



Phytiatry (Plant Medicine):
A University science with educational priorities and professional challenges in modern world agriculture

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Outline of the presentation

Clarifications of the terms Phytiatry/PlantProtection/Plant health and Focuses on Phytiatry (Plant medicine)

Do we need it? Could it exist as a discrete science ? YES

Mainly because of the vast difficulties in Pest and Disease Diagnosis/Management and Pathogen and Pest Dispersal and for establishing a new attractive profession.

Undergraduate and Post graduate University Education

Current efforts and initiatives

Role of relative Scientific Societies around the globe

PHYTIATRY/PLANT MEDICINE

- *I will analyze a variety of concepts by*
- *presenting arguments using also pictures which*
- *emphasize the fundamental particularity of all Phytiatry sciences*
- *Proving the requirement for upgrading the education and specialization on basic and applied disciplines of Phytiatry*
- *and demonstrating the necessity of Phytiatry in European and world agriculture as a new profession of plant medicine doctors*

PHYTIATRY

since I strongly believe that the term Plant or Crop Protection must be replaced by Phytiatry

- *I will focus on concepts used broadly but occasionally erroneously to*

1. Clarify the confusion over the proper meaning of the scientific terms Plant protection, Plant health and Phytiatry

2. Designate discrepancies among them

PHYTIATRY

3. Demonstrate the significant role that Plant Medicine Doctors can play today and in the future and eventually

4. Bring out the need for establishing Phytiatry as new University multidisciplinary science

PHYTIATRY :

an emerging concept covering sciences far beyond those involved in Plant protection and Plant health

- *What is the rationale?*

Why

Phytiatry and doctors in Plant Medicine and NOT

Plant Protection and Plant protectionists

PLANT PROTECTION

Plant protection is a rather

- artificial-technical concept, coined out as a term related to the control of plant pests and diseases
- Generally it deals with the use of chemical means, cultural practices or state regulations for pest control.
- Thus, plant protection refers mainly to applied Plant Medicine aspects

PLANT HEALTH

Plant health

refers mainly to national or international rules and legislations

- Protecting safety of plant food
- Securing the health and quality status of crops
- Regulating the trade of plants and plant products
- Supervising the sale and use of plant protection products, or pesticides and
- Setting standards to monitor and control pesticide residues

PHYTIATRY

On the contrary the term

- Phytiatry as Medicine in Humans, is directly correlated with all aspects of basic and applied topics of various multidisciplinary Plant Medicine sciences
- The sciences that deal with basic and applied research and implementation of methods, techniques and tools for the diagnosis, prevention, therapy, dispersal or protection from plant diseases and pests and generally management of plant pests and diseases

PHYTIATRY

- Obviously ALSO includes all measures and regulations concerning Plant protection and Plant health necessary to manage pests and pathogens
- Consequently the terms Plant Protection or Plant Health are not similar and broad enough to cover all aspects of Phytiatry

PHYTIATRY:

Over 40 different scientific disciplines listed below could be included in Phytiatry

1. Phytopathological Mycology
2. Bacteriology
3. Virology
4. Molecular Plant Pathology
5. Epidemiology
6. Agricultural Entomology
7. Agricultural Zoology
8. Nematology
9. Weed Science
10. Phytopharmacology
11. Breeding for disease and pest resistance
12. Disease and pest Diagnosis
13. Plant Protection Strategies
14. Identification of new diseases, pests and weeds
15. Disease and Pest Monitoring
16. Molecular Biology
17. Biotechnology
18. Ecotoxicology
19. Environmental Protection
20. Plant Physiology and Biochemistry
21. Plant Breeding
22. Select varieties for treating diseases and enemies
23. Experimentation and Biometrics

And more

1. Basic knowledge of general and specific Pomology,
2. Viticulture,
3. Horticulture,
4. Floriculture,
5. General and Special Agriculture,
6. Forestry
7. Farming systems
8. Soil Science,
9. Soil management /
10. Fertilizers - Nutrition
11. Multiplication of seed and plant breeding
12. Harvesting process and impacts on Plant products
13. Ecology and landscape architecture
14. Communication and information
15. Socio-economic impact of applied plant medicine
16. Quality production
17. Consumer protection
18. Work safety
19. Production Systems
20. Stored-Product Protection,
21. Harvest Processing, etc.

Plant protection is just an applied part of the multidisciplinary science of Phytiatry

Here are selected arguments clarifying the occasionally misleading and inadequate term of **Plant Protection** as a term of general use

Argument -1

International Plant Protection Congresses How did they evolve?

The first IPPC was held in Louvain, Belgium in 1946
Congresses up to 1979 focused principally on new means of controlling insects with discussion relating to the chemical control of plant diseases

The Congress held in Washington, DC in 1979 was the first organized by a multidisciplinary group with emphasis on integrated pest management (IPM).

IPPCs have provided a forum for plant protection scientists to communicate and discuss important problems and new discoveries related to crop losses due to pests and their management.

Obviously this is just Applied Phytiatry (Plant Protection)

Argument -2

*Scientific views of academic people
concerning differences among the terms*

In Leuven, Belgium

the Late Prof. C. Van Assche in Agro-Ecosystems,
Analyzing the theoretical and applied concepts of
chemical soil disinfestation

- used the term of **Plant protection**
 - as part of the **Phytiatry**
- Today in the University of Leuven a course entitled:
 - **Principles of Phytiatry** is taught

Argument -3

- The late Prof. Dekker, J.
 - of the University of Wageningen
redefining the concept of plant protection
(International Symposium on **Crop Protection**, Gent (Belgium), 1988
- Introduced the terms
Phytiatry and Phytopharmacy
instead of **Plant protection** to cover all aspects of
Phytiatry including research and application

Argument -4

***Plant Medicine Program**
University of Florida since 1999*

Late Prof. George Agrios, the founder of the
PH.D. in Plant Medicine program in Gainesville, Florida

*did not use the term plant protection
but introduce the term **Plant Medicine***

Argument -5

Similarly in The University of Nebraska

- **Doctorate in Plant Health and not in Plant Protection**
- to train practitioners rather than researchers in entomology, agronomy, plant pathology and soil science

Argument -6

In Bari Italy

Medicina delle Piante and not Plant protection

- Corso di Laurea Specialistica in Medicina delle Piante
(Facoltà di Agraria Università di Bari)

Argument -7

AGROINNOVA, using the *proper* Italian term refers to Phytiatric congresses



Argument-8

Doctor of Plant Health

A new professional program for plant practitioners

Selected Examples of plant diseases where the meaning of Plant Protection is not valid and replaced by Plant therapy such as..

- Deficiencies
- Phytophthora foot rot
- Downy and Powdery mildews
- Recovery of Verticillium wilt of olive
- Thermotherapy of plant material infected by viruses and viroids
- And many more.....

Plant Health Alternatives, LLC
Alternative Health Care for Trees and All Plants



Stressed catalpa



Cured catalpa

Furthermore

International organizations

relevant to Plant Protection and Plant Health

- The role of the operation of several relevant international organizations,
- demonstrate the restricted meaning of the terms Plant Protection and Plant Health
- compared to the broad term of Phytiatry

EPPO

European and Mediterranean Plant
Protection Organization

- EPPO European cooperation in plant health
- Protect plants, develop international strategies against the introduction and spread of dangerous pests and to promote safe and effective control methods
- Provide information related to standards and publications on plant pests, phytosanitary regulations, and plant protection products

Several international organizations deal with Plant Health



- But this is not *Phytiatry*
- Obviously the relationship between the terms and the scientific contents of Phytiatry and Plant health
- is something similar to the relationship of the scientific contents of Human Medicine and Public health

APHIS

Center for Plant Health Science and Technology

- *Plant Health Science and Plant Protection and Quarantine (PPQ).*
- Provides scientifically valid regulatory and policy decisions.
- Provides practical guidance and tools for the identification, management and exclusion of pests and plant diseases.

EFSA

European Food Safety Authority

- *PLH - Plant Health Panel*
- deals with organisms posing a risk to plant health.
- These include plant pests which threaten crop production and species which threaten biodiversity.

Plant protection and Plant Health are applied aspects of the Phytiatry

- Consequently 'Plant Protection' is a rather narrow term, thus unable to cover the concepts of protection, recovery and therapy in plant disease and pest management for both educational and practical purposes.
- Indeed fundamental or applied research, which contributes to better understanding plant health problems and inventing means or methods of managing them, are not just plant protection.
- Furthermore, problems in studying nature, biology, ecology and obtaining correct identity of the causal agents, pests or plant pathogens, which create vast difficulties in the diagnostics, must not be considered simply as plant protection.

PHYTIATRY: EDUCATION

UNIVERSITY STUDIES

1. UNDERGRADUATE STUDIES
2. POSTGRADUATE STUDIES
Masters in Europe or elsewhere
or PhD in USA or elsewhere

UNDERGRADUATE STUDIES

Specific University studies in Phytiatry

- Today there is a scientific gap in *Phytiatric sciences* mainly at the undergraduate level
- There are few cases of Universities in the world offering first University degree, such as..
- Bachelor in Plant Protection and Integrated Pest Management in California State University - Fresno and in Belgrade, Serbia and Plovdiv, Bulgaria

POSTGRADUATE STUDIES

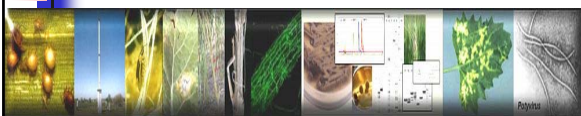
- *Masters in Europe or elsewhere*
- *or Ph.Ds. in USA or elsewhere*
- **WRONG USE OF THE TERMS**

Master in Plant Protection and Plant Health are just part of the Phytiatry

- However Several Universities around the globe offer master courses under the title of Plant or Crop Protection and in several cases students are dealing with molecular research aspects as part of the request of the degree but **this** is not Plant Protection only

A FEW EXAMPLES

GOETINGEN New Master program: CROP PROTECTION



Started: October 2010.
This master program is a job and research oriented, interdisciplinary program. Graduate students **have the opportunity to learn about the basic and applied aspects** of research of a broad range of disciplines including plant pathology, nematology, entomology, virology, weed science, pesticide use, legislation and toxicology, **molecular phytopathology**, **mycotoxin** research, plant nutrition and plant breeding.

British Universities: Postgraduate Crop Protection courses

University Of Dundee 1 course
Harper Adams University College 3 courses
University Of Reading 6 courses
Imperial College London 2 courses

- Postgraduate Crop Protection courses
wrong name
- **Could we call the post graduate courses in medicinal schools just master's degree in public health?**

PHYTIATRY

- Before referring to other existing Masters or Ph.D. courses specifically in Phytiatry around the world
- I am going to refer in detail to the negative consequences on agriculture which are apparent today due to the gap of this scientific specialization



**Do we have Phytiatry specialists
able to diagnose
Plant health Problems**

- **MANY CONSIDER THEMSELVES AS SPECIALISTS**
- **but**
- **Are they, the so called plant doctors, scientifically reliable?**
- **Are they all eligible for the job?**
- **Are they available at the actual sites of plant production today?**

Empirical plant doctors.....in the 21st century ?

- Several people consider that services in *applied phytiatry* could be still based on a general crop production knowledge, simply increased and specialized through the everyday practice.
- But this service is occasionally based on inadequate superficial knowledge, on empirical information or on unethical attitude of practitioners.
- Unfortunately *leading* to tragic diagnosis and proposals for management with negative financial and environmental impacts.

Diagnostician plant doctors today

- *Plant protection stations,*
- *University labs or*
- *extension plant pathologists or entomologists could offer basic diagnosis*
- *But today specialized professionals in Plant Phytiatry particularly in countries with diversified agriculture are missing, thus creating problems in plant diseases and pest diagnosis and management WHY ?*

BECAUSE

Similarities in symptom expression in plants CAUSED BY different pests or pathogens

- *Symptom recognition in plant diseases or identity of pests, are fundamental tools in clinical or laboratory plant disease and pest diagnosis and management.*
- *However, Symptom recognition becomes even more difficult due to the vast number of non-parasitic diseases and plant stress problems causing indistinguishable symptoms.*
- *This is more complicated with the variability of cultivated plants and cropping systems around the globe.*

NEGATIVE CONSEQUENCES

Numerous cases in every day agriculture need scientists with broad background and experience on *Applied Phytiatry*

- *Dutch elm disease / fungi and insect vectors*
- *Insects vectors of viruses, viroids and phytoplasmas*
- *Infectious degeneration of the vine / Nematodes / Glyphosate*
- *Complex symptoms attributed to viruses, toxicities or deficiencies*
- *Bacterial diseases and insects*
- *Rhizomania (Virus) and Polymyxa betae (protozoa) etc.*

PHYTIATRY

Problems in correct diagnosis

- *Examples of phytiatric problems arising from*
- *1. Wrong diagnoses;*
- *2. Failure to diagnose;*
- *3. Unable to distinguish between the causes of similar symptoms;*
- *4. Ignorance of the nature and biology of the pathogen;*
- *5. Quarantine Pathogens and Pests*

Plant disease and pest Diagnosis and consequently Management

- *Difficulties related with the vast number of problems in Plant disease and Pest diagnosis*

Examples of Phytopathological problems arising from wrong disease diagnosis

- *Similar pests problems could be also given*

1. Wrong diagnosis

Strong Winds
Causing
Stem wounds
BUT AGRONOMISTS
SUGGESTED SPRAYS
FOR AN UNKNOWN
DISEASE!!!!

Just one out of thousand
cases of wrong disease
diagnosis



Several other cases of wrong diagnosis-1

1. Kiwifruit plant (suspect *Phytophthora*) but in the lab it was diagnosed as *Meloidogyne sp* infection.
2. Grapevine (suspect bunch dry rot)) but in the lab it was diagnosed as *lighting injury*.
3. Apricot (suspect *incompatibility between scion and rootstock*) but in the lab it was diagnosed *Eutypa lata*
4. Apricot (suspect *Phytophthora*). but in the lab it was diagnosed *Eutypa lata*.

Several other cases of wrong diagnosis-2

- 5. Apricot (suspect *incompatibility between scion and rootstock*) but in the lab it was diagnosed *Verticillium dahliae* infection.
- 6. Plums (suspect *plum pox*) but in the lab it was diagnosed damage by *Grapholita funebrana* ꝫ *Cydia funebrana*.
- 7. Peach tree (suspect *incompatibility between scion and rootstock*) but in the lab it was diagnosed *Candidatus Phytoplasma pruni* causing disease known as *X-Disease*.

2. Failure to diagnose on the spot


Simply because all cases are not
Botrytis cinerea, *Taphrina deformans* or




apple scab to be easily identified.....



Pepper
Downy mildew or powdery mildew?
need different chemicals to be treated



Melon field cultivation
Verticillium dahliae, Fusarium oxysporum f.sp. niveum or Olpidium bornovanus?
A specialized institute is needed, not always available



Insect damage... toxicity?
Experience is needed




Carrots
Psila rosae, Wireworms or Pythium

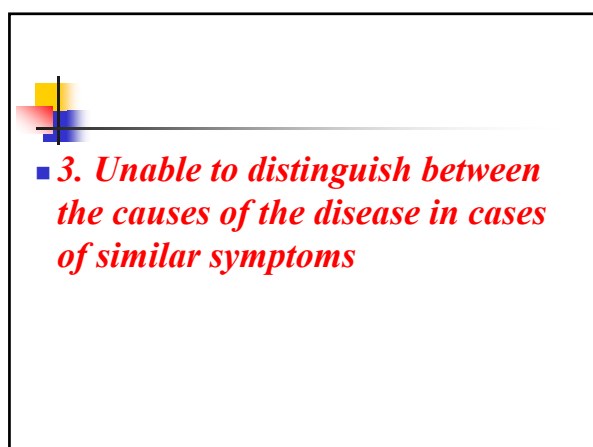
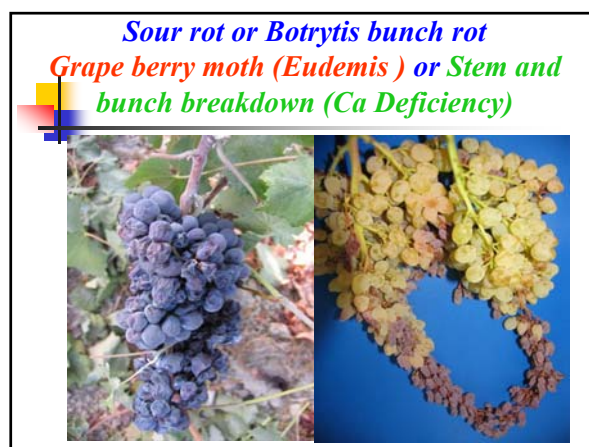
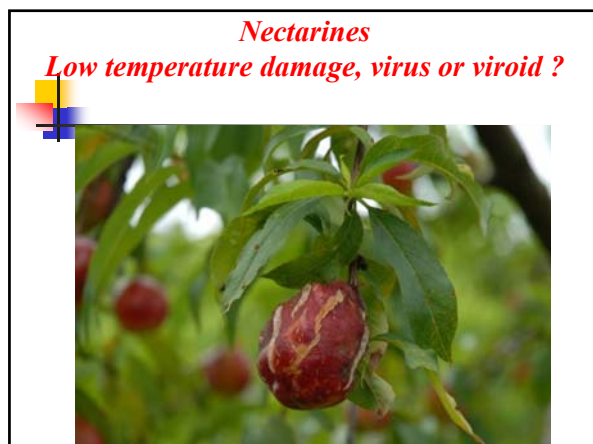


Tangerines not speaking by themselves



Peaches
Unknown problems
possibly Thrips-1? Phytoplasma-2?





ALMOND TREES

*Phytophthora? Verticillium? Armillaria? Rosellinia?
Capnodis (syn. Bupestris)? Or water logging?*

**Potato**

*Verticillium dahliae,
Phytophthora infestans or
Dickeya solani.....?*

**Olive leaves toxicity?**

Herbicides, insecticides, fertilizers?

**Sclerotinia, Pythium or Verticillium****Kalamata olives**

Colletotrichum, Fusarium or soft nose

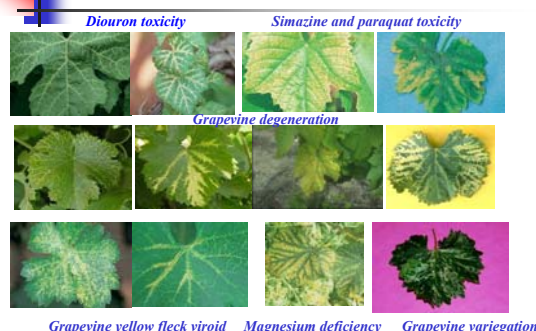


*Fusarium solani, waterlogging or nematodes in
citrus*



A Striking example

*I really doubt it if very few experienced diagnosticians could differentiate these very **similar symptoms** and diagnose each cause*



The problem of diagnosis in the great majority of cases

- *Obviously most of these cases could be identified in well equipped Plant clinics or modern institutes with the help of experienced and specifically educated plant doctors.*
- *However, I am afraid that almost 90% of plant disease and pest diagnosis is carried out by inexperienced so called "diagnosticians" all over the world*

Prescription

- *Recent EU directive asks for Specialized scientists who will meet the specific needs of prescription*
- Obviously those who can diagnose the cause they will be able to prescribe responsibly.
- But they must understand that the prescription can not be done by empirical plant doctors.
- Because of the lack of a proven expertise and the superficial knowledge creates very dangerous "advisers"
- Qualified specialized scientists aware of the pathogens and pests, will examine in detail the problem would study it thoroughly and propose the appropriate management with responsibility. Scientists are not yet available.

4. Ignorance of the nature and biology of the pathogen

*Due to the Ignorance of the source of the inoculum
Verticillium wilt is becoming a real menace
in olive orchards
Selected impressive cases around the globe*

- *1. The Greek case*
- *2. The Spanish case*
- *3. The Bakersfield case in California*

Greece

Verticillium dahliae- Olive after cotton

Extensive symptoms in almost 80% of the olive trees



Ignorance of the hosts range and the biology of Verticillium dahliae

Andalucía Spain -olives and cotton
Same problem with the defoliating race of *V. dahliae*



Bakersfield case in California



**olives after
safflower/cotton**

5. Quarantine Pathogens and Pests

- Just to mention some reasons
- and few of the most recent alarming cases

- Governmental specialists are not always scientifically equipped to prevent entrance of pathogens or pests through.....

- Dispersal of quarantine plant pathogens and pests
- Movement of Propagative plant material

Examples of International threats

1. Karnal (Partial) Bunt
Tilletia indica



2. Ug99 the emerging virulent stem rust race of
Puccinia graminis f.sp. *tritici*



Citrus greening

***Liberibacter asiaticus* / Asian citrus psyllid**



Candidatus Liberibacter sp –

- 2008
- A new bacterial species '*Candidatus Liberibacter psyllaeus*' has been found in association with serious diseases of tomatoes, potatoes
- In some potato and tomato production areas of North America ...



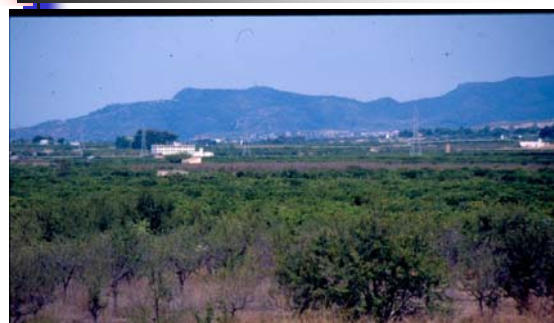
Pepino mosaic virus (PepMV) infects mainly solanaceous plants



Plant Doctors and Specialization

- Illegal importation (smuggling) of noncertified plant material can not be excluded
- Specialists in Phytiatry, to be able to cope with a problem **even after the entrance** otherwise diseases such as tristeza and many others already shown in the EPPO lists might be spread in a country

Valencia when I visited 20 years ago with the tragedy of tristeza



Recently the disease appeared in Greece through smuggling of plant material



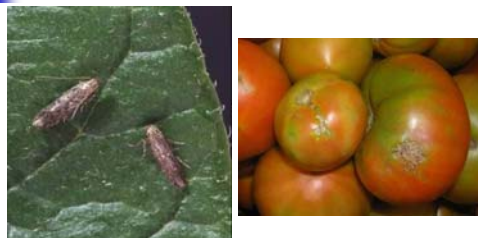
Rhynchophorus ferrugineus



The current pest menace



or Tuta absoluta



Or deal efficiently with very difficult cases such as the German E. Coli Chaos Gets Worse, And Now Nobody Knows Where It's Coming From



POSTGRADUATE STUDIES **PLANT MEDICINE**

- *Ph.Ds. in USA or elsewhere*
- *Masters in Europe*

Post graduate studies in Phytiatry today

- *Plant medicine in post graduate level is a growing field that started in the University of Florida and has expanded in Nebraska and from USA to Japan, India, South Korea, Thailand and Egypt.*
- *These PhD degrees in Plant Medicine are an excellent initiative and significant departure towards the correct direction.*

Plant Medicine **University of**

Agrios did not use the term plant protection



- **Providing leadership in crop and plant health education since 1999**



Future Plant Doctors!

For additional information contact
Dr. Robert J. McGovern, 352-392-3631
rjm@ifas.ufl.edu or visit: <http://ldpm.ifas.ufl.edu>

Doctorate in Plant Health The University of Nebraska



- The Professional Program in Plant Health has started in 2009.
- "It's comparable to the doctor of veterinary medicine program for animals and doctor of public health for humans, only it's for plants,"
- The program is designed to train practitioners rather than researchers in entomology, agronomy, plant pathology and soil science.

In Europe Masters' degree in *Phytiatry*

- **Corso di Laurea Specialistica in
Medicina delle Piante**
(Facoltà di Agraria Università di Bari)



- Although *Phytiatry* programs at a postgraduate level in the USA and Europe are a breakthrough, there are differences in the scientific backgrounds among those entering the programs
- I personally believe that the postgraduate studies should come as a step next to undergraduate studies in *Phytiatry*
- Till then Doctors in *Phytiatry* will be a fine but transitional solution

Common Master's in *Phytiatry* in EU countries

- The University of Bari the Agricultural University of Athens and Plovdiv University of Bulgaria have created a TEMPUS INTERNATIONAL JOINT MASTER DEGREE IN PLANT MEDICINE in cooperation with the Universities of Tirana and Korce Albania, Novisad and Belgrade in Serbia, Osijek and Zagreb in Croatia, Tetovo and Scopia in FYROM and Pristina in Kosovo

International joint Master degree in Plant Medicine (acronym: **IPM**)

158875-TEMPUS-IT-JPCR
Joint Project – Curricular Reform

EAC/01/2009

TEMPUS
Modernising higher education



TEMPUS
Modernising higher education

<http://ec.europa.eu/tempus>



Tempus

(European Union's Programme):

- *supports the modernization of higher education in the Partner Countries of Eastern Europe, Central Asia, the Western Balkans and the Mediterranean region, mainly through university cooperation projects;*

Objectives of the project

The project is aimed at the modernization and harmonization of HE systems (

system of degrees,
setting up a system of credits,
eliminating obstacles to free mobility,
favoring updating of training contents
and communication methodologies)

according to Lisboa Strategy and Bologna process.

Specifically, it consists of a curriculum restructuring, development and implementation in the West Balkan countries in order to:

- a) create a joint Master Degree in Plant Medicine, as a regional network, and
- b) apply improvements and modernizations of teaching using new web technologies.



Terms relative to Phytiatry used by relevant international scientific societies

- Regardless of the existence of hundreds of **international scientific societies** devoted to the plant health sciences, currently new societies use the term Phytiatry or Plant Medicine such as in Switzerland and Germany.
- The Swiss Society for Phytiatry
- The German Phytomedical Society (DPG)

Swiss Society for

Phytiatry
(SSP)

Schweizerische Gesellschaft für Phytomedizin
Società svizzera di fitoiatria
Swiss society for phytiatry



The German Phytomedical Society (DPG)



- The German Phytomedical Society (DPG) is the largest scientific association in plant production in Germany
- The Society is membership-based 1200 members, are professionals within the entire field of phytomedicine Science for Practice
- **Phytomedicine** is the science of plant disorders (whether biotic or abiotic), their diagnosis, management and control.



Hellenic Society of Phytiatry

- The Hellenic Society of Phytiatry was established in Greece in 2009
- As current President of the Hellenic Society of Phytiatry, I send a letter to the Editor of Phytopathology News published by APS,
- With many enthusiastic and positive comments from scientists all around the globe

TJAMOS Phytopathology News

May 2010



- Letter to the Editor
- Establishing Phytiatry as a New Science in Universities
- It is evident that the vast science of agriculture desperately needs the establishment of a separate field of plant health sciences called "plant medicine," known as *Phytiatry* in Greek and analogous to "veterinary science." Indeed, the apparent lack of inspiration and interest of candidate students to study plant pathology, due to the uncertainty in obtaining future jobs (only research centers and university departments offer limited job opportunities) and the lack of attractiveness of our important discipline, necessitate a revolution in educating students in various plant health disciplines. Thus, I strongly support the idea of educating scientists in the field of plant medicine since several scattered sciences dealing with plant health will come closer and create undergraduate programs for plant doctors of preferably a four- to five-year duration. This will also fill the enormous gap of missing specialists in the private sector.

Concluding remarks

- Modern Agriculture in Mediterranean basin and world wide necessitates a revolution in educating students in various plant medicine disciplines at an undergraduate level

Concluding remarks

- The establishment of Phytiatry as a distinct and independent science, in parallel with agricultural sciences
- would create a new very attractive science for obtaining general or specialized plant doctors
- Plant Doctors able to offer specific qualitative and secured service either in the private sector, to the state or in the university, in research centres, in the world agriculture.

Specialized scientists in the Phytiatry

- I do believe in the contribution of the Specialized scientists in solving phytiatric problems.
- Those, who will be able to visit the fields, the orchards and the glass houses to examine the plant health problems, to attend symptom expression, to diagnose the causes and identify pests and weeds and suggest the necessary measures
- Those, who will communicate with the Research Institutes or Stations and inform to whom it may concern
- Those, who will transfer the new research results through an extension service
- Those, who will detect the new problems

Time for common Action

- So I suggest:
- 1. The replacement of the term Plant Protection with the term of Applied Phytiatry.
- 2. The establishment of the term Phytiatry as the overall science
- 3. Redefining the content of Agricultural Education to involve Phytiatry sciences at undergraduate and postgraduate levels as crucial steps for research and application of these sciences in agriculture and economy all around the globe.
- 3.1 Discrete, rational, performance-based and integrated structured training in Phytiatry.
- 3.2 Recognized by the State and based on scientific choices that will clearly highlight the specific role of plant doctors.

Time for common Action

- Universities, private sector and various related societies have to exercise their pioneered role and go ahead with such an initiative to formalize and establish ***Phytiatry*** as a new University science

