produced by jasmonates, provides an increased resistance to pest attack. Only molecular approach in fundamental researches and in the management of the pests, assures knowledge of life phenomenology between plant and insect.*
***Key words:*** *biotic stress, parasitoids, priming.*

***Rezumat***. *Jasmonații sunt principalele semnale în apărarea plantelor împotriva erbivorelor, de asemenea, fiind considerate arme noi în apărare de către plante. Secretiile orale ale insectelor sunt modele moleculare care determină relațiile tritrofice plantă-dăunător-entomofagi, prin eliberarea volatilelor. Amorsarea de plante prin influența semnalelor volatile sau a celor interne produse de jasmonați, oferă o rezistență crescută la atacul dăunătorilor. Abordarea molecular nu numai în cercetările fundamentale ci și în gestionarea dăunătorilor, asigură cunoașterea fenomenologiei vieții între plante și insecte.*
***Cuvinte cheie.*** *Stress biotic, insect parasite, "priming"*

## INTRODUCTION

Plants have developed various strategies for defense against phytophagous and pathogens. Although some of these strategies are constituents, present all the time, others are induced phytophagus attack (Frost *et al.,* 2008). Defenses induced must be adaptive they are costly to implement and there is a variability spatial and temporal phytophagous and pathogens (the plants do not always experience the attack), defending differentiated against various enemies (the defense against one increases susceptibility to other).

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The offset this vulnerability at some plants has a first specific training in relation to environmental signals that indicate the likelihood increasing attack. In defense plant "preparation" (priming) is a physiological process that makes the plant to respond more quickly or aggressively to biotic or abiotic stress future. This training acquired is called "ready state" (primed state). Training may be initiated as a response to environmental signals that indicate the likelihood increase biotic stress, but may persist ready state due to residual effect, following initial exposure to stress. A classic example, a pest induce hypersensitive response, but induction is more effective if the plant has experienced a previous attack. The trees in the ready state persists in several seasons, the phenomenon is called "delayed-induced resistance", which can accelerate the induction of resistance in the presence attacks.

Any signal indicating the presence phytophagus can be a start for induction training. Most signals are usable plant volatiles induced phytophagus (HIPVS) and a subset of volatile organic compounds (VOCs) emitted in response. Finally internal signals are transmitted through the vascular system, or externally by plant volatiles. In case of injury in plants, information is transmitted through the phloem and signaling molecules xilem transported from the place attacked, systems, regions unchallenged. Systems can effectively transmit information signals from the attack site (wound) in regions vulnerable to attack. Signaling internal systems is performed Jasmonic acid (JA) and its conjugated forms.

In the following we present experiments that clarifies the role of plant volatiles in the preparation, plant-herbivore enabled tritrofice relations and parasite-dependent gene sets JA.

Engelbert H et al. (2007) mentions that regulates volatiles at least three genes responsible for serving platform octadecanoidă Jasmonic acid. Maize plants friendly, wounds exposed to volatiles from *Spodoptera littoralis*, regulate the expression of genes defense is enabled for new volatile emissions. Corn rootworm prepared by feeding the growth rate (RGR) was lower parasitoid wasp *Cotesia marginiventris* and was attracted by the abundance of volatiles released by plants activated. The preparation can influence the dynamics of mediation combinations defense phytophagus by direct or indirect defenses, via thirdtrophycs interactions.

## MATERIAL AND METHOD

The first successes in handling the emission of volatile insect repellent

It has been shown that it can manipulate the emission of volatile signals by maize roots attacked by worm *Diabrotica virgifera* western roots, attracting predatory nematode Heterorhabditis megidis (Hiltpold and Turlings, 2008). Corn and ancestral lines in Europe are very attractive at this nematode through the issuance of (E) -β-caryophyllene, but American varieties have lost this signal, the nematode larvae control agent. To restore nematode attraction, corn lines were converted to emission constituent (E) -β- caryophyllene, significantly reducing the attack.

Since the composition of volatile terpenoids dominate HIPV, were the first targets for manipulation is obvious that increasing the attractiveness of crops for

natural enemies of pests calls for targets specific compounds. Recent publications have shown that it is possible to manipulate genetically engineered production of attractants. Kappers *et al.* (2005) brought strawberries FaNES1 gene (a gene synthesis linalool / neriodol) *Arabidopsis thaliana* to launch the (3S) - (E) -nerolidol attracting dust mite predators. In other studies, introduced a gene maize TPS10 (terpenes synthase) in A.th. for sesquiterpene volatile issue, launched the attack caterpillars (Schnee et al., 2006). The transformed plants were more attractive to females parazitoizii, who used corn for finding host volatiles, but after the wasps were paired with host plant volatiles. A third notable achievement is the introduction synthase gene in Arabidopsis (E) -B-farnesene, issuing sesquiterpenic producing aphid control, having a role repellent and attract enemies (Pickett *et al.,* 2006).

The induction of protease inhibitors (PIs) by acid Jasmonic . Ths is a regulators of protein, plays an important role in defending plants with the target insect's digestive canal in digestion and absorption disturbance (Felton, 2005). In turn, herbivores induce post-translational modifications of the proteins, inhibiting their defensive functions by increasing their stability in the stomach. Microarray technology has revealed the genes encoding these proteins palette adjusted grazing.

The protease inhibitors (PIs) or proteins caused by arthropod attack (AIPS) can be adjusted to multiple hormonal signaling, including Jasmonic acid, salicylic acid and / or ethylene (Zhu *et al.,* 2008). Numerous research confirms jasmonates role in the induction of protease inhibitors to attack by herbivores or volatiles emitted by neighboring plants.

Farmer and Ryan (1990) specifies the communication between plants using Meja volatile induce synthesis of protease inhibitors in the leaves. These defensive responses, local or systemic were awarded before that date, ethylene volatile. Methyl jasmonatul applied to the surface of the tomato leaves induces the synthesis of protease inhibitors defense and neighboring plants.

Induction of protease inhibitors (PIs) in wounds, which harm the stomach digestive proteases insects, is the best example of defensive proteins whose synthesis is closely linked to acid signaling Jasmonic (Steppuhn and Baldwin, 2007). Other defensive proteins polyphenol oxidases are dependent Jasmonic acid, threonine deaminases, arginases and stored vegetative proteins. Many other proteins with activity against insects stability and proteases activity in the digestive system. All these components of metabolic should be seen not as separate entities, which operates in a synergistic defense system.

## RESULTS AND DISCUSSIONS

The negative performance of PIs are caused by overproduction phytophagus stomach digestive proteases insects, essential amino acids depleting and reduce growth. Reducing combinations increase may be due to toxic effects of anti-nutritive or antifeedant. For example, entering the wounds polifenoloxidaze act as PIs. Plant enzymes can exert anti-nutritional effects on insects by disrupting homeostasis phytophase amino acids in the digestive tract, but can be extended to other classes of plant-derived nutrients, including lipids, carbohydrases and vitamins.

The study of plant-insect interactions, especially in systems multitrofice offers the possibility to identify semiochemicals, can induce plant defense

responses. In this respect identified cis-jasmonats with great effects and persisting regulation of gene expression associated with plant defenses (Pickett, 2008). Grains have a wide range of induction levels of resistance caused by cis-jasmonate. Some varieties have proven resistant to aphids, thereby identifying a compound jasmonate induced by cis-6-methyl-5-hepten-2-one, the repellent effect at the same time, the attraction of parasitoids. In wheat, the increase of production of the hydroxamic acid (benzoxazinoidă) contribute to its resistance, and this is exploited by the breeding program.

Resistance is enabled induced chemical plants, pathogens and plants phytophagus and prepare for a better defense, joining in good agricultural practices. Tested resistance induction usefulness in combating biotic agents and increase plant productivity by treatment with BIONR, OxyxomTM, or statements Reynoutria MessengerR sachaliensis- MilsanaR and BTH. Also in the induction of resistance to attack cis-jasmonatul bring phytophagus agricultural plant for resistance levels.

By presenting the summary of the signaling mechanisms and inducible defenses in plants at the molecular level is found jasmonats, as coordinators of these mechanisms play an important role in this direction and deepening this research from a fundamental perspective will solve practical issues of management. Undoubtedly that this research approach can not be achieved only in broad team of researchers at the Molecular genetic, biochemical, metabolic, etc. proteonomic will highlight the molecular mechanisms accuracy and ability to change in the interests of preserving the integrity of the plant. Knowledge of molecular phenomena can not be achieved without the use of proper laboratory techniques, improved in recent decades, supported by bioinformatics.

The observations at the macro level, biometric evaluations, weight can not satisfy us. Approach "omice" “genomice, proteonomice, lipidonomice, metabolomice, transcriptomice” are necessary for understanding biological phenomena. Using the genomes sequenced plant, *Arabidopsis thaliana* as tomatoes, tobacco etc, the mutant gene silencing or overexpressing may clarify the signaling chain and biotic stresses preparedness measures and inducing defense.

The researches present and future to establish signaling pathways of the biotic environment of receptor proteins stimulated the factors connecting the nodes of interference of various plant hormones, to decision makers in triggering transcripts (activation sets genes dependent on plant hormones, plant defense default) in the production of secondary metabolites involved in defense.

In preparing students during the license, but especially by masters must increase the proportion of subjects with levels of molecular genetic approaches, biochemical, environmental, etc., for a real knowledge of the phenomena of life and no surface.

## CONCLUSIONS

1. Jasmonates (JAS) are the main signals for adjusting resistance to phytophagous insects, representing new weapons and rapid responses against insect attack produced.

2. Plants can recognize provocateurs derived from feeding herbivores, which is associated molecular patterns phytophagus (HAMPs) compounds flags that can trigger defense. Chemical instigators of oral secretions of insects form plays an important role in the qualitative and quantitative responses of plants.

3. Biotic receptors signals by connecting factors mediating or regulating plant hormones biosynthesis genes and their expansion biosynthesis of secondary metabolites mediate transcription. These events include a reconfiguration transcriptomic with changes in gene transcription levels of defensive and growth; release of volatile organic compounds (VOCs) that functions as an indirect defense and disturbing accumulation of secondary metabolites herbivores or pests nicotine, trypsin and protease inhibitors (TPIs).

4. The secretions of herbivores triggers a plant-herbivore relationships tritrofice-entomophagus through the release of volatiles from the leaves injured, attracting entomofagii. Also, plants can recognize buildup triggering relationship tritrofică plant ponte-deposit ponte- entomophagus oofagi. Practical applications of management can be achieved in under tritrofice relations, introducing genes that increase the number of manufacturing certain volatile entomophagous etc.

5. The induction of resistance in the attacks include direct defense by the synthesis of toxic chemicals or tasteless and indirect defenses by producing volatile or honeydew nectar. Some chemical changes in the leaves injured acts as signs of injury in areas of the plant are not challenged or neighboring plants. Recognising these signals initiate preparation, which included changes at the molecular level, leading to the so-called state prepared leaves unchallenged. Leaves in ready state are able to respond more quickly and vigorously attack herbivores. Induction of resistance is more costly in energy terms, than plants pregătită.a state.

6. Jasmonates plays an important role in the production of protease inhibitors, resulting in overproduction of digestive proteases in the insect stomach, depleting essential amino acids and reduce growth. Reducing combinations increase may be due to toxic effects of anti-nutritive or antifeedant.

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