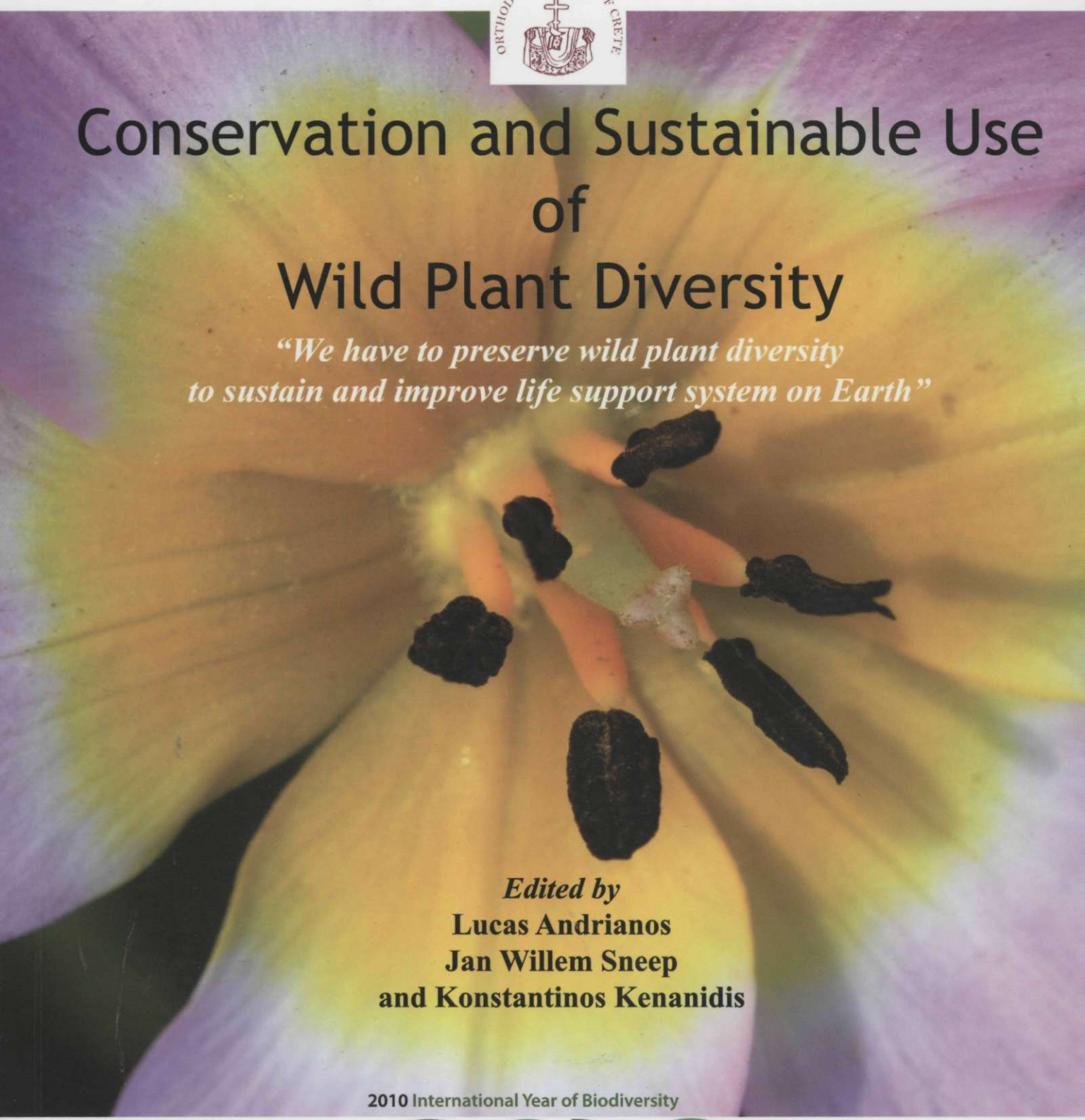
ORTHODOX ACADEMY OF CRETE PUBLICATIONS



Conservation and Sustainable Use of Wild Plant Diversity

"We have to preserve wild plant diversity to sustain and improve life support system on Earth"

Edited by
Lucas Andrianos
Jan Willem Sneep
and Konstantinos Kenanidis

2010 International Year of Biodiversity

2010 Διεθνές Έτος Βιοποικιλότητας

C.S.U.W.P.D.

Conservation and Sustainable Use

of

Wild Plant Diversity

INSTITUTE OF THEOLOGY AND ECOLOGY

ORTHODOX ACADEMY OF CRETE (OAC) PUBLICATIONS

C.S.U.W.P.D.

Conservation and Sustainable Use of Wild Plant Diversity

PROCEEDINGS

Kolympari, Crete, Greece

Orthodox Academy of Crete (OAC)

May 4-8, 2010

Edited by

Lucas Andrianos

Jan Willem Sneep and

Konstantinos Kenanidis

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Under the auspices of His All Holiness, the Ecumenical Patriarch Bartholomew

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Plantlife International
Botanic Gardens Conservation International
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Under the auspices of His All Holiness, the Ecumenical Patriarch Bartholomew

CSUWPD-2010 PROGRAM SCHEDULE

CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY

4-8 MAY 2010, KOLYMPARI, CHANIA, CRETE

ORTHODOX ACADEMY OF CRETE (OAC) - INSTITUTE OF THEOLOGY AND ECOLOGY (ITHE)

*B= Beach time, * Br = Breakfast, * C. Break + P = Coffee + Poster and Photo Competition Exhibition

	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	May 4th	May 5th	May 6th	May 7th	May 8th
	Sunrise Activities	Sunrise Activities	Sunrise Activities	Sunrise Activities	Sunrise Activities
	B	B	B	B	B
8:00-9:00	Br	Br	Br	Br	Br
9:00 9:30		**Panel** Presentation	**Panel** Presentation	**Panel** Presentation	
9:30 10:00	***ARRIVALS and REGISTRATIONS***	SESSION I (2 presenters)	SESSION I (2 presenters)	SESSION I (2 presenters)	***1 DAY-EXCURSION to ELAFONISI BEACH & PROTECTED AREA NATURA 2000 & MONASTERY OF CHRYSOSKALITISA & TOPOLIA or SAMARIA / AG. IRINI GORGE (OPTIONAL)***
10:001 0:30	C. Break + P	C. Break + P	C. Break + P GROUP PHOTO	C. Break + P	
10:301 1:30	**OPENING SESSION:** Greetings, Announcements	SESSION II (2 presenters) SESSION III (2 presenters)	SESSION II (2 presenters) SESSION III (2 presenters)	SESSION II (2 presenters) SESSION III (2 presenters)	
11:301 2:00	**Panel** Presentation	SESSION DISCUSSIONS	SESSION DISCUSSIONS	SESSION DISCUSSIONS	
12:001 2:30	C. Break + P	C. Break + P	C. Break + P	C. Break + P	
12:301 3:00	MUSEUM–B. GARDEN REPRESENTATIVE (FILM)	NGO-CONSERVATIONIST REPRESENTATIVE (FILM)	TOURISM - ESTHETIC SECTOR REPRESENTATIVE	AGRICULTURAL-FOOD SECTOR REPRESENTATIVE	
13:00	Lunch	Lunch	Lunch	Lunch	
			AFTERNOON		
15:001 7:00	BEACH	BEACH	BEACH	BEACH	***(RETURN FROM ELAFONISI) EXCURSION***
17:001 7:30	**Panel** Presentation	**Panel** Presentation	**Panel** Presentation	EXCURSION TO THE MONASTERY of CHRYSOPIGI "the Life Giving Spring" (SAINT KYRIAKI) + **Panel** Presentation (in the Monastery) + DINNER	
17:30 18:00	SESSION I (2 presenters)	SESSION I (2 presenters)	SESSION I (3 presenters)		
18:00 -18:30	SESSION II (2 presenters)	YOUTH – SCHOOL REPRESENTATIVE (THEATER)	SESSION II (2 presenters)		
18:30 18:45	C. Break + P	C. Break + P	C. Break + P		
18:45- 19:15	SESSION III (2 presenters)	INAUGURATION **OF THE NEW BOTANICAL GARDEN OF ITHE - OAC**	SESSION III (3 presenters)		
19:15 19:45	SESSION DISCUSSIONS		SESSION DISCUSSIONS		
19:45 20:15	HEALTH SECTOR REPRESENTATIVE		COSMETIC SECTOR REPRESENTATIVE		
20:30	Dinner Evening walk	Cretan Evening	Dinner Evening walk	Old town Chania by night	Dinner Evening walk

Panels' themes:

1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
3. ***Wild plant in Scientific Research and Development (SRD)***
4. ***Taxonomic Investigations and Conservation Methods for Wild plants (TICM)***
5. ***Models and Issues of Sustainable Use of Wild plants (MISU)***
6. ***Wild plant in health science, cosmetics and pharmacology (HSCP)***
7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010

SAVE BIODIVERSITY

Under the auspices of His All Holiness, the Ecumenical Patriarch Bartholomew

CSUWPD-2010 PROGRAM SCHEDULE

CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY

4-8 MAY 2010, KOLYMPARI, CHANIA, CRETE

ORTHODOX ACADEMY OF CRETE (OAC) - INSTITUTE OF THEOLOGY AND ECOLOGY (ITHE)

	Tuesday, May 4th	**Chairs**
09:00 – 10:00	***REGISTRATIONS***	
11:00 - 11:30	**OPENING SESSION:** Greetings, practical information, announcements **Presenters:** Organizing committee: • Constantinos Kenanidis (General Chair) • Lucas Andrianos (Program chair) • Jan-Willem Sneep (Vice Program chair) • Jacques Zaffran (Scientific Advisor) • Emmanuela Larentzaki (Local committee)	Lucas Andrianos / Constantinos Kenanidis
11:30 12:00	**Panel One: Botanic gardens, reserves and case studies for wild plants (BGRCS)** *"Conservation of wild plants in Europe"* **Presenter**: JAN-WILLEM SNEEP	
12:00 – 12:30	**Coffee Break + Poster, Arts and Book Exhibition**	
12:30 -13:00	MUSEUM–B. GARDEN REPRESENTATIVE : *"A pilot Network of Plant micro-Reserves"* **Film by the** MEDITERRANEAN AGRONOMIC INSTITUTE OF CHANIA (MAICH)	Christina Fournaraki
AFTERNOON		
17:00 - 17:30	**Panel Two: Eco-Theology and Plant Ethics (ETHEPE)** *"Reframing Phototropism and Photosynthesis: A Human Response to Plant Diversity Loss and Unsustainable Utilization"* **Presenter**: CONSTANTINE A. CONSTANTOPOULOS	Alexandros Papaderos
17.30 -18:00	**SESSION I: ETHEPE (2 presenters)** • **Presentation 1:** *"Literature as a tool for promoting biodiversity conservation"* **Presenter**: ROBERT FULGHUM • **Presentation 2:** *"Using Poetry as a Tool to Inspire Conservation and Sustainable Use of Wild Plant Diversity"* **Presenter**: DIANA WOODCOCK	Constantine Constantopoulos

Panels' themes:

1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
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7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010

SAVE BIODIVERSITY

18.00 -18:30	**SESSION II: ETHEPE (2 presenters)** • **Presentation 1:** *"Biofuels: Wild Plants among the Wheat"* **Presenter:** LINDA E. TURNER • **Presentation 2:** *"Green consumerism and its threat to conservation and sustainable use of plant diversity: case study of Chhattisgarh"* **Presenter:** R.N. PATI	
18.00- 18:45	**Coffee Break + Poster and Book Exhibition**	
18:45 – 19:30	**SESSION III: ETHEPE (2 presenters)** • **Presentation 1:** *"The Biblical Perspectives of Environment and Human Beings: A Christian Response to the Ecological Crises of Our Time"* **Presenter:** KARUNAKAR JEEDEE • **Presentation 2:** *"Ethical and cultural values of Biodiversity"* **Presenter:** ARTEMIOS M. ATHANASAKIS AND LUCAS A. ANDRIANOS	Constantinos Kenanidis / Linda E. Turner
19:30 – 19:45	SESSION DISCUSSIONS	Linda. E. Turner
19:45 – 20:15	HEALTH SECTOR REPRESENTATIVE : *"Medicine in Minoan Civilization"* **Film by the** UNIVERSITY OF CRETE, DPT. OF MEDECINE (UOC)	Melpomeni Skoula
20:30	DINNER	

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
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COUNTDOWN 2010
SAVE BIODIVERSITY

Under the auspices of His All Holiness, the Ecumenical Patriarch Bartholomew

CSUWPD-2010 PROGRAM SCHEDULE

CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY

4-8 MAY 2010, KOLYMPARI, CHANIA, CRETE

ORTHODOX ACADEMY OF CRETE (OAC) - INSTITUTE OF THEOLOGY AND ECOLOGY (ITHE)

	Wednesday, May 5th	**Chairs**
9:00 - 9:30	**<u>Panel One</u>: Wild plant in scientific research and development (SRD)** *"Sustainable use of botanical resources for malaria control: toward the discovery of novel compounds capable of effecting a reduction in disease transmission through decreases in the rate of contact between mosquito vectors and human hosts of the malaria parasite"* **Presenter**: KOSTAS IATROU	Papamatheaki Joseph/ Tsaftaris Athanasios
9:30 -10:00	**<u>SESSION I</u>: SRD (2 presenters)** • **Presentation 1:** *"Chemotaxonomy of Allium species"* **Presenter**: JACQUES AUGER • **Presentation 2:** *"Nutritive status of some arid zone tree species of Jhunjhunu district of Rajasthan, India"* **Presenter:** D P SINGH	
10:00 - 10:30	**Coffee Break + Poster and Book Exhibition**	
10:30 - 11:30	**<u>SESSION II</u>: SRD (2 presenters)** • **Presentation 1:** *"Traditional use of wild plant diversity in Crete"* **Presenter**: MELPOMENI SKOULA • **Presentation 2**: *"Sustainable management of dry grassland habitats in Eastern Austria – A challenge for nature conservation"* **Presenter:** MONIKA KRIECHBAUM	Kostas Iatrou
	<u>SESSION III</u>: SRD (2 presenters) • **Presentation 1:** *"Hand Papermaking with Local Botanicals in the Greater Ashanti Region of Ghana: A convergence of craft, art, and environmental conservation"* **Presenter**: MARY HARK • **Presentation 2:** *"Dispersion Patterns of the genetic material of Citrus medica L. (Citron) from its original geographic center, and the genetic relationship between cultivated citron varieties in Mediterranean countries"* **Presenter**: EYTYXIS PROTOPAPADAKIS	Tsaftaris Athanasios
11:30 -12:00	SESSION DISCUSSIONS	Kostas Iatrou / Tsaftaris Athanasios

Panels' themes:

1. Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)
2. Eco-Theology and Plant Ethics (ETHEPE)
3. Wild plant in Scientific Research and Development (SRD)
4. Taxonomic Investigations and Conservation Methods for Wild plants (TICM)
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7. Wild plant in natural ecosystem and climate change (NECC)

COUNTDOWN 2010
SAVE BIODIVERSITY

12:00 - 12:30	Coffee Break + Poster, Arts and Book Exhibition	
12:30 - 13:00	NGO-CONSERVATIONIST REPRESENTATIVE: *"Balkan Botanical Garden of Kilkis- Greece"* **Film by the** BBGK	Eleni Maloupa
AFTERNOON		
16:30 – 17:00	**Panel two: Wild plant in scientific research and development (SRD)** *"Exploiting Wild Genetic Research in Breeding Plants in the Genomic Era"* **Presenter:** TSAFTARIS ATHANASIOS	Kostas Iatrou / Robert Fulghum
17:00 -17:30	**SESSION IV: SRD (2 presenters)** • **Presentation 1:** *"Wild edible flora in the western area of Crete: Case studies by pupils from the 2nd primary school of Kissamos, Crete"* **Presenters**: PANAGIOTA KATERINAKI AND LUCAS A. ANDRIANOS • **Presentation 2:** *"The Orthodox Academy of Crete and The Institute of Theology and Ecology / OAC and the Herbarium J. Zaffran"* **Presenter:** EMMANUELA LARENTZAKI	
17:30 - 18:00	YOUTH AND SCHOOL REPRESENTATIVES (THEATRE): *"Wild edible flora in the western area of Crete:"* **Theatre** *by the 2nd primary school of Kissamos, Crete*	
18:00 - 18.15	**Coffee Break + Poster and Book Exhibition**	

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
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COUNTDOWN 2010
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18:15 - 17:30	**INAUGURATION OF THE NEW BOTANICAL GARDEN** *(Conference room of the Orthodox Academy of Crete)* • **Formal greetings and welcome** CONSTANTINOS KENANIDIS, GENERAL DIRECTOR OF THE OAC • **Message from His All Holiness the Ecumenical Patriarch of Constantinople Bartholomew,** READ BY HIS REPRESENTATIVE, H.E. AMPHILOCHIOS, METROPOLITAN OF KISAMOS AND SELINON, PRESIDENT OF THE OAC • **Speech** REPRESENTATIVE OF THE GREEK GOVERNMENT • **Presentation of a new Book on Biodiversity:** *"Biodiversity as environmental source of ecological and cultural values" Title in Greek: "Η Βιοποικιλότητα ως περιβαλλοντικός πόρος οικολογικής και πολιτισμικής αξίας"* ARTEMIOS M. ATHANASAKIS (PROFESSOR WRITER), VAGGELIS DIAMANTOPOULOS (PROFESSOR AT THE TECHNICAL UNVIVERSITY OF CRETE - DPT. ENVIRONMENTAL ENGINEERING) AND LUCAS ANDRIANOS • **Service of inauguration and Ceremony for the new Botanical Garden of OAC** *(In front of the Museum of Cretan Flora - Jacques Zaffran)* H.E. AMPHILOCHIOS, METROPOLITAN OF KISAMOS AND SELINON, PRESIDENT OF THE OAC • REFRESHMENTS	Constantinos Kenanidis
	• ***Visit to the Ancient olive tree of Vouves - Kolympari*** POLYCHRONIS POLYCHRONIDIS, MAYOR OF THE MUNICIPALITY OF KOLYMPARI • ***Cretan Evening*** *(Gala dinner and traditional dance offered by the Municipality of Kolympari and the Institute of Theology and Ecology OAC)*	

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
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COUNTDOWN 2010
SAVE BIODIVERSITY

	Thursday, May 6th	Chairs
9:00 - 9:30	**Panel One: Taxonomic investigations and conservation methods for wild plants (TICM)** *"Plants of the Bible and Botanical Findings on the Shroud of Turin"* **Presenter**: DANIN AVINOAM	Jacques Zaffran / Deborah Long
9:30 -10:00	**SESSION I: TICM (2 presenters)** • **Presentation 1:** *"New records of six fungi isolated from plant debris submerged in Tigris water in Al-Kut dam locality"* **Presenter**: HUSSEIN AL-NASRAWI • **Presentation 2:** *"Leaf epidermis morphology: a new tool for taxonomy of Tamarix africana Poir.* **Presenter:** GRAZIA ABBRUZZESE	
10:00 - 10:30	**Coffee Break + Poster and Book Exhibition**	
10:30 - 11:30	**SESSION II: Models and Issues of Sustainable Use of Wild plants (MISU) (2 presenters)** • **Presentation 1:** *"The system of plant protection in Belarus according priorities of the European Plant Conservation Strategy"* **Presenter**: OLEG MASLOVSKY • **Presentation 2:** *"Promising practices in community based conservation of medicinal plants in forest villages of Chhattisgarh: An appraisal"* **Presenter:** S.C. AGARWAL **SESSION III: MISU (2 presenters)** • **Presentation 1:** *"Botanical diversity in Morocco: Importance, threat and conservation strategies"* **Presenter**: TALEB MOHAMMED SGHIR • **Presentation 2:** *"Sustainable management of wild plant resource through the application of Fair Wild Standard principles in Bosnia and Herzegovina* **Presenter**: CROOK VICKI	Danin Avinoam

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
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7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010
SAVE BIODIVERSITY

11:30 -12:00	SESSION DISCUSSIONS	Danin Avinoam / Deborah Long
12:00 - 12:30	Coffee Break + Poster, Arts and Book Exhibition	
12:30 - 13:00	TOURISM – ESTHETIC SECTOR REPRESENTATIVE: FLOWERS OF CRETE ASSOCIATION	Julia Jones / Rosmary John
AFTERNOON		
17:00 – 17:30	**<u>Panel two:</u> Botanic gardens, reserves and case studies for wild plants (BGRCS)** *"Achieving Target 5 of the Global Strategy for Plant Conservation: Protection of 50% of the most important areas for plant diversity assured"* **Presenter:** DEBORAH LONG (PLANTLIFE INTERNATIONAL)	Monika Kriechbaum
17:30 -18:15	**<u>SESSION I</u>: BGRCS (3 presenters)** • **Presentation 1:** *"In-situ and Ex-situ conservation of Victoria's Nationally Threatened Orchids: Case Studies"* **Presenter**: KATE VLCEK • **Presentation 2:** *"Regenerating Indian Forests through Microfinance"* **Presenter**: K K KAUSHAL • **Presentation 3:** *"Important plant areas programme provides a framework for conservation in the Falkland islands (Malvinaas)"* **Presenter**: REBECCA UPSON	
18:15 - 18:45	**<u>SESSION II</u>: SRD (2 presenters)** • **Presentation 1:** *"Strict protection vs. conservation management in peat lands: considerations from the Biebrza National Park, NE Poland"* **Presenter:** WIKTOR KOTOWSKI • **Presentation 2:** *"Botanical survey from the Island of Gavdos and the Biological Research Station "Zora" in Lentas (South Crete)"* **Presenter**: ANDREAS TRAXLER	

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
3. ***Wild plant in Scientific Research and Development (SRD)***
4. ***Taxonomic Investigations and Conservation Methods for Wild plants (TICM)***
5. ***Models and Issues of Sustainable Use of Wild plants (MISU)***
6. ***Wild plant in health science, cosmetics and pharmacology (HSCP)***
7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010
SAVE BIODIVERSITY

18:45 - 19:00	**Coffee Break + Poster and Book Exhibition**	
19:00 – 20:00	**SESSION III: SRD (4 presenters)** • **Presentation 1:** *"Status and disturbances endangering Mangrove Tree Species , at Chumbageni deep Sea shore in Tanga Municipalitys' Coast – Tanzania"* **Presenter**: CANISIUS J. KAYOMBO • **Presentation 2:** *"Conservation of Wild Alpine Plants of Kanchenjunga Conservation Area: Potentials and Problems of Community-Based Conservation"* **Presenter**: MAN KUMAR DHAMALA • **Presentation 3:** *"Local resources for food and income security: Distribution, diversity, and ethno-biological value of wild edible fruit plants in eastern India"* **Presenter**: AJAY K. MAHAPATRA • **Presentation 4:** *"Investigations in the status of Portulaca microspecies and reeds in Crete"* **Presenter**: AVINOAM DANIN	Kate Vlcek
20:00 – 20:15	SESSION DISCUSSIONS	Kate Vleck / Monika Kriechbaum
20:15 – 20:30	COSMETIC and FOOD SECTOR REPRESENTATIVE: BIOLEA PRESENTATION FILM BY YORGIOS DIMITRIADIS	Yorgios Dimitriadis

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
3. ***Wild plant in Scientific Research and Development (SRD)***
4. ***Taxonomic Investigations and Conservation Methods for Wild plants (TICM)***
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COUNTDOWN 2010
SAVE BIODIVERSITY

Under the auspices of His All Holiness, the Ecumenical Patriarch Bartholomew

CSUWPD-2010 PROGRAM SCHEDULE

CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY

4-8 MAY 2010, KOLYMPARI, CHANIA, CRETE

ORTHODOX ACADEMY OF CRETE (OAC) - INSTITUTE OF THEOLOGY AND ECOLOGY (ITHE)

	Friday, May 7th	Chairs
9:00 - 9:30	**Panel One: Wild plant in health science, cosmetics and pharmacology (HSCP)** *"Nature as a source for drugs and drug discovery"* **Presenter**: ATHANASSIOS GIANNIS	Kostas Iatrou
9:30 -10:00	**SESSION I: HSCP (2 presenters)** • **Presentation 1:** *"New Zealand native plants – can we use them as natural anthelminthics?* **Presenter**: MARION JOHNSON • **Presentation 2:** *"CRETAN HERBS AND POPULAR MEDICINE: History and perspectives for sustainable management"* **Presenters**: MANOUSOS PEDIADITIS AND LUCAS ANDRIANOS	
10:00 – 10:30	**Coffee Break + Poster, Arts and Book Exhibition**	
10:30 - 11:30	**SESSION II: HSCP (2 presenters)** • **Presentation 1:** *"Wild bitter plants for nutrition and remedy"* **Presenters**: NIKOLAOS SAMARIDIS AND LUCAS ANDRIANOS • **Presentation 2:** *"Micropagation of Phyllanthus amarus Schum and Thonn: an important medicinal plant"* **Presenters**: VINEET SONI AND DEEPIKA MISHRA **Session Topic: Wild plant in natural ecosystem and climate change (NECC)** **SESSION III: NECC (2 presenters)** • **Presentation 1:** *"Mitigating the impact of climate change on the rare wildflowers of the Granite Belt in Southern Queensland, Australia"* **Presenter**: PAUL DONATIU • **Presentation 2:** *"Reduction of Carbon Emission by Wiser use of Forest in the Sub-Tropical Region of North East of India"* **Presenter**: BANN MAKAN	Athanassios Giannis

Panels' themes:

1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
3. ***Wild plant in Scientific Research and Development (SRD)***
4. ***Taxonomic Investigations and Conservation Methods for Wild plants (TICM)***
5. ***Models and Issues of Sustainable Use of Wild plants (MISU)***
6. ***Wild plant in health science, cosmetics and pharmacology (HSCP)***
7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010

SAVE BIODIVERSITY

11:30 -12:00	SESSION DISCUSSIONS	Athanasios Giannis / Marion John
12:00 – 12:30	**Coffee Break + Poster, Arts and Book Exhibition**	
12:30 -13:00	**Panel Two: Wild plant in natural ecosystem and climate change (NECC)** *"Ecological characterization of Tamarix spp. populations of Southern Italy under different environmental constraints"* **Presenter**: ABOU JAOUDÉ	Paul Donatiu
AFTERNOON		
17:00 -	**Departure to the Monastery of Chrysopigi "the Life Giving Spring"**	
17.30 -19:30	**EXCURSION TO THE HOLY MONASTERY of CHRYSOPIGI "the Life Giving Spring" IN SAINT KYRIAKI** **+** **Panel Presentation (in the Monastery)** + **Presenter**: SISTERS OF THE HOLY CONVENT OF CHRYSOPIGI "THE LIFE GIVING SPRING"	Sister Theosemni / Lucas Andrianos
19:30- 20:30	DINNER (Hospitality by the Holy Convent of Chrysopigi "the Life Giving Spring")	
20:30-22:00	WALK IN THE OLD TOWN OF CHANIA	Organizer

	Saturday, May 8th	**Chairs**
9:00 - 17:00	***EXCURSION*** ***to ELAFONISI BEACH and visit to the PROTECTED AREA NATURA 2000, the MONASTERY OF CHRYSOSKALITISA and TOPOLIA***	Lucas Andrianos

Panels' themes:
1. ***Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)***
2. ***Eco-Theology and Plant Ethics (ETHEPE)***
3. ***Wild plant in Scientific Research and Development (SRD)***
4. ***Taxonomic Investigations and Conservation Methods for Wild plants (TICM)***
5. ***Models and Issues of Sustainable Use of Wild plants (MISU)***
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7. ***Wild plant in natural ecosystem and climate change (NECC)***

COUNTDOWN 2010
SAVE BIODIVERSITY

Ἱερώτατε Μητροπολῖτα Κισάμου καί Σελίνου, ὑπέρτιμε καί ἔξαρχε Ἑσπερίας Κρήτης, Πρόεδρε τῆς ἐν Κρήτῃ Ὀρθοδόξου Ἀκαδημίας, ἐν Ἁγίῳ Πνεύματι ἀγαπητέ ἀδελφέ καί συλλειτουργέ τῆς ἡμῶν Μετριότητος κύριε Ἀμφιλόχιε, καί Ἐλλογιμώτατε κύριε Κωνσταντῖνε Κενανίδη, Γενικέ Διευθυντά τοῦ Ἱδρύματος τούτου, τέκνον τῆς ἡμῶν Μετριότητος ἐν Κυρίῳ ἀγαπητόν, χάρις εἴη ὑμῖν καί εἰρήνη παρά Θεοῦ.

Ἀσμένως ἐλάβομεν τό ἀπό ιε΄ Ἀπριλίου ἐ. ἔ., ἀριθμ. Πρωτ. 12, γράμμα ὑμῶν, δι᾽ οὗ ὑποβάλλετε περί τοῦ ὀργανουμένου ὑπό τοῦ Ἰνστιτούτου Θεολογίας καί Οἰκολογίας τῆς καθ᾽ ὑμᾶς Ὀρθοδόξου Ἀκαδημίας Κρήτης Διεθνοῦς Συνεδρίου ἐπί τοῦ θέματος «Διατήρηση καί ὀρθή χρήση τῶν Ἀγρίων Φυτῶν καί τῆς βιοποικιλότητας 2010», μεταξύ δ΄ καί η΄ προσεχοῦς Μαΐου.

Μετά πατρικῆς ἀγάπης καί τιμῆς χαιρετίζομεν ὑμᾶς, ὅλως δέ ἰδιαιτέρως τούς σχόντας τήν εὐγενῆ ταύτην πρωτοβουλίαν καί κοπιάσαντας διά τήν διοργάνωσιν τοῦ Συνεδρίου, ὡς καί πάντας ἐν γένει τούς μοχθοῦντας διά τόν ὡραῖον καί θεῖον σκοπόν τῆς συντηρήσεως καί προστασίας τοῦ ὄντως «καλοῦ λίαν» κόσμου, τῆς καθόλου θείας δημιουργίας.

Ὅθεν, ἐπιδαψιλεύοντες ὁλόθυμον τήν Πατριαρχικήν ἡμῶν εὐλογίαν ἐπί πάντας τούς ἐν οἱαδήτινι ἰδιότητι συμμετέχοντας εἰς τό Διεθνές τοῦτο Συνέδριον, γνωρίζομεν ὑμῖν ὅτι τήν ἡμετέραν Μετριότητα καί τό Οἰκουμενικόν Πατριαρχεῖον κατ᾽ αὐτό θέλει ἐκπροσωπήσει ὁ Ἱερώτατος καί ἀγαπητός ἐν Χριστῷ ἀδελφός Μητροπολίτης Κισάμου καί Σελίνου κύριος Ἀμφιλόχιος, εὐχαρίστως τιθέμεθα τοῦτο ὑπό τήν πνευματικην αἰγίδα τῆς Μητρός Ἁγίας τοῦ Χριστοῦ Μεγάλης Ἐκκλησίας καί εὐχόμεθα πᾶσαν εὐλογίαν Κυρίου εἰς τήν ἀγαθήν διεξαγωγήν καί καρποφόρον περαίωσιν τῶν ἐργασιῶν τοῦ Συνεδρίου.

Ἡ δέ χάρις καί ἡ εὐλογία τοῦ Θεοῦ, τοῦ Δημιουργοῦ τῶν πάντων, εἴησαν μετά τῶν ἀγαπητῶν καί ἐλλογίμων κυρίων συνέδρων.

βι΄ Ἀπριλίου κδ΄

PATRIARCHAL GREETINGS

Most Holy Metropolitan of Kisamos and Selinon Amphilochios, Most Honoured and Exarch of Western Crete, President of the Orthodox Academy of Crete, dear brother in the Holy Spirit and co-celebrant of our Humbleness, and most Eminent Mr. Konstantinos Kenanidis, General Director of this Institution, dear child of our Humbleness in the Lord, God's grace and peace be with you.

With pleasure we received your letter of April 15, 2010, reg. nr. 12, in which you inform us about the International Conference on "The Conservation and Sustainable Use of Wild Plant Diversity 2010", organized by the Institute of Theology and Ecology of the Orthodox Academy of Crete, which will be held from the 4th to the 8th of the upcoming month of May.

With paternal love and honour we greet you, and especially those who kindly took the initiative and laboured for the organization of the Conference; we also greet all those who work hard for the good and divine aim of the conservation and protection of the truly "very good" world, of the whole divine creation.

Therefore, bestowing wholeheartedly our Patriarchal blessing upon all those who participate in this International Conference in whatever property, we let you know that our Humbleness and the Ecumenical Patriarchate will be represented by the Most Holy and dear brother in Christ Amphilochios, Metropolitan of Kisamos and Selinon, and that with pleasure we place this Conference under the spiritual aegis of the Mother, Holy and Great Church of Christ and we wish all blessings of the Lord for the good conduct and the fruitful conclusion of the work of the Conference.

The Grace and blessing of God, creator of All, be with the dear and eminent Conference participants.

24th of April, 2010

Your dear brother in Christ and fervently praying to God
Bartholomew of Constantinople

**Read by the General Director of the Orthodox Academy of Crete, Dr. Konstantinos Kenanidis, and translated by Emanuela Larentzaki and George Vlantis, scientific staff of the Orthodox Academy of Crete.*

PREFACE

«MAKING GOOD USE OF RESEARCH IN ECOLOGY»

Jacques Zaffran

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For several decades, a branch of botanical science, which was considered as minor, has enjoyed considerable success. It is, everybody has understood, Ecology.

The plant ecology or "Science in environmental conditions where the plants live" has always been a part of the science of botany in the broadest sense. There was of course a concern to animal ecology studying characteristics among the animals.

In the 1950s, ecology was considered as secondary subject in academic research institutions or others. This is the extraordinary development of western industrial societies, which moved the science of ecology up than the modest rank of major concern for many scientific laboratories. This development of societies, sometimes pushed carelessly, led to a sharp deterioration of the environment: pollution, depletion of land resources, global warming, and an explosion of diseases related to poor living conditions (allergies, occupational cancer, and consumption of pharmaceuticals more or less harmful).

Today the world wakes up with a hangover. The deterioration of living conditions is on the agenda of any "summit" at the highest level. The introduction of "control programs" against this degradation advanced with slow pace. Politics deal with the subject and Green parties are very popular today.

The conference on conservation and sustainable use of wild plant biodiversity (CSUWPD), organized in 2010 by the Orthodox Academy of Crete obviously falls within this vast movement of public awareness regarding these problems. This institution stands out in the right direction by taking into account ethical factors most often overlooked in this type of event. The initiative of Dr. Andrianos in organizing ecological conferences is worth of praise and I recommend the continuation and the reinforcement of his work at the Institute of Theology and Ecology of the Orthodox Academy of Crete. This is especially necessary given that the Cretan public seems still relatively unaware of the benefits from the protection of its environment.

This conference and the following should be involved to make everyone think about the world he wants to live in the future, which is very close now.

WELCOME MESSAGE

Jan-Willem Sneep

The Planta Europa Foundation, Laan van Meerdervoort 1030,
2564 AW The Hague, the Netherlands
The Dutch National Parks Foundation, Willem Witsenplein 6,
2596 BK The Hague, The Netherlands
E-mail: sneep@nationaalpark.nl

Distinguish guests, ladies and gentlemen, friends,

It is a great honour and pleasure for me to be with you here on this beautiful Greek island with an enormous richness of biodiversity.

I like to thank the Orthodox Academy of Crete for hosting and organising this special conference on the conservation and sustainable use of wild plant diversity.

The United Nations declared the year 2010 as International Year of Biodiversity to stimulate governments and private sectors to pay special attention on the conservation of biological diversity, worldwide. So, there is no better moment for this conference.

Biological diversity (or biodiversity) is not only focussed on threatened species, but it is the variety of life on earth, within species, between species and across ecosystems.

It is certainly beautiful but much more than good television documentary material.

In fact, biological diversity is the foundation upon which human civilization have been built. It established the conditions for our well being and survival.

We depend on the natural richness of our planet for the food, energy, wood, raw materials, clean air and clean water that makes life possible and which drive our economy. But is also look to our natural environment for less tangible things such as aesthetic pleasure, artistic inspiration and recreation.

European society, our immense cultural diversity and our economics are reflected in our landscapes, agriculture and natural spaces. We are the stewards of a wonderful natural legacy that we can pass on hopefully intact to future generations.

Nonetheless we still build cities and roads, drain wetlands, Dam Rivers, clear forests, over harvest the seas and practice intensive agriculture, often at the expense of natural ecosystems.

On top of that we burn fossil fuels and emit chemical into water, soil and air.

The natural environment is very flexible, but only up to a point. These pressures are clearly causing biodiversity decline and disrupting ecosystems processes and the services they provide.

Following a prolonged worldwide decline of biodiversity, the United Nations Convention on Biodiversity (CBD) was adopted in 1992 with three overall goals: the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. I am pleased to see these goals are reflected in the programme of this conference.

Within the CBD framework and the wider sustainable development agenda, it was agreed at the global level in 2002 to achieve by 2010 a significant reduction of the current rate

of biodiversity loss at global, regional and national level and in Europe to stop the decline by 2010.

Unfortunately, we have to conclude, the target of halting biodiversity loss in Europe by 2010 will not yet be achieved. Is there only talk of trouble and strife? No, not at all.

Over the last 25 years together we have built up a vast network of nearly 26.000 protected areas covering all the 27 Member states of the European Union and a total area of more than 850.000 km2, representing approximately 18% of the total EU terrestrial area.

This vast array of sites, known as the Natura 2000 network, the largest coherent network of protected areas in the world, is a testament to the importance of that EU citizens attach to biodiversity.

Plant conservation has also made great progress in Europe since the publication of the first European Plant Conservation Strategy. This Strategy was developed by the Planta Europa Network (75 organisations from 37 European countries) and the Council of Europe in 2002 and renewed in 2008.

The European Plant Conservation Strategy brings coordination and a clear focus to a complex set of issues outlining the many activities which exist or are planned to halt the loss of our plant diversity in Europe. But what we did till now is not enough. So, constant attention for wild plants is really needed.

I realize that we are living in a very fast changing world. Today economic, financial, social and security problems are on the top of the political agendas. Nature conservation, including wild plants, is not really hot (sexy) at this moment.

But I think, only together we can change this by using a more proactive and innovative approach to save biodiversity, to save wild plants in Europe and in the world.

In my opinion it is a privilege and at the same time a challenge for all governments, politicians, regional and local authorities, scientists, NGO's, representatives of organisations in the field of agriculture, forestry, fishery, tourism, recreation, health, and citizens to work together on a world in which wild plants are valued.

The initiative of this Conference is a very good opportunity to share information and experiences on achieving and strengthening the needed plant conservation measures.

I wish you an open, pleasant, fruitful and successful conference.

Thank you for your attention.

EDITORIAL

"This book presents the scientific part of the celebration of the International Year of Biodiversity (IYB2010) organized by the Institute of Theology and Ecology and the Planta Europa Foundation" at the Orthodox Academy of Crete in May 4-8, 2010

The United Nations declared 2010 to be the International Year of Biodiversity. It is a celebration of life on earth and of the value of biodiversity for our lives. The world is invited to take action in 2010 to safeguard the variety of life on earth: biodiversity.

Through the organization of the first International Conference on the Conservation and Sustainable Use of Wild Plant Diversity (CSUWPD), the Institute of Theology and Ecology and the Planta Europa Foundation joined their efforts to take this unique opportunity to increase understanding of the vital role that biodiversity plays in sustaining life on Earth". As the United Nations stated that we are an integral part of nature; our fate is tightly linked with biodiversity, the huge variety of other animals and plants, the places they live and their surrounding environments, all over the world. We rely on this diversity of life to provide you with the food, fuel, medicine and other essentials we simply cannot live without. Yet this rich diversity is being lost at a greatly accelerated rate because of human activities. This impoverishes us all and weakens the ability of the living systems, on which we depend, to resist growing threats such as climate change.

This book collects edited and revised versions of papers and abstracts that have been scheduled to be presented at the first International Conference on the Conservation and Sustainable Use of Wild Plant Diversity (CSUWPD), held in May 4-8, 2010, at the Orthodox Academy of Crete, Chania, Crete, Greece.

The high number of proposals confirms the growing interest for the issues of biodiversity conservation. About forty four (44) abstracts proposal were submitted from twenty nine (29) countries, including *Algeria, Austria, Australia, Bangladesh, Bulgaria, Ethiopia, Faulkland, France, Hungary, Germany, Greece, India, Indonesia, Iraq, Iran, Ireland, Italy, New Zealand, Poland, Romania, Serbia, Sierra Leone, South Africa, Soudan, Sweden, Tanzania,* Turkey, United Kingdom and the United States of America. From these submissions, 39 were selected for presentation and publication in this book. More than hundred participants (108 people) were expected but due to the volcano ashes of Ireland and the general strike in Greece mainland, only one third of the registered participants managed to come to Crete.

The conference brings together multidisciplinary and multicultural approaches of biodiversity conservation. The themes were classified into six categories namely:

- Botanic Gardens, Reserves and Case Studies for wild plants (BGRCS)
- Eco-Theology and Plant Ethics (ETHEPE)
- Wild plant in Scientific Research and Development (SRD)
- Taxonomic Investigations and Conservation Methods for Wild plants (TICM)

- Models and Issues of Sustainable Use of Wild plants (MISU)
- Wild plant in health science, cosmetics and pharmacology (HSCP)
- Wild plant in natural ecosystem and climate change (NECC)

The selected papers present a useful perspective to evaluate the core of biodiversity management and the conference itself revealed the diversity of approaches to the issues of biodiversity conservation.

This book does not contain all the papers presented at the CSUWPD conference as some participants prefer to publish their work in more formal journal. The goal of the CSUWPD conference was not to collect scientific papers but ***to raise awareness for the protection of life and to call the community to celebrate together the year of biodiversity.*** The outcome of the conference is summarized in the *"2010 Declaration for Plant Biodiversity from Crete"* which is stated at the end of this book.

We thank the sponsors of the conference. Special thanks are due to the Chairman of the Planta Europa foundation, Doctor Jan Willem Sneep, for his tireless efforts and significant financial support. We would also like to thank all members of the organizing committee as well as Stefanos Trachanas and his team at the Crete University Press-FORTH for their help in editing this book. Moreover, we thank the Mother Superior Theoxeni and Sister Theosemni of the Holy Convent of Chrysopigi for their exceptional generosity in setting up and supporting the CSUWPD-2010 excursion to their Holy Monastery area. Many thanks and credits are due to all participants at the CSUWPD 2010, for their valuable contributions and unforgettable company. Finally, I would like to thank all the institutions that have supported the CSUWPD event in different ways. It is noteworthy to praise the contribution of the youngest Cretan participants from the "2nd Primary School of Kissamos" (4th Class).

We wish the most constructive inspirations and insights for all readers of this book.

OAC, Kolympari, January 2011
Lucas Andrianos

The Editors

Dr. Lucas Andrianos
Doctor in Environmental Sciences
CSUWPD Organizer
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Orthodox Academy of Crete

Dr. Jan-Willem Sneep
Doctor in Environmental Sciences
Chairman
Planta Europa Foundation

Dr. Konstantinos Kenanidis
Doctor in Theology
General Director
Orthodox Academy of Crete

PART I

Eco-Theology and Plant Ethics

REFRAMING PHOTOTROPISM AND PHOTOSYNTHESIS:

A HUMAN RESPONSE TO PLANT DIVERSITY LOSS AND UNSUSTAINABLE UTILIZATION

The Very Reverend Constantine A. Constantopoulos

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Abstract

In longing to address the need for a "human response to plant diversity loss and unsustainable utilization," conference delegates might be led to believe – quite mistakenly – the claim of supposed "leading causes of declining wild plant diversity and populations worldwide."[1] Questioning the presupposition of such a claim, this paper suggests that the specified problems are not the result of such alleged causes. That is to say, "habitat alteration, unsustainable harvests, overgrazing, the climate change, the introduction of non-native plants, political indifference and public unawareness"[2] are not causes but *effects*, indications of a symptom, certainly an expected consequence of the *real* problem: A pre-existing spiritual disorder.

If the goal of such a conference is to affirm "human responsibility," then there emerges the need for some understanding – easily appreciated by botanists and theologians alike – of the dynamics of how to reinforce humanity's ability to meet it.

Orthodoxy owes a debt of gratitude to botany for being a mindful steward of nature's living examples, phototropism and photosynthesis, which its faithful correspondingly practice in striving for *theosis*. Botany, in turn, is invited to consider how faith-rich Orthodox – like chlorophyll-rich plants growing toward the sun, and manufacturing their own food by converting carbon dioxide and water to an organic compound, then releasing oxygen as a by-product – also grow toward the Son, manufacturing their own food by converting potential and "living water"[3] to "bread of life"[4], then releasing spiritual energy as a by-product.

Through such reframed phototropism and photosynthesis can environmental stakeholders, spiritually energized with discernment, grow toward – or away from – stimuli competing for their attention, manufacturing "food for thought" that is delicious, nutritious and necessary in order to respond in a truly human way to the "severe ecological crisis" at hand, enhancing, as they do, spiritual insight.

Natural science and religion, exemplified by plants and spiritual beings, respectively, enable botany and Orthodoxy to emulate each other's vital paradigms, challenging each to become that of the other's, so that together, through mutual replication, they can rise to the occasion of crisis intervention that is equal to the task.

Keywords: Orthodox, photosynthesis, phototropism, spirituality, theosis

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[1] Refer to "Conference Goals" in Call for Papers, International Conference on Conservation and Sustainable Use of Wild Plant Diversity; May 5-8, 2010; Orthodox Academy of Crete (OAC); Kolympari, Chania, Greece.

[2] Ibid.

[3] John 4:10, 11; 7:38

[4] John 6:35

USING POETRY AS A TOOL TO INSPIRE CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY

Diana G. Woodcock

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I will begin this reading with several of my poems inspired by the Arabian Desert, on the edge of which I have lived for the past six years:

CAPER FLOWER

"Nothing in all creation is so like God as stillness." ~ Meister Eckhart

I chose the middle path
Basho spoke of—between
the world's vacuity and
reality. Landed in the desert's
fragile heart, far from the part
of it dissected by pipelines,
soiled by oil flares.
Could not have felt more
holy if I had been lying
prostrate at the temple gate,
fragile bells calling me
to His side.

Arrived early enough to glimpse
Capparis spinosa with its mustard
yellow thorns—how each flower adorns
the desert floor with delicate
immaculate grace, how it opens
at dusk—its whiteness a light
holding back the dark—
perfumes the air, enticing fragile
moths to come do their meticulous work
of pollination. White wispy flowers
softening the tangled thorny shrub,
dazzling filaments swaying in the desert
breeze as if to please their Maker
with praise—the only movement

in this holy stillness, revealing the desert's
softer side. Though of course such fragile
blossoms cannot long survive—will shrivel
and die soon after sunrise.

But for now, one ladybug—dining
in style—and I are keeping perfectly still,
as god-like as any two creatures ever will be
this side of the Mystery.

This next one was written for the Qatari artist and wildflower expert who takes me out into the desert after the winter rains every year:

FOR ALI SHARIF, WILDFLOWER EXPERT

A yellow dwarf radiates photons
onto Earth, and impeccably

tailored flowers unfold their petals
like the oppressed unfurling flags

in protest against hunger
and poverty, but mostly against

desperation.
Magnanimous wildflowers,

theirs the most unsordid act
of the day. Don't interrupt.

Let them have their say,
after which you may well decide

silence is the only
appropriate reply.

WILDFLOWERS OVER THE SAND-SEA

In the desert, everything and nothing to lose,
I take my clues from wildflowers. Hoping
not to be nibbled on, I head for a sandy wadi
to learn Peganum harmala's secret—
why seldom grazed. Then on to Citrulus

colocynthis to inquire how on earth it can spread
so far and wide lying prostrate in hard sand. Wishing
to learn the knack of not needing a firm foundation,
I seek out Sesuvium sesuvioides—that fleshy pink-
flowered herb I've heard thrives in drifted sand. Desiring
the gift of always expecting a miracle, I turn to deep pink
Silene conoidea, which always manages to find a damp
nook. Needing to find a way to keep predators at bay
but not wanting to be viscious about it, I inquire of
Centaurea pseudosiniaca how to grow those soft prickles
that cause more tickles than harm.

Wanting always to be a beacon of light in the darkest night,
I seek out Selene villosa in the dunes to ask how to flower
after dusk. Aspiring to foster hope even in the midst
of death and decay, I take a lesson from magenta-flowered
Limonium axillare on fossil corals. Desiring always to
smoothe over hard places, I find Cleome trinervia
among rocks, shining orange as the sun. Then knowing
days will come when I'll need a weapon to ward off
the aggressor, I go to deep blue Blepharis ciliaris to ask
how to be more dangerously prickly.

I go with specific requests, but each one knows best
what I need—in all their radiance they've listened and heard
the desert voices, their petals like bows from which hope
is shot. Each flower undeterred by desert conditions—
each a drift of a dream, a subtle stream of delicate sweet
scent that hints of heaven. Each blossom waiting and listening
for the desert to stir, offering ecstatic communion to me,
a desert pilgrim. Each one defying this harsh, desolate land—
so exquisite I fear every one is a mere mirage. Kindred
with these flowers in their desolate spaces, holding steady
against the shamal's sandblasting and the infinite sun,
I hear them calling insistently, gently—nudging me away
from the world's ways till I am found and calmed by them,
their beauty spread over the sand-sea so marvelously I can't
imagine leaving them. I lay my head on each one's breast
and find the infinite rest I've been seeking.

DESERT SOLITUDE

Nowhere better to preserve one's solitude
than among wildness and weeds—
how the heart bleeds for these.
Only in solitude will you notice
each cycle of universal

reciprocity—water, oxygen—
miracle of existence.
In solitude, eroding soil
will cry out to you how we've
squandered our inheritance.

You'll fee a tug toward
being something—anything—
other than human: an oleander
blossom scenting the late March
air, lacking ambition to do

anything more than simply bloom—
no recognition of the brevity of
its day in the sun.
Preserve your sanity, your
solitude among the surge

of pink and white blossoms
beyond which a desert stretches
to the border you must not cross—
on the other side, Saudi and the
sadness of another eroded country.

This next poem was inspired by a verse from the Koran:

GARDENER'S DREAM IN THE DESERT

"Remember, it is forbidden to live in a town which has no garden or greenery." –
Kiddushin 4:12

After China, I returned bent
on building a humble hermitage
beside a lily pond or stream
surrounded by bamboo. After
Sausalito, a houseboat seemed the
only way to go—and lining my
dock with California poppies. After

walking the Camino de Santiago,
lavender was all I wanted to grow.
Reading Tolstoy, I vowed to trade my
paved-over cosmopolitan world
for a rural estate and live like a
peasant among fields of sunflowers.

But we all know how these things
go—wanting one thing and
ending up with its opposite.
Living in the desert now, laboring
over my tiny patio garden, I
imagine bamboo, poppies,
lavender, sunflowers growing
luxuriantly beyond my hermitage
houseboat on my rural estate at
the opposite end of this world.

But resisting cursing desert sun
and saline soil, I marvel how the desert flora
humble me to see with clarity all that lies
between Fish and Moon.

In the desert noon, only one desire: to fall
eventually like rain to earth and turn to
herb, or into the sea and emerge as pearl.
Each dusk I pluck yellow leaves from budless
shrubs that all day long have shrugged their
spindly branches at the sun, and I ask that
I might be kept "one day full fed and one day
hungry,"* and that the desert hyacinths (dhanoun)—
those radiant root parasites—might bloom,
however briefly, this year.

*from the *Kashf al-Mahjub*, oldest Persian treatise on Sufism, by al-Hujwari

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Qatar soon will open its Qu'ranic Botanic Garden, which will feature all of the plants mentioned in the Qu'ran, as well as all of Qatar's endemic species. I'm working on a collection of poems to be released in conjunction with the Garden's opening. These next few poems are from that collection:

DESERT ECOLOGY 38: UMBRELLIFERAE

Here's the secret to thriving
in this desert: taking part in Ammi
majus' existence— glabrous herb

sprouting in cultivated land. Listen
intently till you hear the lower leaves of each
Bishop's weed withering at anthesis.

Though you be heavy, notice
how each fruiting umbrel opens
as if in flight. And though darkness

appears to reign, how each one—
long-beduncled—reflects one ray
of mysterious, glorious light.

DESERT ECOLOGY 45: SCROPHULARIA & ACANTHUS

Forget playing it safe.
If you need a mentor to show you
the way, employ the climbers and
twiners, or the thistle-like spiny ones—
fragrance of heaven wafting from their
spike-like racemes or cymes in the axils
of upper leaves. Scrawled across
desert sands, secrets of the universe
dispersed by dawn and evening breeze.

Be bold as S. deserti, growing among
rocks and stone fragments. Be spiny-
tipped and prickly-toothed as Blepharis
ciliaris, braving gravelly habitats—
hozoom and shallow runnels.
Observe well Desert figwort and eyelash
plant, each a portal to the other side,
each unfolding in liminal spaces,
sprouting in gaps, breaking through cracks
in the desert's pavement, eternity

throbbing in their calyxes and corollas.
Find yourself in the midst of their bracts.

Stay still long enough to get caught up
in a moment of being—bold as these herbs,
in love with sand and wind, moth and bee,
tender parched earth. Whirl
like a dervish round and round,
joyfully unraveling yourself from every
fantasy of safety. You and these herbs—
figwort and acanthus—in the theatre of
desert space swaying in the shamal,
full of life, your feet sprouting wings,
all fear of flying forgotten as you elevate
and float light as a desert lark's feather
above the climbers and twiners.

DESERT ECOLOGY 44: LAMIACEAE AND SOLANACEAE

Come drift in this little poem like a raft
far from the familiar and your comfort zone.
Come find tucked into one line a finite image
of infinity. Here and now, Vernal Equinox,
greening of the desert: intricate branches
of the Salvia aegyptiaca singing in the depressions;
twigs of Lycium shawii—abode of jinn*--
transforming into thorns; buds where sewage
is spilled promising to burst forth any day now
from umbrellate short-peduncled corymbs
of Solanum nigrum. Wait with the Caper white,
neither of you doubting, till the Worm Moon—
poised between crescent and full—threatens to pry it
open before dawn. Come drift among four-angled stems
of Salvia and Teucrium, the silvery aspect of the small-
spined Solanum elaegnifolium, the many-seeded berries
and flowering stars of Lycium shawii painting the hozoom
and rodat red and violet. Linger among native common
shrublets in shallow silty places, in course-soiled
depressions, among perennial herbs on hammada,
in runnels and wadis, on rocky slopes. Come

let's hang out among hairy nightshade (Solanum
villosum), weed of disturbed and enriched places
lavishing its graces equally on sewage pond
and tended garden (may we do likewise). Let's meditate
on herbs and low shrubs growing in rhythm—

the instant's incarnation. Entering into each herbal
presence, you'll enter yourself—each shrublet a bridge,
each broad-leafed herb a juncture, each rigid thorny plant
a span of connection to the other side. Tangle of white
fleece in narrow runnels. Overhead, the jubilant song
of the desert lark. Who would dare at this point of equal
balance light and dark to speak disparagingly of weeds?

Diamonds in the rough, haven't we had enough
of playing favorites, deciding what should live
and what must die? Why oh why must we play god?

Wild-scented desert, herb and weed-enriched,
calling us to love without judgment,
with absolute abandon.

*spirits

This last poem was inspired by *Anima Christi:*

DESERT ECOLOGY 46: OROBANCHACEAE

"Heaven is under our feet as well as over our heads." –Henry David Thoreau

Cistanche tubulosa,
sanctify me.

Your fleshy stem covered with
oblong-lanceolate scales,
save me.

Your ovoid fruit,
fill me with love.

Your thick, dense spike,
strengthen me.

Your calyx with acute
scarious-margined lobes,
empower me.

Robust, perennial root parasite,
hear me:

Within your littoral salt marshes,
hide me.

May I never be separated from you.

Protect me by your yellow, blue, purple
flowers from evil's power.

Call me, dear Desert hyacinth,
at my death's hour.

Thank you.

BIOFUELS: WILD PLANTS AMONG THE WHEAT

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Abstract

It sometimes seems as if we see energy options in stark terms of good and evil. For decades, environmentally aware people have portrayed nuclear power and fossil fuels as bad options that need to be replaced by the good option of renewable energy. But now, as humanity finally develops renewable sources of energy, we witness the re-emergence of this good and evil dichotomy as each renewable option is pursued with greater vigor. Thus, one increasingly hears that the development of energy from biomass, called biofuels, is an inherently bad thing to do. This will lead to higher food prices and a greater risk of starvation among the planet's very poor. It will lead to a loss of natural ecosystems and plant diversity with the development of monoculture biofuel plantations. But is this perception fair? Or is this a product of a desire to see the world in simple terms of good and evil? The purpose of this paper is to explore the potential benefits and risks of biofuels as an energy option for humanity, with a careful nuanced look at the complexity of energy options and their impacts. Part of this involves the development of a richer understanding of energy options and their desirable and undesirable attributes to develop them and minimize the risks associated with them. To serve this end, this paper focuses on second generation biofuels and uses *the Parable of Weeds among the Wheat* as an analogy to move beyond a dualistic world view analysis.

Keywords: Biofuels, Eco-Theology, Plant Ethics, Renewable Energy, Sustainability.

1. INTRODUCTION

It sometimes seems as if we see energy options in stark terms of good and evil. For decades, environmentally aware people have portrayed nuclear power and fossil fuels as bad options that need to be replaced by the good option of renewable energy. But now, as humanity finally develops renewable sources of energy, we witness the re-emergence of this good and evil dichotomy as each renewable option is pursued with greater vigor. Thus, we increasingly hear that the development of energy from biomass, called biofuels, is an inherently bad practice, causing higher food prices and a greater risk of starvation among the planet's very poor. It will lead to a loss of natural ecosystems and plant diversity with the development of monoculture biofuel plantations [Jaccard (2005)]. But is this perception fair? Or is this again a product of a desire to see the world in stark terms of good and evil? The purpose of this paper is to explore the potential benefits and risks of biofuels as energy options for humanity with a careful nuanced look at the complexity of energy options and their impacts. To serve this end, this paper focuses on second generation biofuels and uses the *Parable of Weeds among the Wheat* [The Gospel (1990] as an analogy to illustrate the need for humanity to listen for subtleties and challenge the assumptions and desires that see the world in stark terms of good and evil. This paper begins with an examination of the first generation biofuels in light of the myopic good or evil debate and continues with an expanded presentation of the *Parable of Weeds among the Wheat* [The

Gospel (1990)]. Following is a discussion of our present energy system, our need for alternative energy in an integrated system, and the hope for biofuels. Finally this paper examines second generation biofuels, research advances and the parable of the weeds more closely to demonstrate how Christianity and science are not mutually exclusive and can help people break free from a tyranny of their assumptions about and desires for simple black and white solutions. In the process people will gain a richer understanding, and mobilize and motivate humanity to throw themselves and everything they have into the creation of a global sustainable energy system—that includes biofuels among an array of diverse options.

2. BIOFUELS: WILD PLANTS AMONG THE WHEAT

2.1 The Good Bad Debate

People can have strong views about biofuels, seeing them as either an eco-friendly saviour or a big scammer contributing to global warming [Hunt (2008)]. Proponents of biofuels tout them as non-polluting, sustainable, reliable, and locally attainable fuels [Demirbas (2008)] that can save our manufacturing lifestyle and lead to a new industrial era [Ragauskas et. al. (2006)]. Opponents claim that renewable fuels and the eco-hype promoting them are a scam [Grunwald (2008)] and a scourge, diminishing grain supplies, and inflating food prices [Hunt (2008)]. They see biofuels as a plague, a scourge designed to wipe humanity out by adding to the human carbon footprint and contributing to global warming through the destruction of forests, such as the Amazon that store large amounts of carbon, as poor peasants rush to sow these new crops that store far less amounts of carbon and plant false hopes for a sustainable future [Grunwald (2008)].

Up until 2008, little heed was paid to biofuel critics. But by the spring of 2008, biofuels were no longer touted as humanity's saviour. By summer, as wheat, corn, and rice prices soared and the news of food riots in poor nations fuelled and drove public debates, biofuels became the big scam and the false saviour that was making monoculture plantation farmers and investors rich while hindering efforts to reduce climate change and its impacts on the Earth's most vulnerable, the poor [Hunt (2008)].

Countering the claim that biofuels are carbon negative and bad for the environment, Peter Kendell, the president of Great Britain's National Farmers Union, claimed that the extra wheat yield of a fertilized crop yields six times more energy than that used to produce it. Further to this Kendall confidently reported that farmers could produce enough biofuel to meet the government's greenhouse gas reduction emission targets for 2010 and added that a certification scheme ensuring Britain did not import carbon negative biofuels would reduce the risk to rainforests [Harris (2007)].

While many critics have quickly pointed the finger of blame at biofuels for increased food prices, people have started to look at nature and human economy as an integrated system [Jaccard (2005)] and question the prevailing assumption that the introduction of biofuel crops into our agricultural system has caused grain shortages and soaring food prices [Hunt (2008)].

2.2 The Weeds among the Wheat

The parable of the weeds among the wheat provides a classic example of the human desire for a sustainable agricultural system and the hope for an ever abundant wheat harvest and how a wild plant assumed to have been planted by the Devil—the enemy of the Master—causes the Master's farming slaves to question their Master.

> The kingdom of heaven may be compared to someone who sowed good seed in his field; but while everybody was asleep, an enemy came and sowed weeds among the wheat, and then went away. So when the plants came up and bore grain, then the weeds appeared as well. And the slaves of the householder came and said to him,

> 'Master, did you not sow good seed in your field? Where, then, did these weeds come from?' He answered, 'An enemy has done this.' The slaves said to him, 'Then do you want us to go and gather them?' But he replied, 'No for in gathering the weeds you would uproot the wheat along with them. Let both of them grow together until the harvest; and at harvest time I will tell the reapers, Collect the weeds first and bind them in bundles to be burned, but gather the wheat into my barn.' [The Gospel (1990)]

In explaining this parable to the disciples, Jesus identified the weeds as the children of the evil one, and the enemy who planted them as the Devil. Why would Jesus identify weeds, wild plants in such a way?

Christians often claim that Jesus used the *Parable of Weeds among the Wheat* to illustrate how people need to repent of their heretical and desirous ways so that when they die they can be judged obedient and worthy to enter the Father's Kingdom. For many that may be the simple truth. However, Jesus challenges all the disciples gathered together pressing in closely to listen, to listen carefully [The Gospel (1990)].

> Explain to us the parable of the weeds of the field." [Jesus] answered, "The one who sows the good seed is the Son of Man; the field is the world, and the good seed are the children of the kingdom; the weeds are the children of the evil one, and the enemy who sowed them is the devil; the harvest is the end of the age, and the reapers are angels. Just as the weeds are collected and burned up with fire, so will it be at the end of the age. The Son of Man will send his angels, and they will collect out of his kingdom all causes of sin [stumbling blocks] and all evildoers, and they will throw them into the furnace of fire, where there will be weeping and gnashing of teeth. Then the righteous will shine like the sun in the kingdom of their Father. Let anyone with ears listen! [The Gospel (1990)]

Did your ears pick up on the words fire and furnace? Did you hear how the angels collect the causes of sin, the stumbling blocks, as well as the evildoers? Because if you did, then you will have heard how the angels throw what they have collected into a fiery furnace and those who have ears to hear with will shine like the sun.

The other key words in this allegoric explanation are the "harvest," the "end of the age," and the Devil. The Devil is the enemy of the Master who keeps slaves. The end of the age is the harvest, the time when the plants mature. In this case the end of the age is when the disciples, those who hear the message, mature. When the disciples mature—the Son of Man will sit down with them and direct the harvesters to collect and use all the resources collected. Everybody will benefit and mature people not fooled or led astray—by the Devil—the Father of Eros who ignites human desire—will gather in the harvest and everyone will shine like the sun. The harvesters will not just bring wheat into the barns of the world. They will gather weeds. Then there will be weeping and gnashing of teeth over the fire – soaring fuel prices, food shortages, and foreign competition—and then the harvesters will get on with the task at hand. They will produce a fiery furnace, a more efficient energy system, to make the commodities of life. In the process something extraordinary will happen. The people will become righteous and they will shine like the sun. In the process of throwing themselves and everybody and everything they have into the creation of an efficient sustainable energy system, humanity will undergo a transformation and emerge as righteous. Transformed they will distribute rays like the sun —electricity and its benefits to all. When humanity comes of age, humanity will do the will of the Creator—shine like the sun—and humanity will no longer be a slave in the Master's house.

The Parable of the Weeds illustrates that the Master and the Devil, like Christians and Scientists are not mutually exclusive. They can work together to help people break free from the tyranny of assumptions about and desires for simple either-or solutions and choices. Assuming the Devil is the bad crop choice and the Master is the good crop choice or vice versa keeps the master slave and the good bad cycle going and imposes an either-or moral choice on their supporters showing loyalty or a

preference for either one. People not fooled by assumption or led astray by the desire for simple quick fix solutions can break free from this cycle. They can shine like the sun. Christians and Scientists can mobilize political action groups to weep and gnash their teeth with fiery resolve over food and energy issues. Glowing like angels, these groups working together can motivate humanity to commit to work for and towards the creation of a global energy system—a fiery furnace of hope—so all can be free to shine like the sun.

Religious and secular teachers, scientists, and indigenous prophets, philosophers and poets who love the earth need our respect. We need to listen to them and we need to listen with our ears tuned to listen for their prejudice and ours. Teachers often use debates to simplify the issues and expect their students to be capable of arguing both sides. The objective is to prepare students to defend and criticize new invasive ideas that threaten well cultivated old ones. Poets, teachers, and storytellers often use fiction, and figurative truths like the parable above to embellish the truth. Technically, they tell lies or exaggerations to push people into hearing and accepting a more complex version of the truth. In doing so, they push us into a refining fire of discovery beyond a good bad analysis of nature and the human economy, they show us an integrated system, and challenge all our assumptions [Jaccard (2005)] so that we will have the political resolve to challenge the laws, policies, and practices of our governments, and ethical institutions when they are failing and no longer sustainable [Lomborg (2010)].

2.3 Our Present Energy System

Our present global energy system is not sustainable and it is linked to our economic, agricultural, and political systems [Jaccard (2005); Hunt (2008); Lomborg (2010)]. We cannot shine like the sun while our need for sustainable fuel sources and our international accords cause the world's most vulnerable inhabitants to remain in poverty [Lomborg (2010)]. The late, former President of the Philippines, Corazon Aquino, in her inaugural address said: "Faith is not simply patience which suffers passively until the storm is past. Rather, it is a spirit which bears things—with resignation, yes, but above all with blazing, serene hope." Blazing hope is active and compelling. It causes people to weep, to gnash their teeth and to motivate others to sustain the dream and the burning desire for a just sustainable system, to face the truth, and find a way to actively replace and renounce the tyranny of selfish assumptions and immature desires closely interwoven with our unsustainable, failing systems.

In the World Policy Journal, Spring 2008 Edition, Susan Hunt speaks to a recent report published by the International Energy Agency, admitting that biofuels have contributed to recent price increases in food crops, qualifying other factors, such as droughts and the increased demand for "meat and milk products in Asia [as playing] a significantly larger role." Building on the theme, that biofuels are neither a saviour nor a scam, Hunt points out that soaring fossil fuel prices, not the high prices of biofuels, have caused higher diesel prices and fertilizer costs for farmers, pushing up food prices. She also reminds her audience, that farmers use 40% of the grain crops they grow to feed their livestock. To this she adds, that the recent demand for meat and dairy in Asia combined with the diminishing of world food stocks caused by droughts in corn and wheat producing countries have also contributed to food price increases, far more than the demand for grain used in the production of biofuels [(2008)]. For Hunt, "The most egregious scam on the American people is not biofuels. Rather, it is the myopic debate that distracts from the larger issues at hand." She urges her audience to see and hear the bigger picture and recognize that our present day agricultural, energy, transport, and economic systems are failing. Recognizing this failing is not the end of all things. Hunt concludes, "Human innovation, forward thinking legislation, and collective action will be our saviors, not the fuel flavor of the day" [(2008)].

2.4 We Need Alternative Energies

Biofuels are only one energy alternative. For a global sustainable energy system, we need a diverse system [Jaccard (2005); Koh and Ghazoul (2008)]. Other energy alternatives such as solar, wind, hydro electricity, nuclear, and energy efficiency should be included and considered according to

regional environmental assessments of risks and benefits that include the impacts to natural economy and human economy that is part of nature [Jaccard (2005); Koh and Ghazoul (2008)]. No energy is perfect. Each alternate energy source impacts the environment and makes demands on the economy and the land. The materials and rare minerals used for solar panels are costly to mine and produce, and the panels themselves need open space free from shade [Jaccard (2005); Parfit (2005)]. Windmills can be unsightly and interrupt bird migration; nuclear energy requires uranium and creates hazardous wastes; and even energy efficiency has a downside. People need energy before they can use it efficiently [Parfit (2005)], and the replacement of old inefficient energy consuming products and systems, causes more garbage.

Concern about land use and rising food prices has affected the way people feel about biofuels and the heightened awareness of climate change and its impacts plays a significant role in the policies and the research and development of the emerging biofuels industry. Statistics gathered in 2008, held agriculture responsible for 14% of global greenhouse gas emissions and deforestation to clear land for agriculture for another 17% showing that biofuels do not directly cause greenhouse gas emissions [Hunt (2008)]. Currently, according to Transport Canada, 30% of Canada's total energy use is in the transportation sector and transport fuels account for 25% of all greenhouse gas emissions [Canmet Energy (2009)]. In North America another 35% of all greenhouse gas emissions come from the buildings and the industry that supports them [Biello (2008)]. To total these percentages of green house gas emissions challenges the popular assumption that the manufacturing industry is the biggest polluter. Adding up 14% + 17% + 25% + 35% totals 91 %. This means that 91% of greenhouse gas emissions come from agriculture, deforestation, transportation, and the building industry—and biofuels are insignificant in the equation.

As long as the good versus bad debate over biofuels floods our ears, people fail to hear the prejudices and subtle nuances that link biofuels to other issues such as land use, food prices, transportation costs, dietary preferences, weather, and access to energy sources [Hunt (2008)]. As Hunt and others [(2008) such as Jaccard (2005), Koh (2008), and Parfit (2005)] point out, biofuels present risks and opportunities and we need to consider them as an alternative fuel. Globally, approximately 1.6 billion human beings lack access to electricity and approximately 2.4 billion still rely on inefficient traditional ways of burning biomass sources [Hunt (2008)]. Humanity needs access to and control of clean energy options [Jaccard (2005)] in order to illuminate their lives and shine like the sun [The Gospel (1990)].

2.5 The Burning Hope: Reducing and Reversing Climate Change

The hope for biofuels, especially second generation biofuels, is that they will diversify humanity's energy options and reduce the need for fossil fuels and the traditional burning of biomass. With the awareness of climate change and the desire for healthy sustainable alternatives to fossil fuels, people and nations are turning to the burning of biofuels as a sustainable option [Jaccard (2005)]. Since the discovery of the first burning bush, biomass has been the traditional energy source, thinking wood and plant stock was renewable and plentiful. As populations have increased, burning wood for fuel has caused deforestation and desertification. In addition, the burning of straw or other combustible biomass material in open fires has seriously affected human health and air quality. Now that developing nations have invented more efficient furnaces and technologies using fossil fuels, the overall quality of health and life expectancy for humans has improved considerably [Jaccard (2005)]. Today, biomass can be burned in efficient furnaces and converted to liquid fuel that can in turn be used to generate electricity. For example, one innovative company in Renfrew Ontario Canada, Envergent Technologies, converts biomass into pyrolysis oil in an almost carbon neutral process [Regalbuto (2009)]. This oil can then be used to power generators or to supplement transport gasoline as a drop-in replacement fuel without any engine alteration. Envergent plans to have the capacity to produce 100 million gallons a year by 2011 and be completely ready to market their biomass gasoline by 2012 [Regalbuto (2009); Envergent Technologies (2010)].

As promising as this biomass gasoline is, it has drawn criticism because although pyrolysis production is almost carbon neutral, it is not neutral. The external production produces some carbon and capacities of companies near to production readiness cannot produce enough to replace gasoline consumption entirely [Gaunt and Lehmann (2008)]. Further to this concern, pyrolysis oil and other biofuels can only offset CO_2 emissions from fossil fuels and with the predicted doubling of energy needs by 2050 [Lomborg (2020)], energy consumers need to find a way to lower CO_2 emissions in the atmosphere to reverse climate change [Gaunt and Lehmann (2008)].

On the other hand, researchers think they might have found away to lower CO_2 in the atmosphere through the production of pyrolysis bioenergy. Although at the moment it is cheaper to produce pyrolysis at high temperatures, a major by-product of low-temperature pyrolysis production is biochar. Applied to the soil, biochar seems to improve the nutrient content and the physical and biological make-up of the soil. Preliminary research suggests that the application of biochar to the soil reduces the soil's nitrous oxide (N_2O) by 50% and completely suppresses methane (CH_4) emissions. If further research supports these preliminary findings, pyrolysis bioenergy combined with biochar application to the soil presents an energy strategy that benefits the environment *and* reduces greenhouse gas emissions [Gaunt and Lehmann (2008)].

The practical wisdom of the world's environmental policy makers suggests that the only way to stop global warming is to convince governments and their citizens that they must slash their reliance on a finite supply of CO_2 emitting fossil fuels [Lomborg (2010]. Developed nations want to break their dependency on fossil fuels for a number of reasons. Oil rich nations and conflicts abroad control the flow of oil, and local refineries want the ability to meet domestic demands in the event of a natural disaster or terrorist attack [Hunt (2008)]. At the same time concerned policy makers point out, rich nations have an obligation to the poor [Lomborg (2010); (Hunt 2008)]. Right now fossil fuels are efficient and cheap. In order to make drastic cuts in CO_2 emissions by limiting reliance on fossil fuels, developing nations such as China and India would need to slash their domestic economic growth and condemn hundreds of millions of people to poverty [Lomborg (2010)]. In order to achieve the goal of keeping global temperature rises below two degrees Celsius and to keep nations from relying on fossil fuels, environmental policy makers and governments would have to impose global carbon cuts and taxes that would cost the world $40 trillion a year in taxes and lost revenue, a price even the wealthiest of nations cannot afford [(Lomborg (2010)].

To reduce and reverse climate change, nations need to develop affordable alternatives to coal and oil and some experts are now suggesting that governments set aside a 0.2% global tax on gross domestic product—approximately $100 billion a year – for green-energy research and development. This they argue would be cheaper than trying to cut carbon emissions and predict that this tax would reduce global warming far more quickly as bioenergy development becomes more profitable and sustainable [Lomborg (2010)]. Although, presently biofuels and other green alternative energy sources are incapable of assuming a large portion of the fossil fuel load, research is making advances producing a second generation of biofuels and with more research, comes more hope [Hunt (2008)].

2.6 Second Generation Biofuels

With the research and development of second generation biofuels such as biobutanol, synthetic diesel, and other biofuel products derived from switchgrass, garbage, and algae, comes the hope and expectation to increase alternative fuel production, lower greenhouse gas emissions, and make improvements to the environment [Hunt (2008)].

Switchgrass is a native prairie grass that can produce cellulosic ethanol. Farmers can get 500% more renewable energy from its conversion in comparison to the energy the farmers expend in growing and producing it [Science Matters (2010)]. According to the David Suzuki Foundation, the results of a life-cycle analysis, using production and management information from 10 different farms in the Midwestern United States and published recently in the National Academy of Science journal proceedings, demonstrates that greenhouse gas emissions from cellulosic ethanol used on the farms

were 94% lower than if the farmers had used energy that had come from a petroleum fuel. Another benefit and another reason researchers are excited about this demonstration is that switchgrass grows on marginal land. This means that farmers can maintain switchgrass crops using fewer chemicals, rotating them with wheat fields—making it less likely that growing large crops of switchgrass would compete with land already set aside for food production [Science Matters (2010)].

Garbage incineration can produce biogas to generate electrical power. In February 2008 a company called the Plasco Energy Group opened a 27 million dollar demonstration plant in Ottawa. "For every tonne of trash brought into the plant" it can produce biogases to generate "about 1,400 kilowatt hours of power—enough electricity to supply an average [Canadian] home with power for almost two months" [Cernetig (2008)]. Plasco Energy CEO Rod Bryden said Plasco can build a plant in Vancouver or anywhere in 18 months that is capable of processing 500 tonnes of garbage a day, approximately one sixth of Metro Vancouver's current garbage loads. Taking a risk, CEO Bryden proposed that Vancouver provide Plasco with the land and Plasco in return would finance the building of the plant. Plasco then promised to deliver clean energy for two years by processing the waste environmentally, without violating set pollution standards. Should Plasco fail, Plasco promised to remove their site at no cost to Metro Vancouver and restore the land to its previous state. Should Plasco deliver on their promises, Metro Vancouver would have to commit to a 20 year contract paying Plasco a pre-negotiated price per-tonne fee for garbage disposal. As of September 2009, Metro Vancouver was too uncertain of the cost implications involved with Plasco's deal and was considering a cheaper landfill strategy [Jackson (2009)].

Raw algae produce oil and when refined this oil can replace biodiesel and jet fuel. An algae farm can be located in a variety of places and does not compete with food production because it can use sea water and gobble up pollutants from sewage and power generating plants [Associated Press (2007)]. Raw algae use photosynthesis to transform CO_2 and sunlight into energy and as they perform this natural function they produce oil [Associated Press (2007)]. However, a 2007 press release stated that algae fuel was not cost efficient enough and that to achieve better cost efficiency, the cost of production needed to drop dramatically from USD $20 a gallon to USD $2 a gallon [Associated Press (2007)]. Challenging that assumption, a recent study conducted at the University of Malaya in Malaysia and published in 2008, insists that algae oil is already more economical than diesel [Hossain et. al. (2008)]. This same study demonstrates that microalgae use sunlight to produce oils much more efficiently than crop plants and productivity of many microalgae greatly exceeds the oil productivity of the best producing oil crops [Hossain et. al. (2008)].

Algae biofuel research estimates that to replace 5% of the world's diesel consumption with algae oil grown in ponds will require 2.5 million acres of land [Wolfson (2009)]. Biofuel proponents are not daunted by this fact and are challenging this estimate. *Solix Biofuels* estimates that it can replace US diesel fuel consumptions, at present levels, by growing and harvesting algae on 1 half of 1% of the US's productive agricultural land [Herro (2008)]. Other proponents point out how algae can grow using saline water on desert land unsuitable for vegetation and how algae can grow on municipal and industrial waste water on existing land set aside for waste management [Geer (2009; Torrey (2010)]. They claim that Algae can also be grown vertically in reusable, recyclable plastic bags maximizing the amount of land and sunlight required while minimizing the risk of invasion or escape [Torrey (2010)].

2.7 Further Biofuel Advances

The biofuel industry is making research advances within the biocrop industry to overcome the land use criticism and to minimize environmental risks associated with the growing of wild plants such as camelina, and jatropha for biodiesel jet fuel.

Camelina is primarily known in North America as false flax and classified as a weed species [McVay (2008)]. Commercial airlines are testing jet fuels derived from wild plants such as camelina [Biello (2009)]. Currently, camelina is not grown for food although it could be because it is rich in omega 3,

and it would make a much healthier sandwich spread than corn oil [McVay (2008)]. In addition, farmers can plant camelina in wheat fields in years when the fields would normally be fallow, enhancing the soil [McVay (2008); Biello (2009)]. Farmers are being recruited by the company Targeted Growth to grow camelina. By the end of 2010, Target Growth plans to have production up past 50 million gallons of jet fuel per year. The whole aviation industry hopes to produce 100s of millions of gallons of camelina fuel a year by 2014. This sounds impressive, and is a significant amount. However, the global aviation industry burns nearly 270 million gallons of jet fuel a day. So other biofuel sources have to be recruited [(Biello (2009)].

Jatropha is a tall poisonous shrub that grows on marginal land not suitable for food crops and the aviation industry has been experimenting with it to increase its biodiesel production and to insure that the demand and the price of camelina does not compete with wheat prices or land needs [McVay (2008)].

Overcoming the land use criticism cost effectively and minimizing environmental risks are significant challenges confronting the biofuel industry. 93% of the world's airlines hope to supplement at least 10% of all aviation fuel with sustainable plant sources by 2017 [Biello (2009)]. This has some biologists worried because the growing of wild plants and algae as biofuel feedstocks more efficiently has put the pressure on scientists to genetically modify feedstocks and to use synthetic biology and bacteria such as e coli to speed up the chemical breakdown process. Critics fear that these "genetically engineered organisms could cause havoc as bioweapons or become invasive species" that threaten the diversity of native habitats [Low and Booth (2008); Wolfson (2009)]. Wild plants such as camelina, jatropha, switchgrass, mythcanthus and Eurasian giant reed are being selected, bred, and genetically engineered to enhance the very traits that typify invasive weeds and "the most promising biofuel crops are non-native to the regions proposing cultivation, compounding the potential risk of future invasions" [Barney and Ditomaso (2008)].

According to some plant scientists the risks that these weedy biofuel crops pose to the environment are too great [Simberloff (2008)]. One Australian study recommends against the introduction of jatropha and other plants that have reputations as weeds. It claims that the risks of introducing and cultivating weeds are just too great as colonial history bears witness to the non-native plants introduced by colonial settlers that are now threatening the diversity of native ecosystems [Low and Booth (2008)].

Other plant scientists disagree. They claim that the benefits are too great to prevent widespread introduction of non-native species as biofuel crops. Thus they recommend that non-native species be introduced in an environmentally sustainable manner that minimizes the risks associated with invasive plants through risk assessments based upon area specific pre-introduction and screening trials, taking into account that cultivation for production could put other habitats at risk through the unintended transportation of seeds and cuttings [Barney and Ditomaso (2008)].

Going beyond a good bad analysis of the risks and benefits of the use of wild plants, it is important to remember that big monoculture farming interests often conflict with small-scale farming interests that are often quite diverse. For example: In Asia and Africa, homeowners, especially women and small-scale farmers plant poisonous jatropha bushes as fences to keep goats and cattle away from their fruit, vegetable and flower plots and it is women primarily who collect the seeds to sell or to make candle wax and organic manure cakes for their gardens by expressing the oil by hand with a ram press. 90kg of seeds yield between 15 and 18 litres of fuel that homeowners can use with little or no cost [Tigere et. al. (2006)].

2.8 Challenging our Assumptions

Coming back to the analogy drawn from the Parable of the Weeds among the Wheat that illustrates how the good/bad debate can lead people astray and cause them to make false assumptions is instructive. Taking a closer look at the 'weed' in the parable, it seems that the weeds sewn may have

been darnel. Darnel closely resembles wheat and the well-known Christian commentary of William Barclay points out that the ancient Jews called these weeds (more traditionally known as tares) "bastard wheat," and that there is a popular Hebrew story associated with this plant [Barclay (1975)]. The 1975 Barclay commentary summarizes the story as follows:

> The Hebrew for tares is *zunim*, whence come the Greek *zizanion*; *zunim* is said to be connected to the word *zanah*, which means to *commit fornication*; and the popular story is that the tares took their origin [root] in the time of wickedness which preceded the flood, for at that time the whole creation, [humans], animals and plants, all went astray, and committed fornication and brought forth contrary to nature. In the early stages the wheat and the tares so closely resembled each other that the popular idea was that the tares were a kind of wheat which had gone wrong.

The commentary [Barclay (1975)] then expands upon the Hebrew story as follows:

> The wheat and the tares could not be safely separated when both were growing, but in the end they had to be separated, because the grain of the bearded darnel is slightly poisonous. It causes dizziness and sickness and is narcotic in its effects, and even a small amount has a bitter and unpleasant taste... "Women have to be hired to pick the darnel grain out of the seed which is to be milled."
>
> The picture of a [person] deliberately sowing darnel in someone else's field is by no means only imagination. That was actually sometimes done. To this day in India one of the direst threats which a [person] can make to [their] enemy is "I will sow bad seed in your field."

As Barclay points out, with the introduction of darnel into the wheat field came a popular story of how a wild plant came to be seen as an intoxicating and bitter threat to the food supply [(1975)]. The story of how the *Bastard Wheat* came to be planted is fiction. The origin story of the *Bastard Wheat* is not a scholarly assertion based on carefully researched scientific fact. Nor is the Bible story of *Noah's flood* alluded to in the origin story of the *Bastard Wheat*. Yet, the *Bastard Wheat* story as part of an oral tradition works with the written tradition to provide a richer understanding of the historical socio-economic world of the Hebrew people [(1975)].

Like the *Bastard Wheat* story, the *Parable of Weeds among the Wheat* illustrates the tension between the written and the oral traditions as well as the dualism of a legally recognized plant crop and an illegal wild plant crop assumed to be an enemy plant, a weed. And yet even though darnel like jatropha was poisonous and a false or bastard plant like camelina, women marginalized in patriarchal societies without a legitimate husband, benefitted from its planting. Harvesters hired and brought women into the labour force as a result of its planting so that all could share the benefits of the harvest such as access to fuel sources, refineries, and illumination. Harvesters collected and considered the legal and illegal as an integrated whole, like the biblical exegetes collected and considered scholarly and unscholarly sources. The parable of Weeds illustrates how the Master and the Devil and the authorized tradition and the oral traditions work together to mobilize and motivate people working as a community to challenge the tyranny of assumption and desire so all may share creation's energy—may shine like the sun.

If we challenge the assumptions of authorities who respond to weeds as the enemy, we can be surprised. Science has challenged the age old biblical assumption that darnel is poisonous and has discovered that it is a fungus that infects darnel and makes darnel poisonous, not the darnel itself. Scientists have also learned that the infected darnel plants keep themselves and other plants growing near them from being consumed by herbivores, crop eating pests, protecting the harvest [Clay (1988)]. Research studies have also discovered that darnel (lolium temulentum) can be used as a model plant to help plant scientists genetically modify grass crops to compost them faster and thereby help with the economics of the biofuel industry [Baldwin et. al. (2007)]. Another surprise arising from popular practice reveals that anglers have long realized that darnel seeds, commonly referred to as tares, can

be cooked and used as bait for catching fish, supplementing the diet of agricultural families with fish [Baits and Lures (2009)]. These surprises show how the use of a wild plant can contribute to sustainable diversity and why wild plants should not be defined as good or bad.

Other assumptions that should be challenged arise with policy making. Policy makers need to consider the goals and needs of the small-scale agribusinesses and those of the monoculture plantations as an integrated whole and resist the temptation to assume that the needs of all growers are the same. Likewise, some nations and their communities want control over their food sources and their energy [Hunt (2008)]. Others may not and others may not have the capability. Similarly, people in rural communities have different preferences than urban communities. For instance, rural communities like the traditional idea of collecting biomass and burning it as fuel and so technology has found a way to build small portable on-sight ethanol producing systems that allow small-scale agribusinesses to collect and bundle left over chaff, straw, grass and wood from their operations and grind it on-sight to produce burnable pellets in small stoves that capture the gases emitted to produce ethanol. These small on-sight systems are becoming cost efficient and are capable of producing enough ethanol for the owners own use with the potential to sell or trade left over pellets to neighbours [Lemke (2009)]. Of course one side problem could be an increase in homemade liquor and laws governing the production of grain alcohol will need to be rethought in order to facilitate and promote these small-scale agribusinesses [Lemke (2009)].

The need to rethink and challenge outdated energy policies is imperative especially in view of differing and changing energy needs globally and the emerging global biorefinery industry [Ragauskas et. al. (2006)]. The United States hopes to produce 1.3 billion tons of biofuels, bioenergy and biomaterials annually by 2030 and replace over 30% of their transportation fuels with domestic biofuels produced through an integrated, nationwide industry without cutting back on its present export obligations [Ragauskas et. al. (2006); U.S. Department of Energy and Agriculture (2005)]. As other nations adopt similar hopeful goals, societal policies and sustainable land use practices will need to change and old assumptions about wild plants and their management will need to be rethought, globally and locally.

While rethinking and considering humanity's energy needs, policy makers must not ignore human economy. Humans want comfort. They want comfortable living and recreational spaces and comfortable temperatures inside and outside. They want round the clock electric lights, stoves, refrigerators, fireplaces, television sets, swimming pools, Jacuzzis and patio heaters. People need access to fast convenient transportation to take care of their economic and domestic needs and have a strong desire to acquire and trade useful tools, resources and luxury items to keep or give away as gifts. The acquisition and disposal of these items gives them economic security and pleasure. It also requires energy. Finally, we need to understand what motivates people if we hope to mobilize them and get them working and re-thinking old assumptions and ways to produce and maintain a sustainable energy system [Jaccard (2005)] that will empower humanity to shine like the sun [The Gospel (1990)].

An important assumption to consider as developed nations wean themselves off fossil fuel and support community projects working to achieve a sustainable energy system. Not all countries or regions will be economically capable of weaning themselves off fossil fuel or accepting new innovative ideas [Lomborg (2010)]. Nor do developed nations need to think of first generation biofuels or fossil fuels and our dependency on them as the enemy [Jaccard (2005)]. Some first generation biofuels can help sustain rural economies and the technology exists to help them. The technology also exists to separate carbon from fossil fuels [Parson and Keith (1998]. Carbon storage and sequestering have also drawn heavy criticism and researchers are thinking of ways to address this [Parson and Keith (1998)]. However, in the future our cars, our homes, and places of work will be much more energy efficient and depend upon electricity more so than petroleum based products [Jaccard (2005)]. Other alternatives such as wind, solar energy and hydrogen fuels will also be included in the global sustainable energy system [Jaccard (2005)].

2.9 Conclusion

Working together and challenging the tyranny and divisiveness of foolish assumptions and immature desires, Science and Christianity can mobilize and motivate the whole diverse human population into a global community for the purpose of creating and maintaining an integrated sustainable energy system—that includes biofuels among an array of diverse energy options, including fossil fuels. The biofuel industry is making research advances within the bioenergy and biorefinery industries to provide secure locally attainable fuel alternatives, while striving to overcome the land use and food price criticism and to minimize environmental risks associated with the growing of biocrops.

Christianity's *Parable of the Weeds among the Wheat*, understood in the context of the good and evil dichotomy that has re-emerged with advances in the biorefinery industry, is ethically instructive and morally compelling. In this context, the *Parable of Weeds among the Wheat* reveals and resolves the tension between science and faith, between the scholarly and the unscholarly. Moreover, this parable enriches our understanding of cultural preferences and demonstrates how every person, every plant, and every cause and effect are interconnected and need to be considered in relation to realizing the goal, the everlasting hope for energy and the joy of clean air, fresh water and sustainable soils refreshing one and all daily.

To mobilize and motivate humanity with the vision and goal to shine like the sun, leaders in the Science and Christian communities need to communicate this vision to members. They must also push their members into a refining fire of discovery beyond a good bad analysis of nature and human economy, to help them realize the integrity and worth of an integrated system, and hone their members' discernment skills to better equip them to listen and challenge cultural assumptions, laws, policies, and practices of governments, and ethical institutions.

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GREEN CONSUMERISM AND ITS THREATS TO CONSERVATION AND SUSTAINABLE USE OF PLANT DIVERSITY:

CASE STUDY OF CHHATTISGARH

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Abstract

The Green Consumerism movement has ignited market liberalization along with entry of big players into sector of development of the nascent state of Chhattisgarh. A lot of infrastructural development has been initiated with public private partnership. The industrialization has been revolutionalized. The fruits of development have been swindled by outsiders who have gained unregulated access to and control over productive resources in the state. The influence of consumer choice for better varieties of rice has been reflected on agriculture sector. The mushrooming growth of rice mills around small towns of Chhattisgarh promoted by business communities of other states facilitate not only force farmers boosting up agricultural productivity by use of hybrid seeds and chemical fertilizers but also deprive local farmers off enjoying fruit of infrastructure development and growing market demand on the harvest.

The paper is based on one year field investigation focused on developing viable mechanism for documenting traditional botanical knowledge as related to dynamics of market forces regulating production to consumption chain of herbal products in Chhattisgarh. The study has conducted over 57 shamans, 29 bone setters and 167 community elites and tribal healers of 35 forest villages examines sensitive dimensions of sustainable use of Medicinal Plants as related to consumer behavior.

The supply of raw materials of herbal products is affected by unsustainable and exploitative process stimulated by marketing protocols of pharmaceutical companies. These companies have encouraged inefficient, imperfect, informal and opportunistic marketing of medicinal plants. This has led to corresponding damaging to conservation efforts by Forest Department.

Strict regulation mechanism is needed on trading of medicinal plants so that mushrooming growth of trade centers on raw medicinal plant products can be regulated. The wide gap between Macro and Micro level policy framework very often creates bottlenecks in translating global and national environmental agenda at grassroots. The provisions of National Biological Diversity Act 2002, has not been given shape in good number of states. The State Biodiversity Board has been formed. The State level Biodiversity cells, district level Biodiversity Council and District Biodiversity Cells have not been formed. A very little effort has been made to evolve People's Biodiversity Registry at community level directed

towards creation of biodiversity inventory as well as sense of collective ownership of the community on indigenous biodiversity resources around their territory.

Keywords: Intellectual Property Right (IPR), GATT, TRIPs, Cultural Values, Sustainable use of medicinal plants, Patenting, Traditional Resource Right (TRR).

THE BIBLICAL PERSPECTIVES OF ENVIRONMENT AND HUMAN BEINGS:

A CHRISTIAN RESPONSE TO THE ECOLOGICAL CRISES OF OUR TIME

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Abstract

In this paper, a modest attempt has been made to find out a long lasting solution to the ecological crises in response to the Christian ethical environmental sayings. The article has been divided into six parts. In the first part, an introduction has been given illustrating the facts and figures of the hazards related to environmental pollution, climate change and other ecological crises. Then, focus has been made on the Hebrew Patriarchs, Laws of Sabbath rest and other Laws related to land, animal care, land resting, harvesting, health and hygiene as mentioned in the Old Testament. Then, perspectives from the New Testament have been traced in relation befitting the context. The teachings of Jesus Christ regarding environment, the relevant teachings of Paul, Peter and Holy Spirit's role have been logically set. Then, an in depth analysis has been done on Christian response to the ecological crises under the optimistic avenues of Eco-theology. Finally, some recommendations have been made in their regard with a hope of bringing about a metamorphic change in human mind, society, science and technology for dreaming of a suitable and sustainable earth.

Keywords: Eco-theology, ecological crises, plant ethics, earth

1. INTRODUCTION

The shadow of the monstrous environmental depredation is engulfing the habitat of living creatures of our planet more than ever before. The global toxicities are affecting by posing destructive threat of varieties to one and all every moment that nobody has ever dreamt of. The more we explore the factors of it, the more it explodes in the fatal forms of pollution, depletion and ecological degradation. They result in incapacity, death and destruction of the entire biological system. Thus, ecological crises have emerged as the most dangerous factor. The sequence and consequences of this hue and cry is known to all the august and conscious citizens of the world. An epistemic incarnation cannot even manifest to bring about a miraculous solution to this multi folded hazard.

Only in the last half century or so, humans have long affected their environment. Even then, the despoliation was very fast. Now the protective ozone shield is thinning twice as fast as scientists thought a few years ago. A minimum of 140 plant and animal species are being destroyed everyday. Forests are vanishing at a rate of some 17 million square kilometers per year, an area about half of the size of Finland. World population is growing by 92 million

people annually. Of this, 88 million are being added in the developing world. Misuse of science and technology, the greed and selfishness of the affluent affect the fauna and flora of the earth. Building up a human made sustainable habitat in the globe is still a dream. There are several political, cultural, ideological, regional and religious differences add into the problem. Of course, some are resorting to pantheistic attributes to encounter and bring about a solution to the problem. But the atavistic passion of the misuse of science and technology has been irrationally unleashed all the way. As a result, destruction has now stood unconquered.

In this context, being a devout Christian, I represent benevolently the facts in the Bible written in a positive context of ecological safety, adaptable and long lasting biosphere management engineered with enlistment of human values. Thus, I have initiated the discussion with reference to the perspectives of the Old Testament with eleven points from the perspectives of the New Testament. The third part of the paper attempts at representing Christian response to ecological crises with a special emphasis on the practical utility of the Bible reading and preaching. Finally, it leads to certain recommendations which must inculcate rational, metamorphic and conscientious evolution across the length and breadth of the human world irrespective of caste, creed or religion and generate a far reaching possibility of ecological comfort.

2. THE BIBLICAL PERSPECTIVES OF ENVIRONMENT AND HUMAN BEINGS

A. THE OLD TESTAMENT PERSPECTIVES: CREATION THEOLOGY

a) God's Creation is Good:

God created and it was good indeed. (Gen.1:31). It is contrary to Greek Gnosticism which says that Matter is evil and Spirit is good. God is pleased, satisfied, even delighted with the results of the creative process. (Ps. 103:31). So, God uttered "good" seven times. God's creation was not only good but also "meaningful, beautiful and purposeful. God wants the very best for man and woman, as He prepares the best possible environment for them". (Gnanakan1993:47).

b) Then, I refer to God's Creation-Expression of Grace and Love:

The whole creation is an expression of God's Grace, that is God's free and faithful loving kindness that characterizes God's nature and acts. In the creative process, there is an act of love and recipients of ongoing love. (Ps. 136:1-9).

c) Then, God, the sustainer of Creation:

God provides food and shelter for all forms, gives them the breath of life. (Ps. 104:10-13). God has compassion not only for human beings but also for the whole of creation. (Ps. 145:9). Through Covenant with Noah, God makes a pledge to all humanity and all creatures and to the earth itself. (Gen. 9:17).

d) God is also the Preserver of Creation:

Though God punished the environment and humans due to human wickedness, He preserved the remnant and each kind of animals and birds in pairs.

e) The Garden of Eden represents Perfect Ecosystem:

Before the disobedience of human couple, there was a perfect ecosystem in the Garden of Eden. Human beings were interrelated and interdependent with rest of the creation. Relationship between human beings and God is so intimate that God walked in the Garden of Eden hand in hand with humans, which never occurred again.

God's spirit was inherent in all the creation. But in humans, spirit of discrimination between Good and Evil was also inherent, unique from the rest of the creation. But what did human beings choose? In fact, humans were given the responsibility to cultivate land and take care of it. (Gen. 2:15). This responsibility was extended to a proper management of animal world also. (Gen. 2:19). Did humans obey?

Sin introduced the alienation between God, humans, and rest of the creation. When Adam fell, the threefold relationship got unraveled. The caring stewardship of the cosmos turned into cursing. (Gen. 3: 17-19). Human sin affected the nature too. (Gen. 3:17).

f) Dominion and Image of God:

We can find "Dominion" and "Image of God" like terms are very often misinterpreted. Lynn White made a scathing attack on Christianity as the most anthropocentric religion by quoting Genesis 1:28 "Be fruitful and increase in number: fill the earth and subdue it. Rule over the fish of the sea and birds of the air and every living creature that moves on the ground." "We shall continue to have a worsening ecological crisis until we reject the Christian axiom that nature has no reason for existence, save to serve man." (White:1967:79). Lynn criticizes the attitude of the theologians towards the nature and their interpretation of the word "Dominion".

John Wesley interpreted "Dominion" as the mediation of divine blessing to non-human creatures. Focus of most theologians has been overwhelmingly on human history related to the negligence of natural history. Concentration of theologians from Augustine to Luther has been on sin and salvation, fall and redemption of humankind, but not on natural history. Calvinists of Holland taught that maltreating animals is quite permissible on Christian grounds because only humans have souls. But St. Francis of Assisi, whom Pope John Paul II declared "patron saint of ecologists" lived a new relationship with nature in a way that was so moving that he became an archetype of ecological concern for the collective unconscious of human kind.

Thomas of Celano describes especial and profound love of St. Francis of Assisi towards God's creatures:

Indeed he was very often filled with a wonderful and ineffable joy from his consideration while he looked upon the sun, while he beheld the moon, and while he gazed upon the stars and the firmament….How great a gladness do you think the beauty of the flowers brought to his mind when he saw the shape of their beauty and perceived the odor of their sweetness? When he found an abundance of flowers, he preached to them and invited them to praise the Lord as though they were endowed with reason. In the same way he expressed with surest purity cornfields and vineyards, stones and forests and all the beautiful things of the fields, fountains of water and the green things of the gardens, earth and fire, air and wind, to love God and serve him willingly. Finally, he called all creatures brother, and in a most extraordinary manner, a manner never experienced by others, he discerned the hidden things of nature with his sensitive heart, as one who has already escaped into the freedom of the glory of the sons of God. (I Celano, 81-82)

Schaffer (1970:16) agrees that human beings were given dominion over creation. But since the fall, man has exercised the dominion wrongly. Christians shall exercise dominion without being destructive."

Raja (1996:225) writes, "Dominion shall be understood in terms of the shepherd-king (Ez. 34:1-15), namely through compassion, concern and caring for each of the creatures, so much so, as the Psalmist says, these all look to thee to give them their food in the season. (Ps.104, esp. v.27).... when humans are given "Dominion" over the creatures that are only invited as vice -regents to imitate and follow this shepherd-leader king."

"Image of God" can be defined as man's rationality which is different from the rest of the creation, and allied to the divine nature.

g) Laws:

During the period of Hebrew patriarchs, God gave laws to them. There were Law of Sabbath rest (Ex. 23:12), land resting (Ex. 23:11a) and Law of Harvesting (Lev. 19:10).

h) Reverence for Nature:

Israelites had reverence for nature (Deut. 22:60). According to Deuteronomy 20:19, cities may be captured, but trees should not be destroyed.

j) Monarchs:

Monarchs had even closer relationship with nature. Monarchs were wise and raised questions regarding origin of all things and about the earth. (I Kings 4:19-24). During the four centuries of monarchy, Hebrew religion labored to covenant theology.

j) Pollution of Land and Water:

Land got polluted due to extreme degree by copulation of heavenly beings with human maids. (Gen. 6:1-4). Plagues sent by God when Pharaoh was stubborn to release Israelites caused pollution of land and water (Exodus. 7:11).

k) Prophets' Anguish over Pollution of Environment:

Prophets had concern not only for the sinful nature of Israelites, but also for the environmental degradation.

Isaiah condemned land grabbing greed (Is. 58:10). Isaiah, like an ecologist describes the pollution (Is. 24:4-6). Joel, "the prophet of ecology and development" calls for environmental awareness (Joel 1:2-4; 6-7; 9-12; 17-20; 2:2-10). He calls for repentance to change life styles (2:12, 17). Amos asserts that to shed blood is to commit violence to the earth. Jeremiah laments when the rulers become oppressive because nature also shares in the great sorrow that would stalk the land when Yahweh turns away from the people (Jer. 4:28; 12:4; 9:5).

But the prophets believed in the redemption of nature in future (Is. 43:18, 19; Joel 2:12; 3:16-18). The Psalmist prays for restoration of original intended harmony of creation (119:19).

B. THE NEW TESTAMENT PERSPECTIVES

1. Jesus –A part of Nature:

Though Jesus did not talk directly about ecology, which might be an unknown term those days, yet He had a positive attitude towards natural environment. He had concern for lilies

and sparrows. He drew inspiration of glory on the mountain tops. He delivered His famous sermon on the mount. His triumph over temptation of Satan was on the mountain (Matt. 17:1,2). He had agony on the mount olives. He ascended into Heaven from a mountain (Luke 24:50).

2. Jesus' teachings on nature:

Jesus used mustard seed and leaven in parables while teaching about kingdom of God. In his parables, soil is the environment. Seed is that brings out life. Jesus taught "Blessed are the meek: for they shall inherit the earth". (Matt. 5:5). (New King James Version). Indigenous people who live very close to nature belong to above category. Their firm belief is that "whatever befalls the Earth befalls the sons of the earth."

Jesus used inanimate things like salt to teach people to be like them. The Good Samaritan showed sympathy not only towards the wounded traveler, but also to the ass. Jesus stressed the significance of "Good Stewardship" in the parable of talents (Matt. 25:14-30).

3. John's teaching on Creation:

No other Gospel is so cosmic in purpose as Gospel of John. John writes in the prologue that Jesus Christ is Lord of Cosmos (1:1-3). John relates the kingdom of God to come to redemption of creation. He describes, "He who was seated on the throne said, I am making everything new" (Rev. 4:11).

4. Paul's teachings on Creation:

Paul describes Jesus as Creator and Sustainer of the whole universe. (Heb 1:1-3). Protestant theologians taught that only human beings will be renewed and regenerated at the Second Coming of Christ as only humans have souls. Paul clearly specifies in Romans 8:19-22, that whole of the creation will be liberated. Paul describes in Romans 14:17 that in kingdom of God, there will be righteousness, peace and joy.

5. Peter on Renewal of Creation:

Peter speaks in Acts 2:21 that God restores everything. Peter looks forwards to a new Heaven and a new Earth (II Pet. 3:13).

6. Holy Spirit's Role in Creation:

The Holy Spirit was there even before the creation and brought order into universe. Creative aspect of Holy Spirit was described by the Psalmist (18:9-12). Being a Person of Holy Trinity, the Holy Spirit had a special role in making of human beings (Gen. 2:7). The Psalmist describes that Holy Spirit will renew the creation (104:30).

7. Characteristics of Renewed Creation:

Isaiah describes in 11:6-9 that there will be symbiotic relationship among animals and between animals and human beings in the kingdom to come. There will be total transformation of environment. Isaiah sketches it in Is. 55:12, 13. God speaks through Ezekiel about renewed creation (34:25, 26a, 28b).

3. CHRISTIAN RESPONSE TO ECOLOGICAL CRISES

Why and how should Christian church respond to ecological crises? Sanjeevaraj (1991:55) writes, "Christian church has a double obligation in trying to fulfill the worldwide threat of ecological crises, first to submit as one who has offended the profound God's creation, and secondly to commit to meet this moral crisis, with the message of the redeeming love of Jesus Christ."

The Bible teaches us that the intrinsic relationship between mankind and creation. Adam was created from adamah, the earth, and hence the respect for earth (adamah) is respect for Adam.

The Bible teaches the correct relationship of human beings to the rest of creation, whereas materialistic view denies creator and spiritual aspect in human beings and pantheistic view teaches that God is all and all is God.

4. BIBLE TEACHING AND ITS PRACTICE

1. Realization that God is owner of creation:

The Bible affirms that God is the owner of all creation (Ps. 24:1; 87:11). The universe including all that are in it, birds, fish and plants belong to God (Job 38:4,8, 9) that humankind was entrusted with the care for it.

2. Realization of Human Stewardship:

In the New Testament, there are two words to mean stewardship. Epitropos (Mt. 20:8; Gal. 4:20) i.e., one to whose care or honor of another has been entrusted, a curator, a guardian and oikononmos (Luke 16:2,3; I Cor. 4:1,2; Tit.1:7) i.e., manager.

3. Accepting Greed as a Sin:

Greed is one of the reasons for ecological crisis. The man of millennium, Mahatma Gandhi says, "The Earth provides enough to satisfy everyone's need, but not everyone's greed." The Bible condemns the sin of greed. King Solomon blames the greed "the treacherous are caught by their own greed" (Prov. 11:6b). Greed is a sin contrary to character of God. Solution to greed is: "Let you be without covetousness; be content with such things as you have." (Heb 13:5a). Jesus said, "...I have come that they may have life, and that they may have it more abundantly." (John 10:10 b).

4. 11th Commandment:

Skolimowsi gives 11th commandment. Skolimowsi says, "The earth is the Lord's and the fullness thereof. Thou shall not despoil the Earth now destroy thereupon."

5. Concern for Neighbor:

One of two commandments given by Jesus was: "Love your neighbor as yourself" (Matt. 22:39). By exploiting our nature, we are exploiting our poor neighbor also.

6. Concern for future generations:

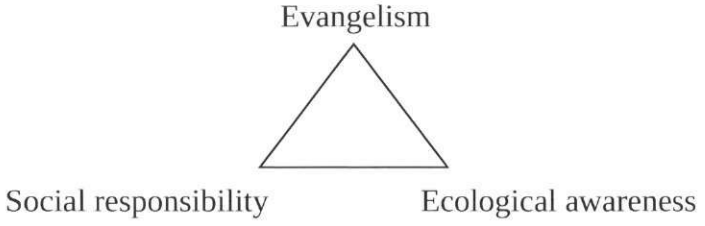
Our consumerism, greed and selfishness are such that we are blind about future generations. The Israelites had a responsibility for future generations. "Choose life so that you and your

children may live (Deut. 30:19). When God made covenant with Noah, it was not only for that generation, but also for all future generations (Gen. 13:15).

7. Eco-theology and its Relationship to Creation:

There should be a drastic shift of the western theology from traditional to the modern approaches. This is not much critical of science and technology related to pollution. Evangelicals have to change their attitude towards human aspect of theology, not only shall stress sin and salvation, but also social and ecological problems.

Though the evangelism is primary, church has three fold responsibilities, i.e., evangelism, social responsibility and ecological awareness



Christian opinions, ideologies and ethics must come forward to solve the practical problems related to ecological crises. Religion should be devoted to solve real life problems.

5. DISCUSSION

Humans cannot live without environment. There is no theology of God without environment. Humans have to rise to higher level to appreciate God's environment. Humans during ancient times were unskilled but had valuable empirical knowledge and close affinity with nature and revered it. But the modern human beings, they boast of having high caliber and knowledge, are behaving as if they have no sense at all. They are as St. Paul says in Romans 1:22a "Although they claimed to be wise, they became fools." When will we have common sense like tribal in "Chipko Movement" in India, who prevented contractors to cut trees and hugged the trees. Though it is not possible to attain "zero pollution" in the present context, yet we cannot but tackle ecological crises than wait only for the renewal of creation.

Today many people including Christians believe and live in promoting themselves socially and live at the expense of others. If they want to be true to Jesus Christ, we need to live for others. This is the only way by which we can participate in the cosmic mission of God.

6. CONCLUSIONS

Before too long, the Church has a great role to save local ecological problems. We should "think globally and act locally."

1. Mother is a good environmental teacher. She can teach the children about personal hygiene, tender care of plants and trees and appreciation of beauty of nature and birds.

2. We shall have simple life styles, shunning all the wasteful things. Jesus Christ, Gandhi and Mother Theresa showed examples by having simple life styles. Paul condemned materialism. (I Tim. 6:10).
3. Christians must observe family planning procedures strictly to check population expansion.
4. Preference of public transport system to private vehicles to reduce air and noise pollutions.
5. Living in communities is preferable as early Christians showed an example by sharing everything they had.
6. Reduce non-vegetarian food and prevent morbidity and curb pollution.
7. Village Republic model of Gandhi: Village industries shall be set up to make villages self sufficient and avoid migration to urban areas.

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ETHICAL AND CULTURAL VALUES OF BIODIVERSITY

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Abstract

This paper develops the need for protection of "the life" and "its biodiversity", as it is dictated by the principles of ecology and religious concepts, and also from its relation with the ethical values and its rules, international or not, of right. This need for the conservation and protection of local, national and planetary biodiversity is often realized by human populations who are living in areas with rich biodiversity and possess high level of ecological and religious consciousness and responsibility. Still this consciousness is reinforced by the perception, scientifically proven, which considers that each living, human or not, organism constitute a part of the planetary biodiversity whose catastrophes fracture the wholeness and the functionality of ecological chain in which the organism is interlaced and as a result the offense, degradation or even the extinction of the "existence" of life.

Afterwards, this paper shows the cultural values of biodiversity, through the interrelation and interaction of human with the nature and the: whole" environment, which conveys to a "cultural diversity" in balance and harmoniously connected with the biodiversity of the traditions, of regions. The "coexistence of this high level of biodiversity and cultural evolution "satisfy" the spiritual, esthetical, morphological and educational needs of human population who live in a biotope of such ecological and cultural values. For this reason, these regions represent useful and efficient laboratories of eco- environmental studies, analyses, researches and "educations", that can teach and sustain the contemporary and future citizens of the Greek and universal communities, ecological knowledge, capabilities, positions, perceptions and and 'attitudes'.

And that is why scientific and institutional efforts of the globalised scientific and cultural community cannot be successful unless they pass through the channel of educational process by participating, living, searching and multidisciplinary pedagogic activities. For the same reason, the attempt of political leaders and international organizations, influenced by their search for economic ambition and advantages, could not impose an institutional agreement and commitment to protect and conserve their environment. Consequently, to be effective, the endeavors of different countries should be reinforced by the local intervention and initiatives of citizens who really care about the quality of their whole environment. With such methodology and using value approach of the struggle against local and global environmental problems, the implementation of the goals of the IYB 2010 "International Year of Biodiversity" could be promoted and realistic.

Keywords: IYB 2010, environmental ethic, cultural biodiversity, biotope, pedagogy

1. INTRODUCTION

The conservation and management of biodiversity require the use of procedures, processes and measures similar to the principle of sustainable use, and research, measurements and estimates of species components and offered functions of ecosystems. Moreover it needs sound management and feasible implementation strategies to convince the political, economic and scientific leaders of our planet to act responsibly and sustainably in organic "dignity" to conserve and protect the ecosystem of which give it power, value, beauty, integrity, competence and prestige. Although the conservation of biodiversity genes, species and ecosystems is not easy to build, in terms of economic utility, the technocratic perceptions of scientists and political leaders who usually decide. Why can easily assess the value of forms of direct economic importance, but not however the value of indirect benefits that arise from the eco-systemic functions of biodiversity, such as the formation of soils, protection of water resources, degradation of pollutants, the adjustment of global change, etc. But the cultural value of biodiversity, we need to strees on is that human civilizations coevolved with the environment in their areas. The co-evolution has shaped cultural diversity, as previously mentioned, the conservation of which, for many students of history and sociology, an argument similar to the conservation of biodiversity. The ratio of these two diversity, biological and cultural nature, not an ideology, but crucial to the historical, social and economic status of particular areas and traditional villages that grow in areas of immense natural beauty, covering many and varied needs of human populations (Athanasakis 1996, 2005).

2. BIODIVERSITY INTERACTIONS

The relationship of diversified natural environment and culture, in particular, were noted in Greek mythology. So the 12 gods of ancient Greece lived in the highest peak of Mount Olympus and Lake Stymfalia, a temple dedicated to Artemis, was the first Greek Wildlife Refuge. Even the exploits of Hercules with Stymphalian Hens, the Hydra and manure of Augeias relate to wetlands, and many rivers were deified (Falcon and Koutrakis 1996). Cultural references are associated with the concept of diversity as a reality and ecological resource of great value, requiring care, protection and conservation, showing that biodiversity of natural areas is a cognitive area of environmental education and training not only for institutional education levels, but and process (informal or otherwise) lifelong education for all citizens of Greek and global society. This training not only in building the knowledge and the emergence of environmentally friendly attitudes, perceptions, attitudes and values can convince the prospective citizen to protect any life form. This obligation, which derives from the ethics of the environment, documents the minutes of the urgent need for conservation of biological diversity (Athanasakis 2005). This is because research and institutional efforts of the global scientific and political community cannot be effective if they do not cross the "channels" of the educational process, through participatory, experiential, exploratory and interdisciplinary teaching activities.

But the moral of the environment has a wide range depending on the diversity and diversity of human cultures. Why is it moral, personal responsibility as a human, it works differently for human populations that kill an elephant, or an oyster, or a chicken or a fish or a plant, so any intervention to be based on different arguments, depending on the value weight. Differentiated such a climate of change, human actions, show the diversity of human

environmental attitudes in developed, developing or underdeveloped countries where the problem of survival has different economic, social and cultural characteristics which influence in these countries, the procedures for maintaining and protection of their biological diversity. Apart from interpretation, remains the indisputable value of the assumption that it considers non-moral behavior abandonment of biota to future generations, who have lost biodiversity.

3. IYB2010: INTERNATIONAL YEAR OF BIODIVERSITY

Based on these reports, the UN has declared year 2010 as "International Year of Biodiversity in an attempt to alarm the ecological consciousness and responsibility for the protection of natural ecosystems. So they warn that the rate of loss of species is 100 times greater than expected and that our planet today "lose" three kinds of time, so the "loss" that threaten the very human existence, losing priceless ecological resource -logical, economic and cultural value. So in January 2010 in Berlin, as Germany holds the Presidency of the Global Biodiversity Treaty, German Chancellor Angela Merkel and the executive director of the UN Environment Programme (UNEP) Achim Steiner, called for the establishment of a body to collect scientific data and outlines effective policies for conservation and biodiversity protection, hoping that at the meeting to be held in October 2010, Japan will reach a binding agreement, this time limitation loss of biodiversity. It is hoped that world leaders and members of the global scientific community at this time, will work collectively, consciously and responsibly on the global problem of biodiversity loss, without political and economic considerations that undermine the credibility of the scientific and ethical research. However, expectations for the quality of our environment, involving only the efforts of political leaders, researchers and scientists, without participatory awareness-raising, mobilization and empowerment of global society will not solve the issues and problems of the holistic environment.

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PART II

Wild Plant
in Scientific Research and Development

SUSTAINABLE USE OF BOTANICAL RESOURCES FOR MALARIA CONTROL

TOWARD THE DISCOVERY OF NOVEL COMPOUNDS CAPABLE OF EFFECTING A REDUCTION IN DISEASE TRANSMISSION THROUGH DECREASES IN THE RATE OF CONTACT BETWEEN MOSQUITO VECTORS AND HUMAN HOSTS OF THE MALARIA PARASITE

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Abstract

Over a million children under the age of five die due to malaria infection in countries of the developing world every year. Responsible for this plague of the Third World is a parasite, which is transmitted by female mosquitoes sucking blood from human hosts. Female mosquitoes locate their hosts by sensing certain volatile chemicals emitted by humans. Specialized biological molecules in their antennae, the main organs for odor sensing, regulate how mosquitoes perceive the various odors in their environment through a complex process. If we could disrupt this process, then female mosquitoes would lose their ability to orient themselves towards their human hosts, obtain a blood meal from them and transmit the malaria parasite in the process. Consequently, the rate of transmission of the malaria parasite would be curtailed.

This presentation will discuss how plant specimens collected from various locations in Greece are used as sources for the isolation of extracts containing substances capable of interacting and interfering with the function of specific components of the smelling apparatus of mosquitoes that transmit the malaria parasite to humans. The way in which the initial biochemical screens whose goal is the fast detection of the presence of candidate bioactive components in the crude extracts are coupled to physiological and behavioral tests on live mosquitoes will be discussed together with the transition from identified natural components with desired bioactive properties, such as pronounced mosquito repellent or attractant activities, to the synthesis and use of synthetic counterparts.

The identification of multiple disruptors of host seeking behavior of female mosquitoes will provide multiple new and effective tools to be employed in the effort to reduce the incidence of contact between the human host and the insect vector carrying the malaria parasite. Thus, formulated versions of biologically active compounds could be used for the protection from mosquito bites of individuals (via bednet treatment and/or dermal application) as well as larger groups of people (via perimetric positioning of odor-based mosquito disorienting baits in villages where malaria is endemic). Last but not least, if successful, the approach described in this presentation will serve as a paradigm for analogous efforts aimed at a reduction in disease transmission by other disease-carrying insect vectors.

TRADITIONAL USE OF WILD PLANT DIVERSITY IN CRETE

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Abstract

Relics of traditional knowledge still survive today in rural areas of Crete expressing the long interaction between people and plants. The present study concerns the preservation of the intangible biocultural heritage which is essential for understanding and improving the sustainability of our relationships with the living world. More than 330 plant species are reported, as used for food, traditional medicine and materials. Even though the great majority of the species that are used are rather common, these include 10% of the Cretan endemic flora. The number of reported species corresponds to 20% of the Cretan flora. A rapid loss and erosion of knowledge amongst people during recent years was observed, while the intensification of agriculture and the overharvesting of natural plant populations reduce the diversity of wild species in favor of invasive plants.

SUSTAINABLE MANAGEMENT OF DRY GRASSLAND HABITATS IN EASTERN AUSTRIA

A CHALLENGE FOR NATURE CONSERVATION

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Abstract

Dry grassland habitats in eastern Austria are characterised by a high biodiversity. However, land use changes during the last century have caused a loss of biodiversity. The cultural landscape is in a state of transformation. Areas that were useful in former times are not economically any more. The stress on productivity and specialisation has serious impacts on the biodiversity of our cultural landscape. From an economical point of view, low productivity grasslands, extensively managed grasslands, have no economical value. Without subsidies there is no sense to use it any more. The consequence is either intensification or abandonment. From a nature conservation point of view, this development is disastrous. Therefore, nature conservation projects take care of these habitats. Unfortunately, nature conservation activities often relate to vegetation units or phytosociological units – abstract units that are not relevant for a positive development of biodiversity. Interactions of land use and biodiversity are complex and depend on spatiotemporal interventions. Each intervention has an impact, but if managed in a small-scale way, plants as well as animals have opportunities to live and survive. This paper shows examples from Eastern Austria: management of dry grassland habitats in the Natura 2000 areas Wachau and Eichkogel, which are also famous wine growing areas. Constraints, obstacles and chances of nature conservation projects are discussed. Moreover, there is a focus on challenges, how nature conservation projects can be designed and performed more efficiently.

Keywords: biodiversity, nature conservation, habitat management, dry grassland habitats

DISPERSION PATTERNS OF THE GENETIC MATERIAL OF *CITRUS MEDICA* L. (CITRON) FROM ITS ORIGINAL GEOGRAPHIC CENTER, AND THE GENETIC RELATIONSHIP BETWEEN CULTIVATED CITRON VARIETIES IN MEDITERRANEAN COUNTRIES

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Abstract

Electrophoretic analyses by isozymes were used to investigate the phylogenetic relationships between the genetic materials of Citrus *medica* L from various historical places. Studying the dispersion of this crop from its original geographic centre, it was found that the genetic material of *C. medica* from Crete, Naxos and Corsica are closely related with those from Egypt, Calabria and Israel, respectively.

Keywords: Citron, phylogenetic relationship, isozymes, cultivar taxonomy

1. INTRODUCTION

Citron (*Citrus medica L.*) is believed to have originated in the warm regions of the Himalya. In the 7th century B.C., the cultivation of citron was spread to the valley of Tigris and Euphrates and other warm regions of Mesopotamia. In Mesopotamia, citron was used as an essential oil in aroma production and as an antidote against different poisons. Since the conquests of Alexander the Great, citron was cultivated in the Middle East (Persia etc.) and it is thought that his armies carried it to the Mediterranean region about 300 B.C (Anonymous 1957). The citron trees were imported from Syria and Egypt through the Persian conquerors, the Ahemenides (Ahmessibles). In the Arab world Citron got known under the name "Atroung" which is a translation of the Coptic word "Ghitre". A Jewish coin, struck in 136 B.C., bore a representation of the citron on one side.. However, it is strange that the Bible mentions frequently figs, grapes and olives but never citron. Nevertheless, the word "Hadar", used by Moses, most probably refers to citron. This assumption is strengthened nowadays by the use of citron in the celebration of Tabernacles. The Jews go to synagogue holding a citron and other fruits (Levitikon). The Jews who had close commercial relations with the Assyrian and the Persians brought it to Palestine. Citron was distributed to the Greeks and Romans.

Citron was distributed to the Greeks and Romans. Theophrastus from Eressos (Lesbos), who described, in his fourth book of *"De historia plantarum"* (The History of Plants), the plants of Middle East after the conquests of Alexander the Great, named the citron tree "Apple of the East" and gave an exact description of the citron tree and its fruits which were used as antidote against poisonings with a specific application: *"if it is given together with wine it brings cramps to the belly and helps thus the body to get rid of the poison"*. Vergil (70-19 B.C.) was the first of the Latin writers to describe the citron; like Theoprhastus he called it the 'Median apple' and described uses similar to those given by the earlier author. Dioscorides, a native of Cilicia who wrote a treatise on Materia Medica between 60 and 79 A.D., mentioned citron and Pliny, in his *Natural History*, about 77 A.D., called citron *malus medica*, *malus Assyria* and *citrus* and described its use as a medicine, poison antidote, perfume, and protection from moths. Athenaeus, a philosopher who was teaching in Alexandria at the end of the second and the beginning of the third century A.D. says about citron in "Deipnosofists" (228 A.D). *"At the time of our grandparents, nobody used to eat citron but they put it as a heirloom in their trunks for the clothes, to protect them against moth*". So, according to Athenaeus, citron became suitable to eat after his grandparents time, that is some decades before the writer. Plutarchus also, who lived the same about years in the small Greek town Chaeronea, mentioned that citron (median apple) was nice to eat cucumber, melon and pepper. The second century the citron was widely cultivated around the eastern Mediterranean, since its price was comparable with that of the fig (Tolkowsky, 1938, p.62). Archaeological and literary evidence support the net impression that the citron was introduced in Italy about the time of Augusts and by the middle of the first century A.D. was producing fruits in some of the warmer parts of Italy (Andrews 1961). The barbaric invasions at the close of the fourth century interrupted citron culture in districts where artificial protection was required for its maintenance, for the invaders effaced all traces of luxury by destroying the magnificent homes of the rich Romans. However, in Sicily, Sardinia, and a large part of the Kingdom of Naples, where the climate was sufficiently mild to permit its growth as a naturalized plant, the citron survived the invasion.

Citron are an important crops relative to mediterranean civilization. However,little is known about their genetic diversity. The relationships between the citron descemdants and their ancestors is not well investigated. Some chemical studies have been establish for the relationships between citron cultivars by the analysis of essential oils of the peel and leaf. (Venturini et *al* 2010, Vekiari et *al* 2004, Gioffre, 1980, Huet,1986)

After the 1980s, new biotechnological methods based at first on iso isozyme (isoenzymes) and later on molecular marker analyses were applied to determine the origins of plant varieties (Protopapadakis 1987,Protopapadakis et *al* 1998). In most cases, the DNA-based marker technology provides the same type of information as isozymes, but allow for clearer resolution of genetic differences. However, in a lot of projects the performance cost is a crucial point. Cost can be reduced to the necessary conservation measures and by the implementation of less expensive research techniques. In this case, isozymes seem to be the more appropriate technique. In the present work, carried out in our laboratory by using the isozyme technology, the origins of several citron varieties from Crete, Calabria, Naxos, Corsica and Egypt were examined.

2. MATERIALS AND METHODS

To certify the citron varieties, in our study, an isozyme electrophoresis technique, based on Esen and Soost (1976), Esen and Scora (1977) and Torres et al. (1978), was applied, in which leaves was replaced by pollen as a source material for isozyme extraction. Pollen is an excellent source material, since it assures better reproducibility because of its lower variability (Saito, 1970; Payane and Fairbrothers, 1973). Pollen was collected in spring and autumn from plants of nine citron varieties of the Institute of Sub-tropical Plants at Chanea. The plants had been grafted on 9 blocks of five tree for each variety on Sour oranges rootstocks. The varieties tested were as follows:

A) Acid pulp varieties with violet coloured flowers and young shoots

a. 'Diamante': It is widely cultivated in Calabria (Italy). It produces large, smooth ovale to ellipsoidal fruits; basal cavity furrowed and surrounded by low collar.
b. 'Naxos': It is widely cultivated in the Naxos island, Greece. Its fruits are large, long-oval with a very thick and fleshy rind; the surface is more smooth than the former.
c. 'Etrog': It is widely cultivated in Israel. Its fruits are smaller than the former and ellipsoid in shape with few bumps.
d. 'Lisse': It is widely cultivated in Chanea, Crete. There are two accessions of this cultivar, large oval or ellipsoidal fruits.
e. 'Koptiki': It is cultivated in Alexandria, Egypt on dooryard gardens.

B) Acidless pulp varieties with flower whites and green young shoots

a. 'Corsican': The fruit have good size, large and elliptical in shape with yellow color, The fruits are rough and bumpy.
b. 'Cedressa': The fruits of this variety are bigger of Corsican and they are very rough with shape ovale to round. This variety is existing to dooryand gardens in some villages of Spain.
c. 'Lefki': There is variation of the fruits size and with differents shapes from ovale to ellipsoidal that are smooth with few bumps cultivivated in Crete.
d. 'Garoufalato': The fruits are medium large, cultivated in Peloponese and Parga. The fruits of this variety are biggers of Corsican very rough with shape avale to round. This variety was exporfed to U.S.A from Parga to Jews diaspora for the feast of Tabernacles.

Isoenzymatic analyses were carried out from pollen collected from plants three-four times in each year.

Electrophoresis technique

Polyacrylamide gel electrophoresis was performed in a vertical slab apparatus, as described by O' Farrel (1975) with some minor modification, in a 10% gel buffered by 370 mM tris-HCI, pH = 8.8, using a discontinuous buffer system. The electrode buffer was 10 mM tris-glycine, pH=8.8.

20 mg of pollen grains were used in each individual sample. Extracts were taken in a solution of 10% sucrose. Electrophoresis was carried out in a refrigerated box (4 C to 6 C) during a

16- h period by constant tension of 80 V (initial intensity of 40 mA current). Isoenzymes of esterase and acidic phosphatases were detected according to the method of Gabriel (1972), and peroxidases isoenzymes according to Gove and Hoyle (1975).

3. RESULTS AND DISCUSSION

Esterases:

The citron varieties studied gave three types esterases of zymograms: Est1, Est2 and Est3. The citron 'Diamante' and 'Naxos' from the acid group as well as 'Lefki' and 'Garoufalato' from the acidless group contained the Est1, the 'Corsican' and 'Cedressa' from the acidless group contained the Est2 and 'Lisse' and 'Koptiki' the Est3. (Fig. 1). These esterases were distributed in two zones (probably two loci) as is indicated in Fig. 1. Since the esterases have been shown to comprise a dimeric structure in both vertebrate or invertebrate organisms (Ward, 1977) and also in plants (Schartz, 1960), the following hypothesis could be said.

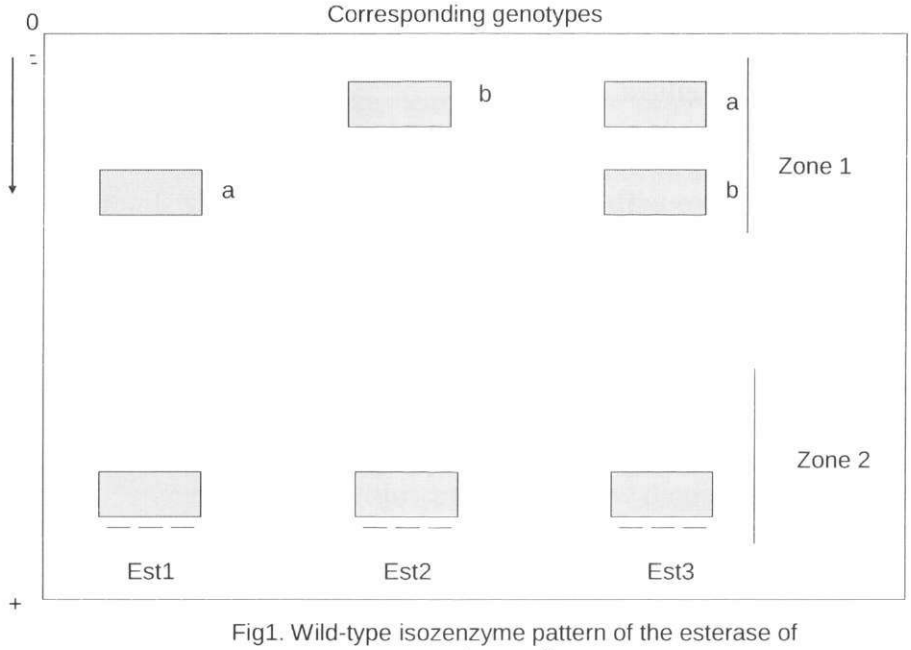

Fig1. Wild-type isozenzyme pattern of the esterase of citron pollen

Zone 1: All the analysed trees showed three types of bands coded from alleles a and b. Therefore, on the Est_1 and Est_2 the bands are controlled by the alleles a and b, respectively, but on the Est_3 there is a hybrid enzyme controlled by the alleles a and b together in the same locus. In this case, there two codominant alleles controlling two isoenzymes with different electrophoretic mobility.

Zone 2: This zone consists of one major band with one small minor band indicating weak intensity. All the analysed trees showed these bands. This zone is controlled by one locus.

Acid phosphatases (rapid and slow)

The distinction between rapid and slow acid phosphatases is a result of the Rf and the pH optimum which is necessary for its development. Therefore, at pH 4 or 5 only the slow bands appear, while at pH 3 or 3,5 they are more weak than the rapid. The slow acid phosphatase migrates slowly and it is dimeric. On the other hand, rapid phosphatases would be monomeric if we recorded the data of its speed migration faster than the blue of bromophenol, (Mathieu de Vienne, 1977). It is known that monomeric and dimeric acid phosphatases are present in a single organism (Jacobs and Schwind, 1975).

Rapid: This enzyme has a simple genetic determination. Extracts from all the cultivars produced zymograms with only one band in the area of higher electrophoretic mobility with the exception of the cv Armenon which had a second band in the area of low electrophoretic mobility (Figure 2).

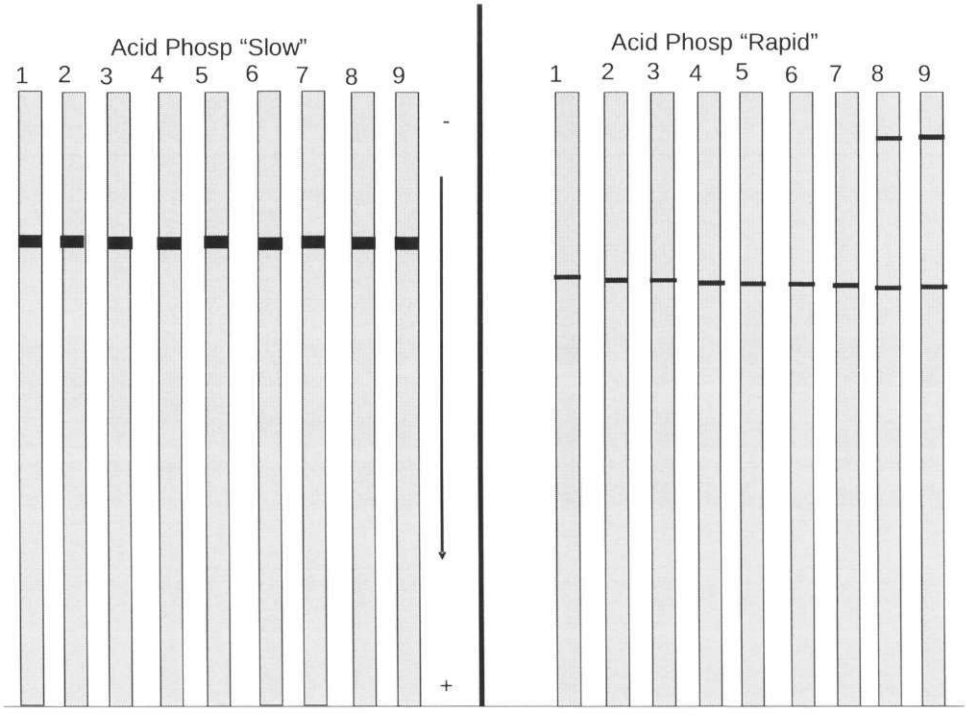

Figure2. Diagrams of acid phosphatases from pollen (slow and rapid) observed on the trees of different varieties. No1: Diamante, No2: Naxos, No3: Etrog, No4: Lefki, No5: Garoufalato, No6: Corsican, No7: Cedressa, No8: Lisse, No9: Koptiki.

Slow: Extracts from all the cultivars tested developed zymograms with one band in the area of the highest electrophoretic mobility zones of 8 and 9 which includes high and weak activity (Figure 2).

Peroxidases

The peroxidases were demonstrated by a form of two major zones : the first (A) and the second (B). Data showed that the isoesterase enzymes exist in multiple molecular forms in C. *medica* and that their zymograms are important markers for cultivar identification.

The stability of the grouped expression of these esterases (Figure 1) independently of the type Est1, Est2 or Est3 suggests that a very strict linkage between the corresponding genes could exist and confirms the importance of this enzyme for the taxonomy of the Citrus genus. This system is therefore valuable for the identification of genetic material.

The slow acid phosphatases in this genus appear as monomorphic genotypes, since their zymograms showed only one band. The rapid acid phosphatases are important for the identification of the variety 'Lisse' particularly with respect to the second band in the anodic area (Figure 2).

The data obtained for peroxidases showed that two zones exist in multiple molecular forms without variation in the electrophoretic analysis when the separation of the bands was based on the molecular weight of the enzymes. All the results described above show that the hydrolases (acid phosphatases and esterases) of pollen could be used as genetic markers in investigations on the genetic constitution of citron population in Medittereanea.

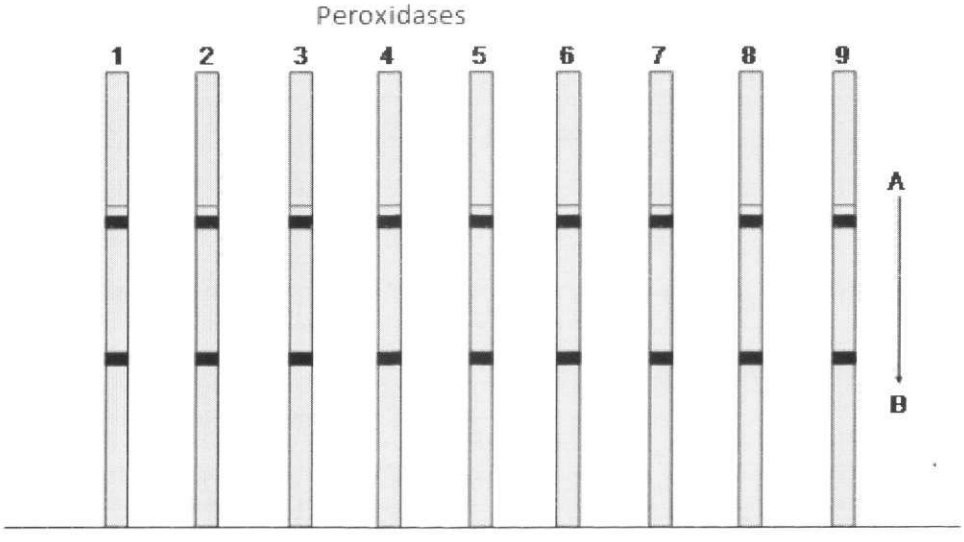

Figure 3. Corresponding schema of Peroxidases.

The results of this research show that the varieties 'Lisse' cultivated in Mylopotamos, Rethymnon and Apokoronas in Crete, 'Naxos' in the Naxos island and 'Corsican' cultivated in Corsica are related closely to the citron genotype cultivated in Egypt, 'Diamante' cultivated in Calabria, Italy) and 'Etrong' cultivated in Israel and Marocco.

The close genotypic relationship between the citron varieties from Crete and Egypt, as well as from Naxos and Calabria, found in our study, could be attributed to the exchange of citron material between these regions, respectively, in ancient times. Although geographically separated, the above regions had close agricultural contacts that could allow frequent transfer of plant genetic material.

Citrons trees usually have a spreading growth habit with relatively sparse foliage and are typically very thorn. All varieties appear to fall in two natural groups-the acid and the acid less sweet citrons. The cultivation of citron in Mediterranean countries has been in progress for many centuries. The brined fruits of the Cretan cultivars are shipped to the

northern Europe and used as candied peel in traditional Christmas cakes, while the fruits of the cultivar 'Etrog' from Morocco are shipped to Israel for religious use. From the 'Corsican' citron variety cultivated in Corsica and the 'Naxos' cultivated in the Naxos island candied fruits, jam and two local liqueurs named 'Cedradine' in Corsica and 'Kitro' in Naxos are produced. (Graikou et *al* 2006)

Some historical varieties of *C. medica*, after having survived for many centuries, connected with local traditions and economies are actually in danger to disappear. In the last few years, the Cretan variety ''Lefki'', the only one with white flowers, from the citron germplasm of Crete (all the other have violet flowers) has already disappeared.

To save the historical germplasm of citrons in Crete we suggest that some plants be planted in the monasteries yards, as we have already done with some rare cultivars in the Monastery of Chrysopigi, Chanea, Crete, following the Italian paradigm, where monasteries collect citron germplasm.

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WILD EDIBLE FLORA
IN THE WESTERN AREA OF CRETE
CASE STUDIES BY PUPILS FROM THE 2ND GRAMMAR SCHOOL OF KISAMOS, CHANIA

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Abstract

This paper relates the work of the pupils from the 2nd grammar school of Kisamos which is located in the western part of Chania Crete. Kisamos area has many hills overgrown by wild plants. Crete has about 1800 wild plant species and subspecies from which 193 are endemic. Looking at their parents cooking wild plants in daily diet, pupils become interested in the secret of wild edible plants. With the guidance of their teacher, they wanted to investigate the utility and the identity of specific wild plants of their choice. Cretan wild plants grow in fallows, waste lands, rocky lands, slopes, hills and even along graveled sea sides. Cretan diet comprises many varieties of wild plants which have high nutritious values. Cretan people eat their leaves, flowers, seeds, shoots, and even roots, raw or cooked. Wild plants are useful for human being because of their pharmaceutical properties, vitamins, dietetics fibers, proteins and antioxidant substances which prevent cardiovascular diseases.

Unfortunately, Cretan wild edibles plants are in danger of extinction. To protect those plants people should to collect only what is needed, without polluting the environment and avoid burning and chemical practices, etc. Through this work, pupils feel closer to nature. They realize that nature, especially wild edible plants, are part of their life and there is an urgent need for protection. Why? Because they represent their invaluable heritage. The same spirit is promoted by the United Nations Environmental Programme for the celebration of 2010 as International Year of Biodiversity.

Keywords: Kissamos, Crete, edible wild plants, biodiversity, IYB 2010

1. INTRODUCTION

We are the pupils of the 4th grade of the 2nd Grammar School of Kisamos. We live in a nice market town at the western end of the prefecture Chania, on the island of Crete. Our place is full of hills where lots of wild plants grow.

The richness of the flora is due to the geographic place of Crete and to its mild climate. Research has shown that there are ca. 1800 kinds and sub-kinds of plants on Crete, of which 193 are endemic!

We decided to concern ourselves with the wild edible plants, as we had often seen our parents collecting herbs, whereas we did not have a clue concerning what they were used for, we did not know their secrets, and we even did not know which was which.
So we started this work, because we want to know more about the wild flora in our surrounding area.

The wild plants we can find on uncultivated fields, rocky mountains and hills, even on rocky beaches. They are used in the Cretan Cuisine and are of high nutritional worth.

Of the plant we can eat the leaves, the blossoms, the fruits, the shoots and even the roots, either cooked or raw. The ingredients they have are very important for the human organism, as they contain vitamins, dietary fibers proteins as well as anti-oxidant substances, helping prevent cardio-vascular diseases.

Unfortunately, however, they are in danger of becoming extinct! In order to protect them, we all have to be careful regarding the way we collect them: collect only as many plants as we need, be cautious not to pollute the environment, not light any fire in the woods, etc.

As we worked on the issue of plants, we came to feel closer to our physical environment. We feel that our environment and the wild edible plants are our friends, and that they seek our protection. Why? Because they are an inestimable heritage for us.

2. HOW WE PROCEEDED

After our teacher had informed us about the wild edible plants in relation with the Minoan period, about the important role they had played for the survival of the Cretans during difficult times (wars, foreign occupation, "bad years" in production), about their dietary role in the Cretan Cuisine, their pharmaceutical properties, their importance regarding the balance of the eco-system, about their division into different groups of plants, the mossy plants, the shrubby plants and trees, about the places where they grow and many more, we decided to occupy ourselves with the mossy plants in our region.

Each child chose one edible wild plant of their region. In order to learn more about each plant, we followed a certain procedure:

We took a rucksack, a knife, water and our camera and went out into the nature together with our parents or grandparents, aunts and cousins. We walked a lot, climbed on hills, went on difficult paths, walked up on rocky grounds, through olive groves and meadows, we were pricked by thorns, we fell, we stumbled, but we found "our" plant.

Our joy was indescribable. Our plant was the most beautiful, the most sweet-smelling of all, just because it was "ours". After observing it closely, we took a picture of it and, with the help of our accompanying person, cut it. We observed its leaves, its shoots, its roots, its flowers…

After collecting the quantity we needed for cooking, we also collected other edible wild plants that our parents knew. We sat down in order to take a rest and to enjoy the nature. How good we felt out in nature… Free, with our minds more clear, we also collected many feelings new to us.

Returning home, we had a lot of things to do. Cut away the parts of the plants which are not edible, wash the plants and cook them – a real feast!

Then, we waited with suspense to see, if our cookery had been successful!

Finally, of course, we were pleased with the steaming food or the baked pie or the juice that we drank.

The feast continued at school. We brought our plant so that the others could also get to know it. Also, we gathered information concerning our plant from different sources, folklore, traditional songs and recipes and presented it in class.

The most interesting part was when we tasted the food our classmates had brought. Maybe out of curiosity, maybe because we were hungry, maybe because of the good smell, we tasted and ate food that, at home, we had never eaten, not even tried!

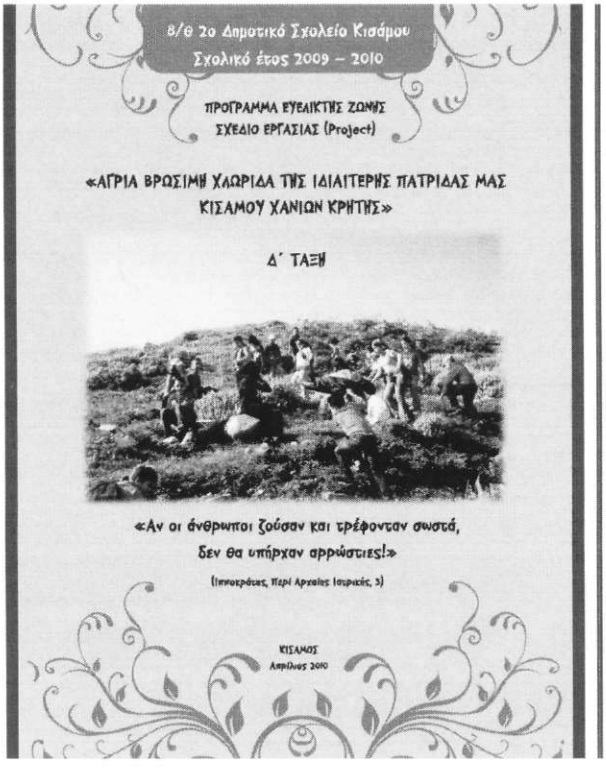
We also dried the leaves and flowers of the plants for our collection and in order to use them for school classes.

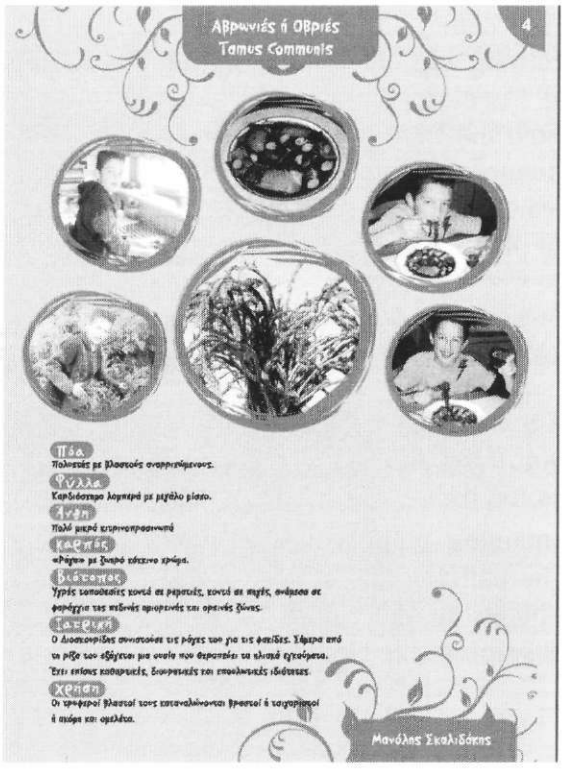
This project brought us nearer to nature, to its beauty, but also to its problems. An experience for life, which will stay in our minds forever.

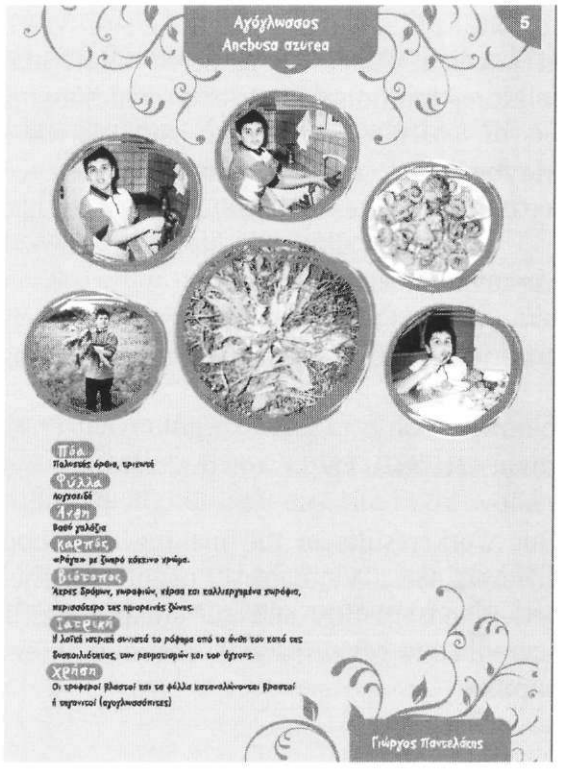
3. RESULTS

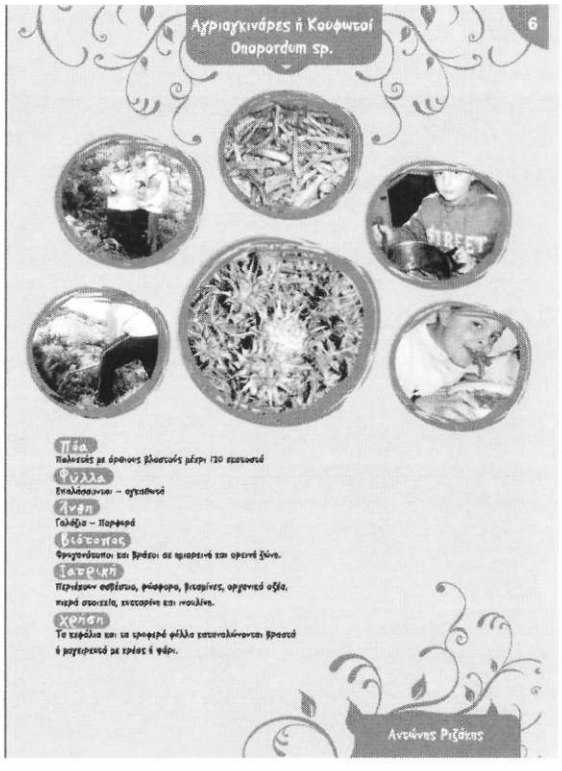
Our work results in the making of a booklet containing photos of wild plants and their different uses. We thank all people who helped us in realizing this project and we hope for a better conservation and sustainable use of wild plants in the future. A special thank is accredited to Ms. Emanuela Larentzaki for her translation of the Greek text from the work of pupils.

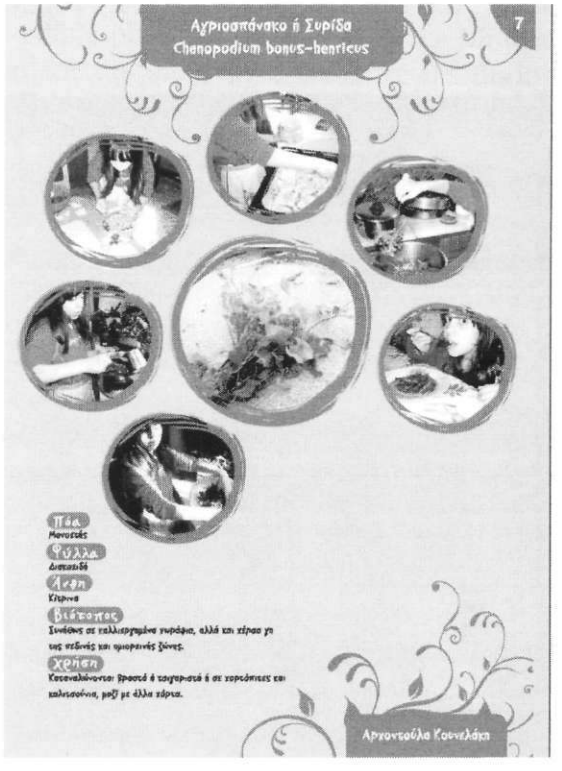
4. EXAMPLES OF CRETAN WILD PLANTS AND THEIR USES

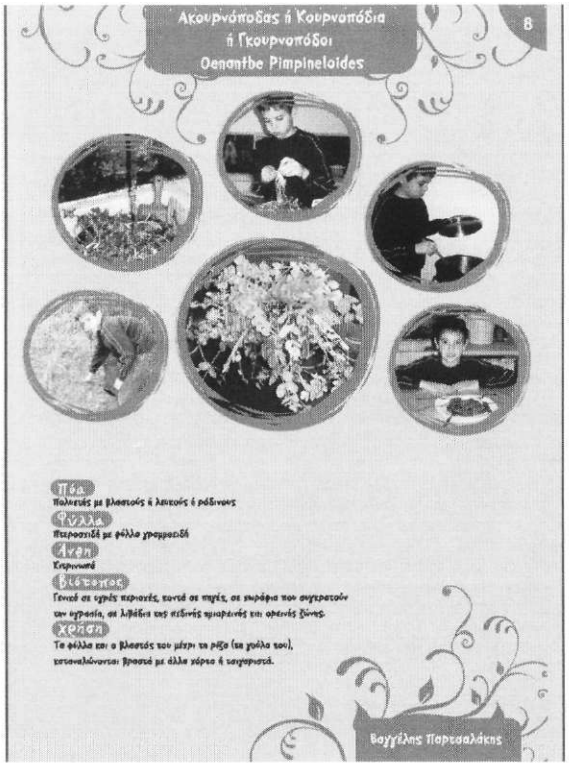


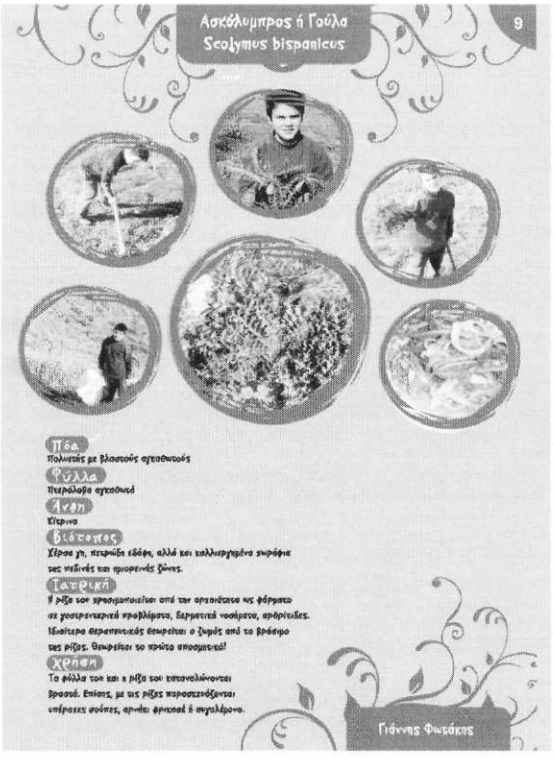

Αβρωνιές ή Οβριές
Tamus Communis
4
Πόα
Πολυετές με βλαστούς αναρριχώμενους.
Φύλλα
Καρδιόσχημο λοβωτό με μεγάλο μίσχο.
Άνθη
Πολύ μικρά κιτρινοπρασινωπά
Καρπός
«Ράγα» με ζωηρό κόκκινο χρώμα.
Βιότοπος
Υγρές τοποθεσίες κοντά σε ρεματιές, κοντά σε κηπες, ανάμεσα σε φυράγγια της πεδινής αμπελικής και ορεινής ζώνης.
Ιατρική
Ο Διοσκορίδης συνιστούσε τις ράγες του για τις φακίδες. Ύφαρα από τα ρίζα του εξάγεται μια ουσία που θεραπεύει τα ελκοπά εγκαύματα. Έχει επίσης καθαρτικές, διουρητικές και εποφλυκτικές ιδιότητες.
Χρήση
Οι τρυφεροί βλαστοί τους καταναλώνονται βραστοί ή τσιγαρισμοί ή σούφα και ομελέτα.
Μανόλης Σκαλιδάκης

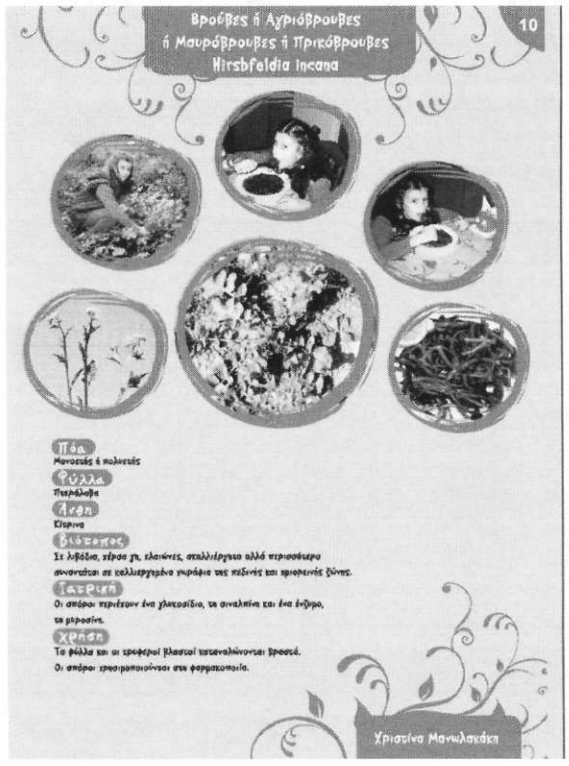

Αγόγλωσσος
Anchusa azurea
5
Πόα
Πολυετές όρθιο, τριχωτό
Φύλλα
λογχοειδή
Άνθη
Βαθύ γαλάζια
Καρπός
«Ράγα» με ζωηρό κόκκινο χρώμα.
Βιότοπος
Άκρες δρόμων, γκρεμών, κήπια και καλλιεργημένα χωράφια, περισσότερο της ημιορεινής ζώνης.
Ιατρική
Η λοπή πετρική συνιστά το ρόφημα από τα άνθη του κατά της δυσπεψίας, των πετρωσιών κ.α. του άγχους.
Χρήση
Οι τρυφεροί βλαστοί και τα φύλλα καταναλώνονται βραστοί ή ωμοπιοί (αγγλωσσόπιτες)
Γιώργος Πανσελάκης

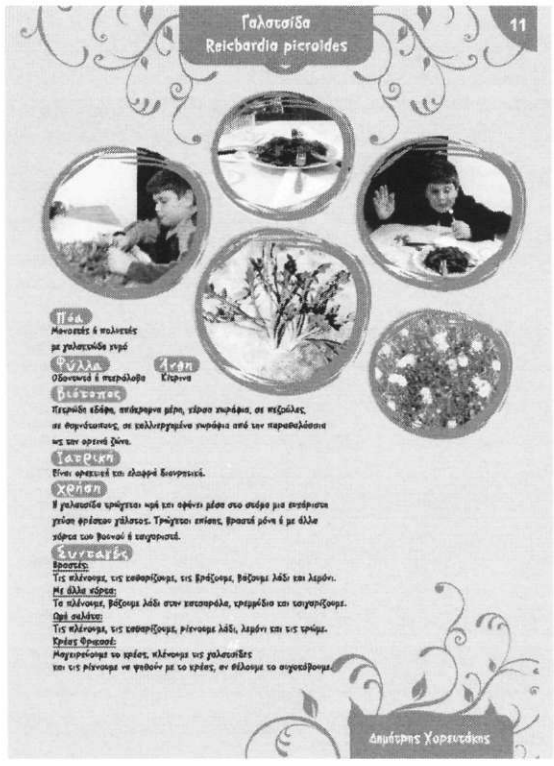

Αγριαγκινάρες ή Κουφωτοί
Onapordum sp.
6
Πόα
Πολυετές με όρθιους βλαστούς μέχρι 130 εκατοστά
Φύλλα
Εναλλάσσονται – αγκαθωτά
Άνθη
Γαλάζια – Πορφυρά
Βιότοπος
Φυτρώνουν και βρέχει σε ημιορεινή και ορεινή ζώνη.
Ιατρική
Περιέχουν ασβέστιο, φώσφορο, βιταμίνες, οργανικό οξύ, νικρά σακχαρα, ενεργίνη και ινουλίνη.
Χρήση
Τα κεφάλια και τα τρυφερά φύλλα καταναλώνονται βραστά ή μαγειρευτά με τρίχες ή φάρι.
Αντώνης Ριζάκης

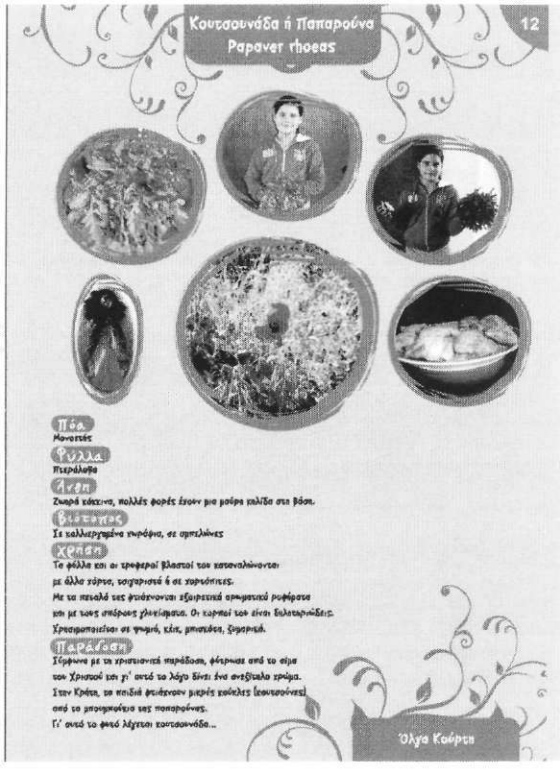

Αγριασπάνακο ή Συρίδα
Chenopodium bonus-henricus
7
Πόα
Μονοετές
Φύλλα
Διασπαδή
Άνθη
Κίτρινα
Βιότοπος
Συνόδους σε καλλιεργημένα χωράφια, αλλά και χέρσα γη της πεδινής και ημιορεινής ζώνης.
Χρήση
Καταναλώνονται βραστά ή ταγηρισμένα σε χορτόπιτες και καλιτσούνια, μαζί με άλλα χόρτα.
Αρχοντούλα Κουνελάκη

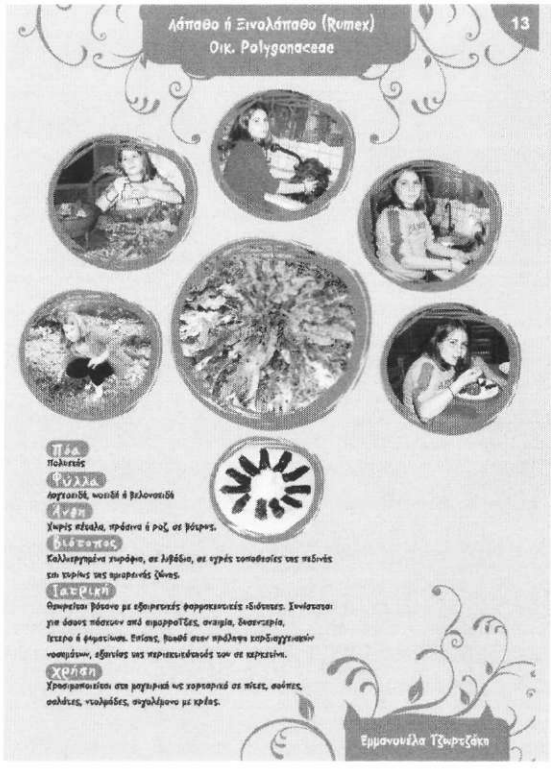

Ακουρνάποδας ή Κουρνοπόδια
ή Γκουρνοπόδοι
Oenanthe Pimpineloides
8
Πόα
Πολυετές με βλαστούς ή λαιτούς ή ράδινους
Φύλλα
Πτεροσχιδή με φύλλο γραμμοειδή
Άνθη
Κίτρινωπά
Βιότοπος
Γενικά σε υγρές περιοχές, κοντά σε ταχέες, σε γωρόφια που συχτεστούν
τον υγρασία, σε λιβάδια της πεδινής ημιαριδικής και ορεινές ζώνες.
Χρήση
Τα φύλλα και ο βλαστός του μέχρι τα ριζο (σε χυλό του),
τστανελιώνονται βραστά με άλλα χόρτα ή ωμόχορτα.
Βογγέλης Παρτσαλάκης

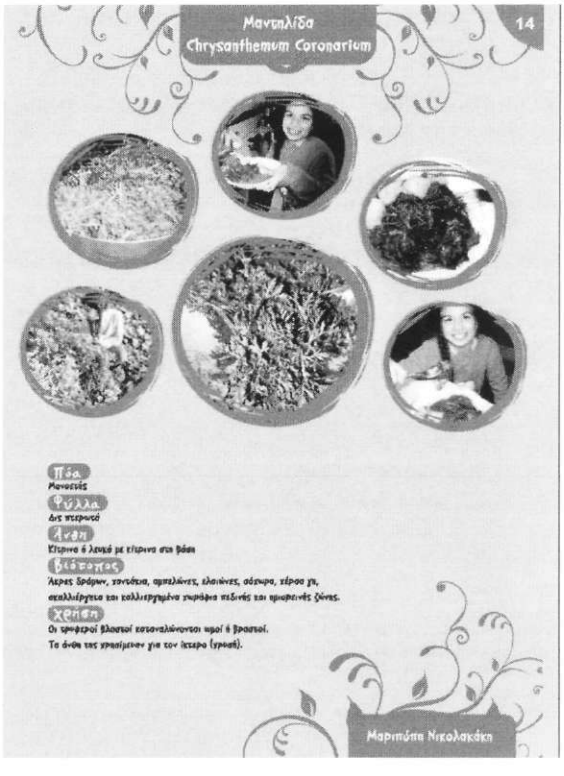

Ασκόλυμπρος ή Γούλα
Scolymus hispanicus
9
Πόα
Πολυετές με βλαστούς αγκαθωτούς
Φύλλα
Πτεράλοβα αγκαθωτά
Άνθη
Κίτρινα
Βιότοπος
Χέρσα γη, πετρώδη εδάφη, αλλά και καλλιεργημένα γωράφια
της πεδινές και ημιορεινές ζώνες.
Ιατρική
Η ρίζα τον χρησιμοποιείται από την αρχαιότητα ως φάρμακο
σε γαστρεντερικά προβλήματα, δερματικά νοσήματα, αρθρίτιδες.
Ιδιαίτερα θεραπευτικός θεωρείται ο ζουμός από το βράσιμο
της ρίζας. Θεωρείται το πρώτο αποσμητικό!
Χρήση
Τα φύλλα τον και η ρίζα του τστανελιώνονται
βραστά. Επίσης, με τις ρίζες παρασκευάζονται
υπέροχες σούπες, αρνάκι φρικασέ ή σκυλάκρονο.
Γιάννης Φωτάκης

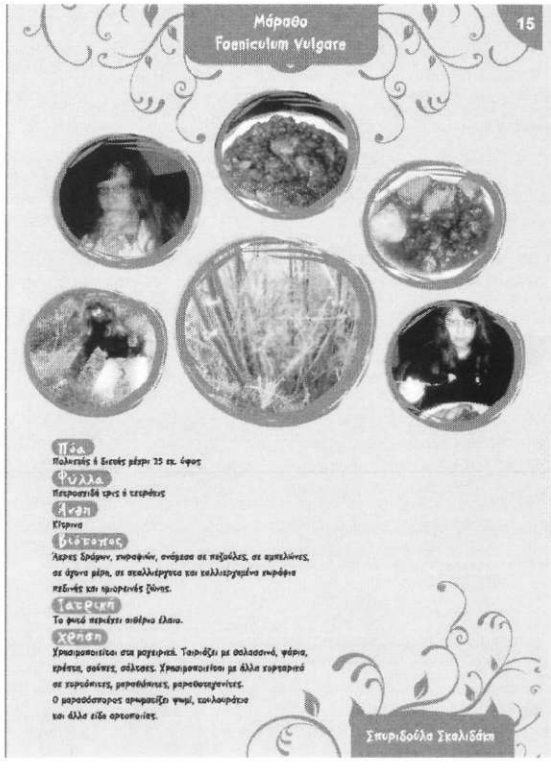

Βρούβες ή Αγριόβρουβες
ή Μαυρόβρουβες ή Πρικόβρουβες
Hirschfeldia incana
10
Πόα
Μονοετές ή πολυετές
Φύλλα
Πτεράλοβα
Άνθη
Κίτρινα
Βιότοπος
Σε λιβάδια, χέρσα γη, ελαιώνες, σπαλλέργεια αλλά περισσότερο
συναντώνται σε καλλιεργημένα γωράφια της πεδινές και ημιορεινές ζώνες.
Ιατρική
Οι σπόροι περιέχουν ένα γλυκοσίδιο, τα συναπίνια και ένα ένζυμο,
τη μυροσίνη.
Χρήση
Τα φύλλα και οι τρυφεροί βλαστοί τστανελιώνονται βραστά.
Οι σπόροι χρησιμοποιούνται στη φαρμακοποιία.
Χριστίνα Μανωλακάκη

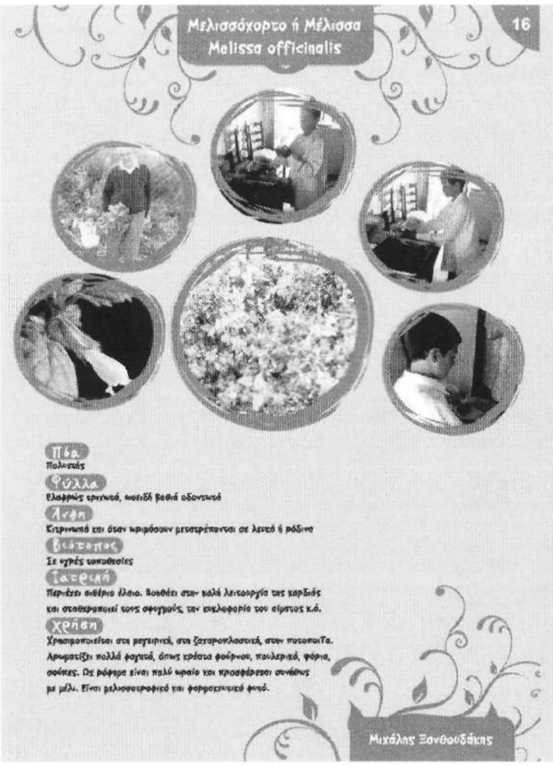

Γαλατσίδα
Reichardia picroides
11
Πόα
Μονοετές ή πολυετές
με γαλακτώδη γυρό
Φύλλα
Οδοντωτά ή πτεράλοβα
Άνθη
Κίτρινα
Βιότοπος
Πετρώδη εδάφη, απάκρημνα μέρη, χέρσα γωράφια, σε πεζούλες,
σε σγρόνατους, σε καλλιεργημένα γωράφια από τον παραθαλάσσια
ως τον ορεινό ζώνα.
Ιατρική
Είναι αφεκτικά και ελαφρά διουρητικά.
Χρήση
Η γαλατσίδα τρώγεται ωμή και αφού βράσει μέσα στο σούρο μια στάρισια
χτύπα φρέσκου γάλατος. Τρώγεται επίσης βραστά ρόνι ή με άλλα
χόρτα του βοσκού ή τστανελιού.
Συνταγές
Βραστή:
Τις πλένουμε, τις τσαφρίζουμε, τις βράζουμε, βάζουμε λάδι και λεμόνι.
Με άλλα χόρτα:
Τα πλένουμε, βάζουμε λάδι στον τσουκαλάκι, τσιμπίδια και τσιγαρίζουμε.
Ωμή σαλάτα:
Τις πλένουμε, τις τσαφρίζουμε, ρίχνουμε λάδι, λεμόνι και τις τρώμε.
Κρέας Φρικασέ:
Μαγειρεύουμε το κρέας, πλένουμε τις γαλατσίδες
και τις ρίχνουμε να ψηθούν με το κρέας, αν θέλουμε το σιγοτέβουμε.
Δημήτρης Χορευτάκης


Κουτσουνάδα ή Παπαρούνα
Papaver rhoeas
12
Πόα
Μονοετές
Φύλλα
Πτερόλοβο
Άνθη
Ζωηρά κόκκινα, πολλές φορές έχουν μια μαύρη τελεία στη βάση.
Βιότοπος
Σε καλλιεργημένα χωράφια, σε αμπελώνες
Χρήση
Τα φύλλα και οι τρυφεροί βλαστοί του κατσαλώνονται
με άλλα χόρτα, τσιγαρισμένα ή σε χορτόπιτες.
Με τα πετιμένα τους φυόνονται εξαιρετικά αρωματικά ροφήματα
και με τους σπόρους γλυκίσματα. Οι καρποί του είναι διλοκαρπώδεις.
Χρησιμοποιείται σε ψωμιά, κέικ, μπισκότα, ζυμαρικά.
Παράδοση
Σύμφωνα με τα χριστιανικά παράδοση, φύτρωσε από το αίμα
του Χριστού και γι' αυτό το λόγο δίνει ένα ανεξίτηλο χρώμα.
Στην Κρήτη, τα παιδιά φτιάχνουν μικρές κούκλες (κουτσουνάκι)
από το μπομπούνι της παπαρούνας.
Γι' αυτό το φυτό λέγεται κουτσουνάδα...
Όλγα Κούρτη


Λάπαθο ή Ξινολάπαθο (Rumex)
Οικ. Polygonaceae
13
Πόα
Πολυετές
Φύλλα
Λογχοειδή, νεοειδή ή βελονοειδή
Άνθη
Χωρίς πέταλα, πράσινα ή ροζ, σε βότρυς.
Βιότοπος
Καλλιεργημένα χωράφια, σε λιβάδια, σε ερημικές τοποθεσίες της πεδινές
και ορεινές της ημιαραιές ζώνες.
Ιατρική
Θεωρείται βότανο με εξαιρετικές θεραπευτικές ιδιότητες. Συνίστανται
για άσους πόνους από αιμορροΐδες, αναιμία, δυσεντερία,
έκτακτο ή φυματίωση. Επίσης, βοηθά στον πρόληψη καρδιαγγειακών
νοσημάτων, εξαιτίας της περιεκτικότητάς του σε καρκεσίνη.
Χρήση
Χρησιμοποιείται στα μαγειρικά ως χορταρικά σε πίτες, σούπες,
σαλάτες, ντολμάδες, σκορδάτο με κρέας.
Εμμανουέλα Τζωρτζάκη


Μαντηλίδα
Chrysanthemum Coronarium
14
Πόα
Μονοετές
Φύλλα
Δις πτερωτό
Άνθη
Κίτρινο ή λευκό με κίτρινο στη βάση
Βιότοπος
Άκρες δρόμων, χαντάκια, αμπελώνες, ελαιώνες, σάτουρο, χέρσα γη,
σκαλισμένα και καλλιεργημένα χωράφια πεδινές και ημιορεινές ζώνες.
Χρήση
Οι τρυφεροί βλαστοί κατσαλώνονται ωμοί ή βραστοί.
Το άνθη της χρησίμευαν για τον έκτερο (γρουσί).
Μαριτίνα Νικολακάκη


Μάραθο
Foeniculum Vulgare
15
Πόα
Πολυετές ή διετούς μέχρι 25 εκ. ύψος
Φύλλα
Πεπροσιλιά τρις ή τετράκις
Άνθη
Κίτρινα
Βιότοπος
Άκρες δρόμων, χωραφιών, ανάμεσα σε πεζούλες, σε αμπελώνες,
σε άγονα μέρη, σε σκαλισμένους και καλλιεργημένα χωράφια
πεδινές και ημιορεινές ζώνες.
Ιατρική
Το φυτό περιέχει αιθέριο έλαιο.
Χρήση
Χρησιμοποιείται στα μαγειρικά. Ταιριάζει με θαλασσινά, ψάρια,
κρέατα, σούπες, σάλτσες. Χρησιμοποιείται με άλλα χορταρικά
σε χορτόπιτες, μαρουλόπιτες, μαρουλοτηγανίτες.
Ο μαραθόσπορος αρωμαΐζει ψωμί, τυρόπιτες
και άλλα είδη αρτοποιίας.
Σπυριδούλα Σκαλιδάκη



16

Μελισσόχορτο ή Μέλισσα
Melissa officinalis

Πόα
Πολυετής

Φύλλα
Ελαφρώς τριχωτά, ωοειδή βαθιά οδοντωτά

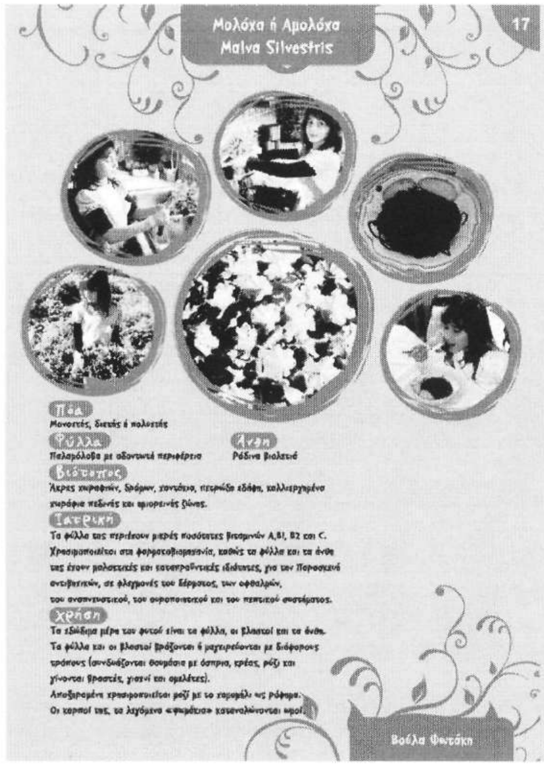
Άνθη
Κιτρινωπά και όταν ωριμάσουν μετατρέπονται σε λευκά ή ρόδινα

Βιότοπος
Σε υγρές τοποθεσίες

Ιατρική
Περιέχει αιθέριο έλαιο. Βοηθάει στην καλή λειτουργία της καρδιάς και σταθεροποιεί τους σφυγμούς, την κυκλοφορία του αίματος κ.ά.

Χρήση
Χρησιμοποιείται στη μαγειρική, στη ζαχαροπλαστική, στην ποτοποιΐα. Αρωματίζει πολλά φαγητά, όπως κρέατα φούρνου, πουλερικά, ψάρια, σούπες. Ως ρόφημα είναι πολύ ωραίο και προσφέρεται συνήθως με μέλι. Είναι μελισσοτροφικό και φαρμακευτικό φυτό.

Μιχάλης Ξανθουδάκης



17

Μολόχα ή Αμολόχα
Malva Silvestris

Πόα
Μονοετής, διετής ή πολυετής

Φύλλα
Παλαμόλοβα με οδοντωτά περιφέρεια

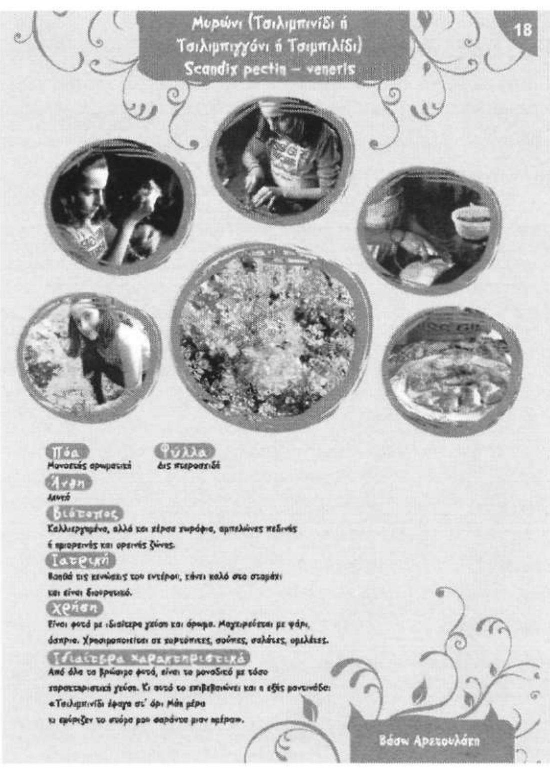
Άνθη
Ρόδινα βιολετιά

Βιότοπος
Άκρες χωραφιών, δρόμων, χαντάκια, πετρώδη εδάφη, καλλιεργημένα χωράφια πεδινές και ημιορεινές ζώνες.

Ιατρική
Τα φύλλα της περιέχουν μικρές ποσότητες βιταμινών A, B1, B2 και C. Χρησιμοποιείται στη φαρμακοβιομηχανία, καθώς τα φύλλα και τα άνθη της έχουν μαλακτικές και καταπραϋντικές ιδιότητες, για την παρασκευή αντιβιοτικών, σε φλεγμονές του δέρματος, των οφθαλμών, του αναπνευστικού, του ουροποιητικού και του πεπτικού συστήματος.

Χρήση
Τα εδώδιμα μέρη του φυτού είναι τα φύλλα, οι βλαστοί και τα άνθη. Τα φύλλα και οι βλαστοί βράζονται ή μαγειρεύονται με διάφορους τρόπους (συνδυάζονται θαυμάσια με όσπρια, κρέας, ρύζι και γίνονται βραστές, γιαχνί και ομελέτες).
Αποξηραμένη χρησιμοποιείται μαζί με το χαμομήλι ως ρόφημα.
Οι καρποί της, τα λεγόμενα «ψωμάκια» καταναλώνονται ωμοί.

Βούλα Φωτάκη



18

Μυρώνι (Τσιλιμπινίδι ή Τσιλιμπιγγόνι ή Τσιμπιλίδι)
Scandix pectin – veneris

Πόα
Μονοετής αρωματική

Φύλλα
Δις πτεροσχιδή

Άνθη
Λευκά

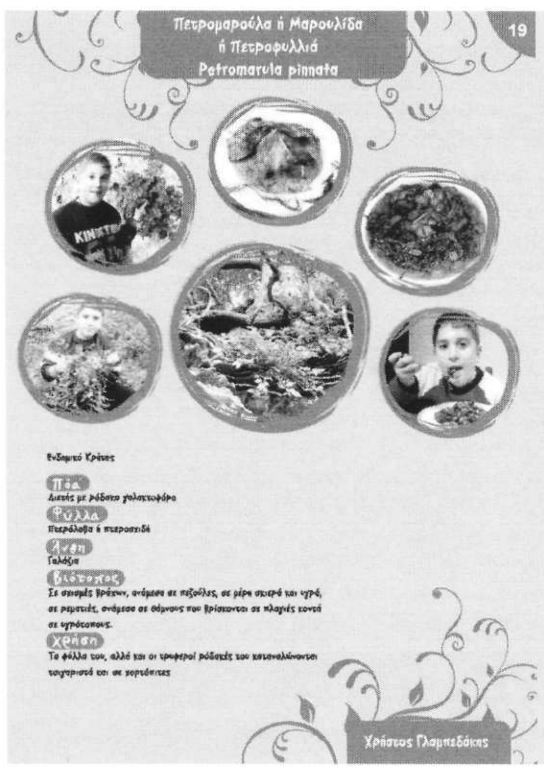
Βιότοπος
Καλλιεργημένα, αλλά και χέρσα χωράφια, αμπελώνες πεδινές ή ημιορεινές και ορεινές ζώνες.

Ιατρική
Βοηθά τις κενώσεις του εντέρου, κάνει καλό στο στομάχι και είναι διουρητικό.

Χρήση
Είναι φυτό με ιδιαίτερα γεύση και άρωμα. Μαγειρεύεται με ψάρι, όσπρια. Χρησιμοποιείται σε χορτόπιτες, σούπες, σαλάτες, ομελέτες.

Ιδιαίτερα χαρακτηριστικά
Από όλα τα βρώσιμα φυτά, είναι το μοναδικό με τόσο χαρακτηριστική γεύση. Κι αυτό το επιβεβαιώνει και η εξής μαντινάδα:
«Τσιλιμπινίδι έφαγα στ' όρι Μια μέρα
κι εμύριζεν το στόμα μου σαράντα μιαν ημέρα».

Βάσω Αρετουλάκη



19

Πετρομαρούλα ή Μαρουλίδα ή Πετροφυλλιά
Petromarula pinnata

Ενδημικό Κρήτης

Πόα
Διετής με ρόδακα γαλακτοφόρο

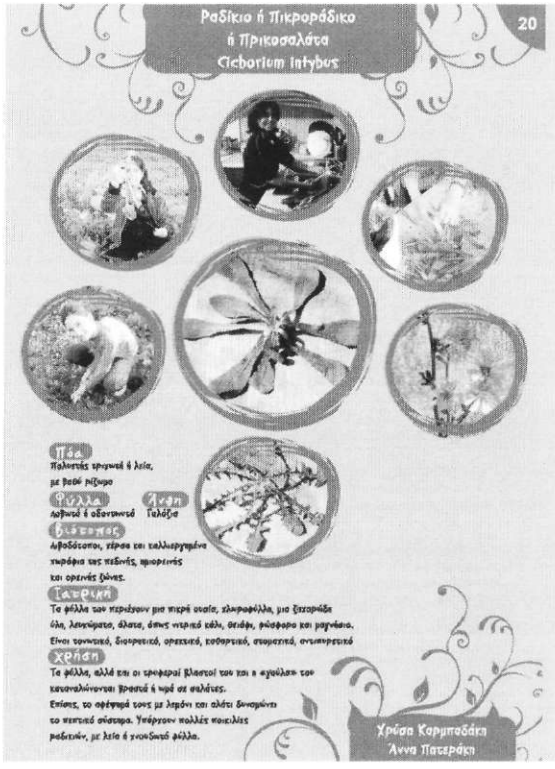
Φύλλα
Πτερόλοβα ή πτεροσχιδή

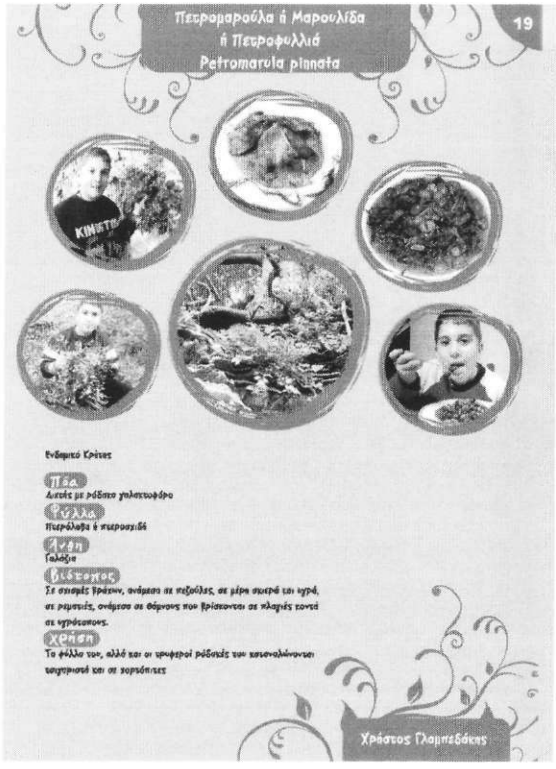
Άνθη
Γαλάζια

Βιότοπος
Σε σχισμές βράχων, ανάμεσα σε πέτρες, σε μέρη σκιερά και υγρά, σε ρεματιές, ανάμεσα σε θάμνους που βρίσκονται σε πλαγιές κοντά σε υγρότοπους.

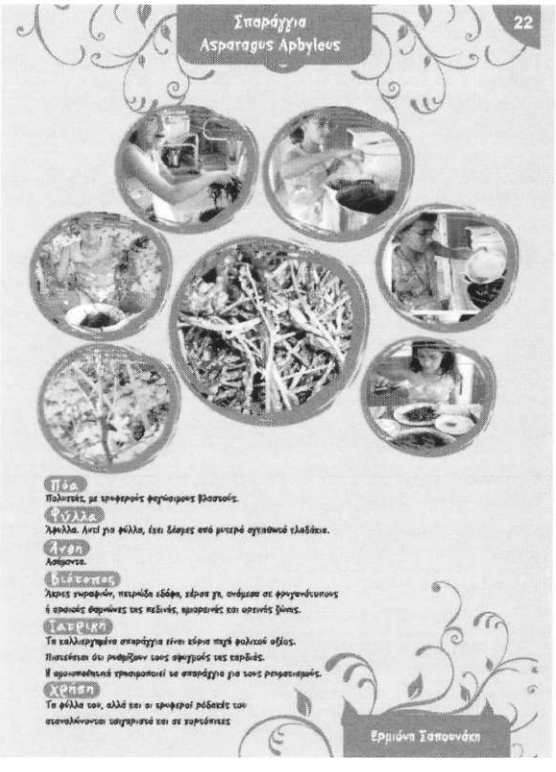
Χρήση
Τα φύλλα του, αλλά και οι τρυφεροί ρόδακές του καταναλώνονται τσιγαριστά και σε χορτόπιτες

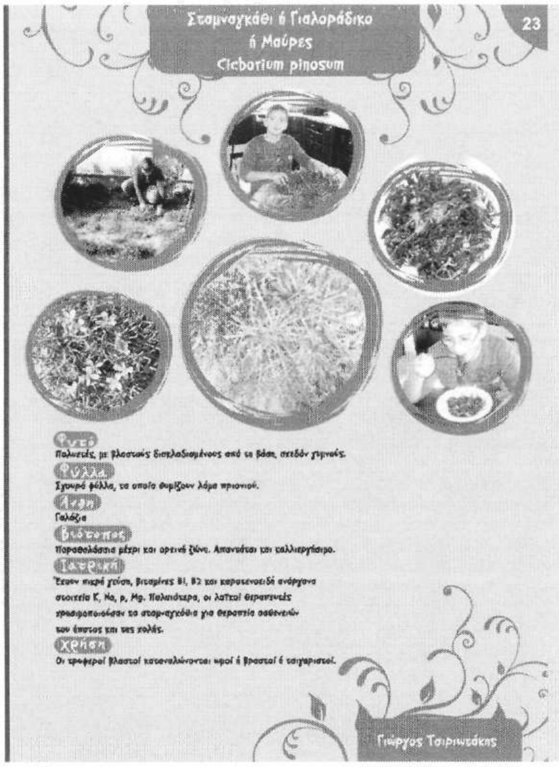
Χρήστος Γλαμπεδάκης


Ραδίκιο ή Πικοράδικο
ή Πρικοσαλάτα
Cichorium intybus
20
Πού
Πολυετές ψυχανθές ή λείο,
με βαθύ ρίζωμα
Φύλλα
Άνθη
Γαλάζιο
Βιότοπος
Αμπελώνες, χέρσα και καλλιεργημένα
χωράφια και πεδινές, ημιορεινές
και ορεινές ζώνες.
Ιατρική
Το φύλλο των περιέχουν μια πικρή ουσία, πληκροφύλλη, μια ξιπαρόλη
όλη, λευκώματα, άλατα, όπως νιτρικά κάλι, σιτάφη, φώσφορο και μαγνήσιο.
Είναι τονωτικό, διουρητικό, ορεκτικό, καθαρτικό, στυπτικό, αντιαιμορραγικό
Χρήση
Τα φύλλα, αλλά και οι ιρυφεροί βλαστοί του και η αγριάδα» του
καταναλώνονται βραστά ή ωμά σε σαλάτες.
Επίσης, το αφέψημά τους με λεμόνι και άλατι δυναμώνει
το νευτικό σύστημα. Υπάρχουν πολλές ποικιλίες
ραδικιών, με λείο ή γκοζωτό φύλλο.
Χρύσα Καρμπαδάκη
Άννα Πατεράκη

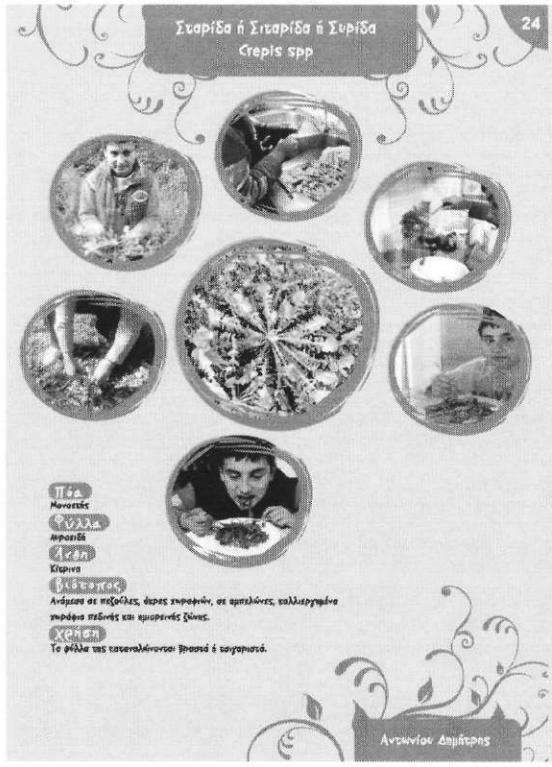

Πετροπαρούλα ή Μαρουλίδα
ή Πετροφυλλιά
Petromarula pinnata
19
Ενδημικό Κρήτες
Πού
Αυτές με ράδιπο γυαλιστερό
Φύλλα
Πετρόλιαβα ή πτεροειδή
Άνθη
Γαλάζιο
Βιότοπος
Σε σκιερές βράχων, ανάμεσα σε πεζούλες, σε μέρα σκιερά και υγρά,
σε ραγισιές, ανάμεσα σε θάμνους που βρίσκονται σε πλαγιές τοντά
σε υγρόσπιτους.
Χρήση
Τα φύλλο του, αλλά και οι ιρυφεροί ράδικές του καταναλώνονται
ταγαρισιά και σε χορτόπιτες
Χρήστος Γλαμπεδάκης


Ραδίκιο ή Πικοράδικο
ή Πρικοσαλάτα
Cichorium intybus
21
Συνταγές
Ραδίκια βραστά
Από τις πιο ωραίες και πιο γευστικές σαλάτες του τοπιού. Τα ραδίκια φυτρώνουν σε όλα τον Κρήτα και στοκαλούν
ένα από το πιο αγαπημένα εδώδιμα χόρτα των Κρητών, παρά τον πικράδα τους που εξουδετερώνεται με βίδι.
Καθαρίζουμε τα ραδίκια, τα πλένουμε καλά και τα ρίχνουμε στο τοπιάλι με αρκετό αλατισμένο νερό. Αφού βράσουν,
τα στραγγίζουμε (ζεστά ή κρύα) με ωμό ελαιόλαδο και λεμόνι ή βίδι.
Ραδίκια γιαχνί
Καθαρίζουμε, πλένουμε και βράζουμε τα ραδίκια. Τα στραγγίζουμε εαι τα βάζουμε στο τοπιάλι με λίγο λάδι και ένα
φιλοτεμαχισμένο κρεμμύδι, να ταγαρισιούν. Προσθέτουμε λίγο από το ζουμί των χόρτων που
στραγγίσαμε προηγουμένως, αφήνουμε να πάρουν ένα βράσιμο και στο τέλος ρίχνουμε λίγο βίδι
ή λεμόνι.
Κρητικά Σαλάτα με άγρια χόρτα, ρίγανη και πετυμέζι από ράδι
1/2 κιλό πικρά ραδίκια φιλοκομμένα
2 φλιτζ. τσάγια φιλοκομμένοι
2 κρεμμυδάκια φρέσκα φιλοκομμένα
2 κουταλιές σιμφάτο ελαιόλαδο
1 κουταλάκι κοφτό ρίγανη
4 κουταλιές πετυμέζι από ράδι
αλάτι
Φτιάξτε
Πλένουμε και καθαρίζουμε τα χόρτα. Τα αφήνουμε να στραγγίσουν
και τα ψιλοβράζουμε σε ένα μπολ. Ρίχνουμε σταγόνα - σταγόνα
το ελαιόλαδο, τα ρίγανη και αλατίζουμε.
Περιτύνουμε με το πετυμέζι από το ράδι καιαερβίρουμε.
Άννα Πατεράκη
Χρύσα Καρμπαδάκη

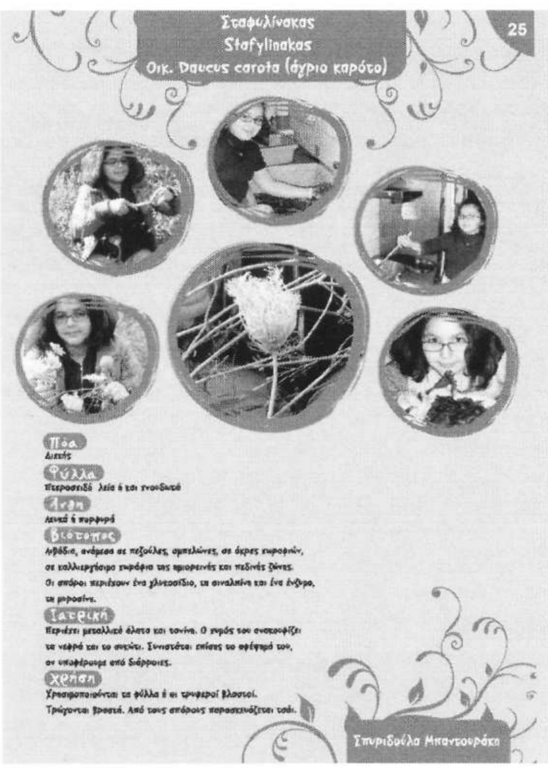

Σπαράγγια
Asparagus Arbyleus
22
Πού
Πολυετές, με ιρυφεροίς φαγώσιμους βλαστούς.
Φύλλα
Άφυλλα. Αντί για φύλλα, έχει βλέπες από μιτερό σχεδόνιό ηλαδάκια.
Άνθη
Λαμπρόντα.
Βιότοπος
Άκρες γκαρφιών, πετρώδη εδάφη, χέρσα γη, ανάμεσα σε φρυγανότυπους
ή αρωμώδες θαμνώνες της πεδινές, ημιορεινές και ορεινές ζώνης.
Ιατρική
Τα καλλιεργημένα σπαράγγια είναι χέρσα πηγή φολτού οξέος.
Πιστεύεται ότι ριζιβιζον τους αφυγμούς της καρδιάς.
Η αφυσικαδική χρησιμοποιεί τα σπαράγγια για τους ρευματισμούς.
Χρήση
Τα φύλλα του, αλλά και οι ιρυφεροί ράδικές του
καταναλώνονται ταγαρισιά και σε χορτόπιτες
Ερμιόνη Σαπουνάκη



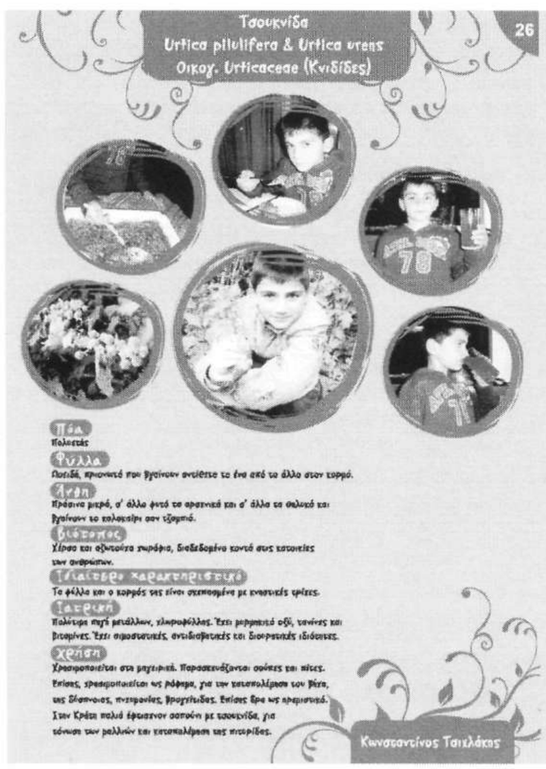
Σταμναγκάθι ή Γιαλοράδικο ή Μαύρες
Cichorium pinosum
23
Φυτό
Πολυετές, με βλαστούς διακλαδισμένους από τη βάση, σχεδόν γυμνούς.
Φύλλα
Σγουρά φύλλα, τα οποία θυμίζουν λάμα πριονιού.
Άνθη
Γαλάζια
Βιότοπος
Παραθαλάσσια μέχρι και ορεινή ζώνη. Απαντάται και καλλιεργήσιμο.
Ιατρική
Έχουν πικρή γεύση, βιταμίνες B1, B2 και καροτενοειδή ανόργανα στοιχεία K, Na, P, Mg. Παλαιότερα, οι λαϊκοί θεραπευτές χρησιμοποιούσαν το σταμναγκάθι για θεραπεία ασθενειών του ήπατος και της χολής.
Χρήση
Οι τρυφεροί βλαστοί καταναλώνονται ωμοί ή βραστοί ή τσιγαριστοί.
Γιώργος Τσιριωτάκης



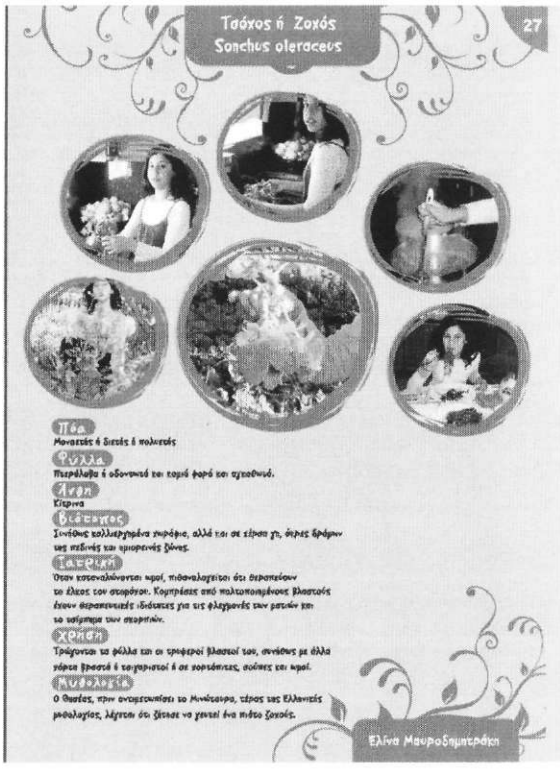
Σταρίδα ή Σιταρίδα ή Συρίδα
Crepis spp
24
Πόα
Μονοετής
Φύλλα
Λογχοειδή
Άνθη
Κίτρινα
Βιότοπος
Ανάμεσα σε πεζούλες, άκρες χωραφιών, σε αμπελώνες, καλλιεργημένα χωράφια πεδινής και ημιορεινής ζώνης.
Χρήση
Τα φύλλα της καταναλώνονται βραστά ή τσιγαριστά.
Αντωνίου Δημήτρης

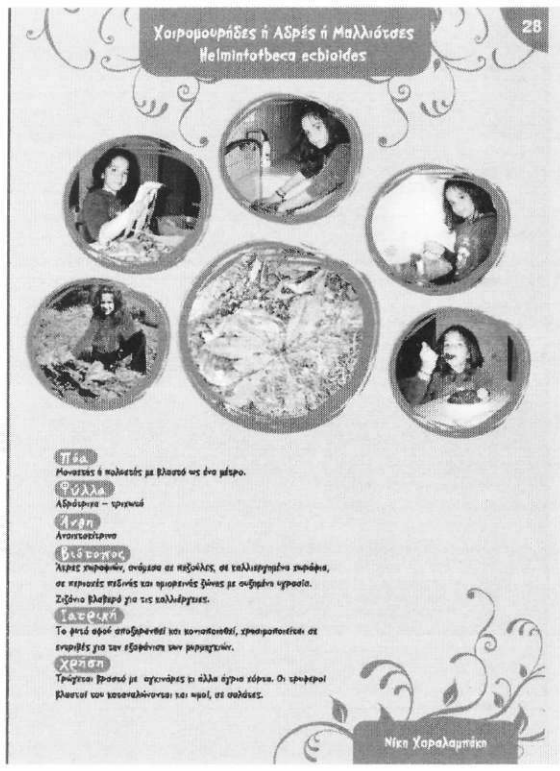


Σταφυλίνακας
Stafylinakas
Οικ. Daucus carota (άγριο καρότο)
25
Πόα
Διετής
Φύλλα
Πτεροσχιδή λεία ή και χνουδωτά
Άνθη
Λευκά ή πορφυρά
Βιότοπος
Λιβάδια, ανάμεσα σε πεζούλες, αμπελώνες, σε άκρες χωραφιών, σε καλλιεργήσιμα χωράφια της ημιορεινής και πεδινής ζώνης.
Οι σπόροι περιέχουν ένα γλυκοσίδιο, τη σιναλμίνη και ένα ένζυμο, τη μυροσίνη.
Ιατρική
Περιέχει μεταλλικά άλατα και τανίνη. Ο χυμός του ανακουφίζει τα νεφρά και το συκώτι. Συνιστάται επίσης το αφέψημά του, αν υποφέρουμε από διάρροιες.
Χρήση
Χρησιμοποιούνται τα φύλλα ή οι τρυφεροί βλαστοί.
Τρώγονται βραστά. Από τους σπόρους παρασκευάζεται τσάι.
Σπυριδούλα Μπαντουράκη

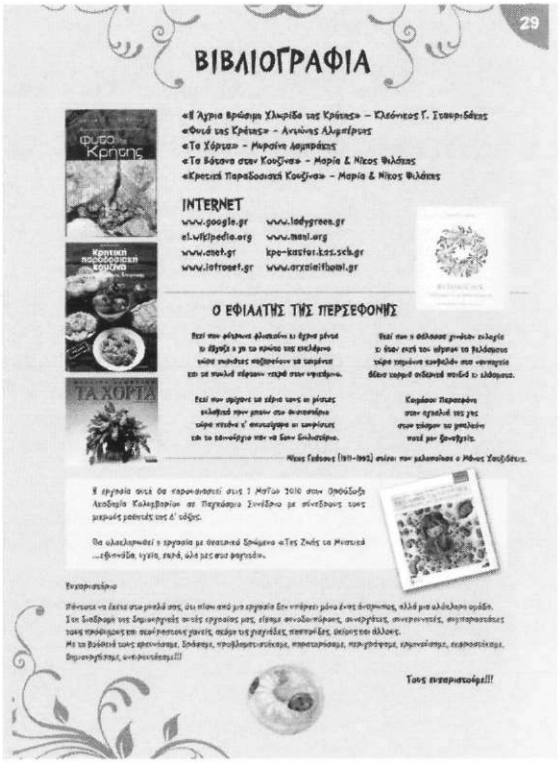


Τσουκνίδα
Urtica pilulifera & Urtica urens
Οικογ. Urticaceae (Κνίδες)
26
Πόα
Πολυετής
Φύλλα
Ωοειδή, πριονωτά που βγαίνουν αντίθετα το ένα από το άλλο στον κορμό.
Άνθη
Πράσινα μικρά, σ' άλλο φυτό τα αρσενικά και σ' άλλο τα θηλυκά και βγαίνουν το καλοκαίρι σαν τσαμπιά.
Βιότοπος
Χέρσα και αζώτούχα χωράφια, διαδεδομένα κοντά στις κατοικίες των ανθρώπων.
Ιδιαίτερο χαρακτηριστικό
Τα φύλλα και ο κορμός της είναι σκεπασμένα με κνιστικές τρίχες.
Ιατρική
Πολύτιμη πηγή μετάλλων, χλωροφύλλης. Έχει μυρμηκικό οξύ, τανίνες και βιταμίνες. Έχει αιμοστατικές, αντιδιαβητικές και διουρητικές ιδιότητες.
Χρήση
Χρησιμοποιείται στη μαγειρική. Παρασκευάζονται σούπες και πίτες. Επίσης, χρησιμοποιείται ως ρόφημα, για την καταπολέμηση του βήχα, της δύσπνοιας, πνευμονίας, βρογχίτιδας. Επίσης δρα ως αφεψητικό. Στην Κρήτη παλιά έφτιαχναν σαπούνι με τσουκνίδα, για τόνωση των μαλλιών και καταπολέμηση της πιτυρίδας.
Κωνσταντίνος Τσιλάκης





5. REFERENCES AND ACKNOWLEDGEMENTS



QUALITATIVE DATA ABOUT SHALLOW WATERS MACROALGAL RESOURCES FROM SOUTH ROMANIAN BLACK SEA COAST

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Abstract

At the Romanian seaside the development of macro-algae mass is reported mainly in summer and is registered especially by the group green macro-algae; thus the largest deposits occur ashore after periods of storm especially, but especially after bottom movement, when a large area of shallow coastline is "shaved" of vegetal carpet. Most macrophyte algae from the Romanian littoral are seasonal species; typical for low temperatures are species of red algae: *Bangia*, *Porphyra* and *Ectocarpus*; species Dasya, Chondria are typical for the summer temperatures and others are frequently met especially in spring – fall; in addition to these, a number of species belonging to the group of green algae. *Enteromorpha*, *Cladophora*, are present in all associations succeeding in the year.

Keywords: Romanian littoral, macroalgal species, hard substratum

1. INTRODUCTION

The Romanian coastal zone is divided in two geographical and geomorphological units [Băcescu et.al., (1971)]:

- northern unit (N, Fig.1) occupies 2/3 of the littoral length, it lays between Musura Bay, at the mouth of Chilia branch, and Cape Singol, including the shore of Danube Delta Biosphere Reserve: this area is characterized by sandy beaches, with low altitudes and reduced as amplitude sub-marine slopes.

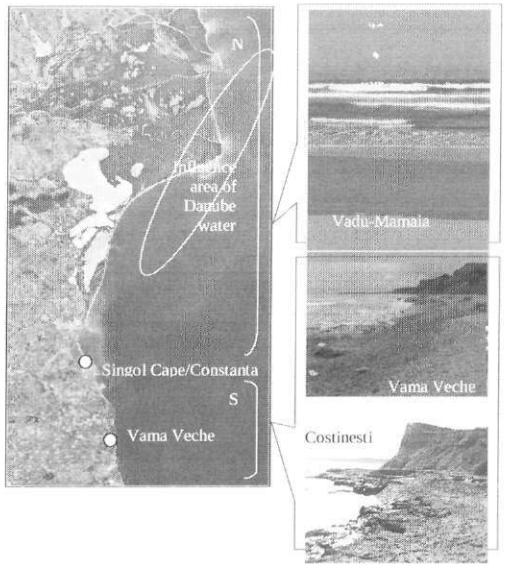

Figure 1. Romanian littoral of the Black Sea
(Map: www.google/googleearth; Picture: Paraschiv)

- southern unit (S), occupying 1 / 3 the length of the Romanian seaside, lays between Cape Singol and Vama Veche, and is characterized by narrow beaches, interrupted by limestone platforms that extend over the water and high cliffs; shallow sediments include a large variety of mollusks shells and pebbles, these beaches being composed of sand with average and coarse particle size.

2. MATERIAL AND METHOD

Observations and collection of algae for qualitative determination was made monthly, especially after storm periods, to identify the dominant perennial and seasonal species, and to capture the different stages of the development cycle. Fresh algal samples were taken in the laboratory, washed of the associated fauna and sorted in the main groups; the sampling is done so that the estimation of the abundance can be done (after density and biomass); for this purpose, a classical procedure was pursued, but unanimously supported by specialists in the world community, that of sampling the "square sample".

Samples are obtained by integral collecting of plant biomass by scraping the substrate corresponding to a square sample; for each sample at least one replicate was taken; samples are stored in the chest freezer and will be processed in the laboratory. Photographs in the field, before taking samples, will complete the picture of the structure of macro-algal associations from the southern part of the Romanian coast.

3. RESULTS

Macrophytes recorded mass development during periods of optimal thermal and nutrients regime, as follows: species of clorophyte group (Tab.1): *Urospora penicilliformis*, red algae species, *Bangia fuscopurpurea, Porphyra leucosticta, Ectocarpus siliculosus* are frequently met in February and May, while species *Dasya, Chondria* appear during summer; cosmopolite species belonging to genus *Enteromorpha* (*E. intestinalis, E. compressa, E.*

linza, E. flexuosa, E. prolifera) *Ulva rigida, Ceramium (C. elegans, C. diaphanum)* are present in all the associations follow one another during the year. Perennial algae: *Cystoseira barbata* and *Cy. bosphorica* from the shallow rocky littoral areas and *Phyllophora nervosa, Ph. brodiaei* from greater depths of circa littoral, but until 50 m (almost 50 years ago a wide field of about 11000 km^2, in the NW part of the sea was described as a true red "plain" formed by species of genus *Phyllophora* – with a biomass over 5,6 million tone; this representing one of the basic biological characteristics of the Black Sea [Sava., (2002)]).

Observations and studies that we have done over several years enabled us to identify the two summer periods in which large amounts of macro-algae are detached from the substrate and bonded to the shore (especially in the group of green algae-*Chlorophyta*): in June – August (Fig. 2).

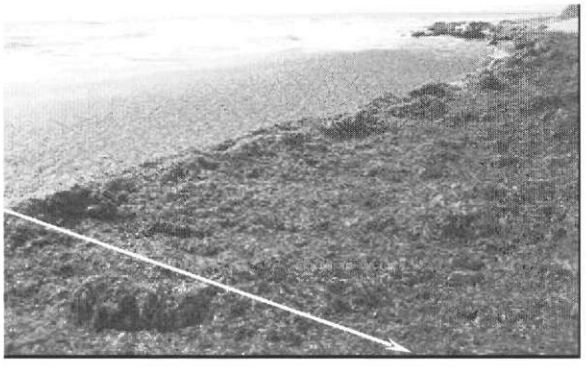

Figure 2. Macro-algae deposit from the shore area of the southern Romanian littoral of the Black Sea

Table 1: The most abundant algae species identified in algae agglomerations on the shore.

Nr. crt.	Taxonomic group	Species
CHLOROPHYCEAE		
1	Ulvales	*Ulva rigida* (*lactuca*) (L.)
2		*Enteromorpha intestinalis* (L.) Link.
3		*E. compresa* (L.) Grev.
4		*E. linza* (L.) Ag.
5		*E. flexuosa* (Wulf.) Ag.
6		*E. prolifera* (O.Múll) J. Ag
7	Cladophorales	*Urospora penicilliformis* (Roth.) Aresh
8		*Cladophora vagabunda* (L.) Hoek.
9		*C. sericea* (Huds.) Kütz.
10		*C. albida* (Huds.) Kütz.
11.	Bryopsidales	*Bryopsis plumosa* (Huds.) Ag.
12		*B. hypnoides* Lamour
ISOGENERATAE - PHAEOPHYTA		
13	Ectocarpales	*Ectocarpus siliculosus* (Dillw.) Lyngb.
CYCLOSPOREAE - PHAEOPHYTA		
14	Fucales	*Cystoseira barbata* (Good et Wood) Ag.
FLORIDEOPHYCEAE-RHODOPHYTA		
15	Ceramiales	*Callithamnion corymbosum* (Smith.) Lyngb.
16		*Ceramium rubrum* (Huds) Ag.
17		*Ceramium elegans* (Roth.) Ducl.

(after Sava, [Sava., (2006)])

4. DISCUSSIONS

In addition to natural factors such as prolonged periods of freezing from the Romanian seaside in the years `70 -`80, the emergence of high intensity storms, the anthropogenic factors have had an important contribution; studies in recent years have shown a significant decrease in the number of species of algae covering the shallow littoral south of Constanta (Table 2), and this was made on behalf of human impact stemming mainly from the work of the Port of Constanta South Agigea (large amounts of fine clay sediments reached the water through port works and hydro technical works, determining decrease of transparency and change of shallow bottom waters because the sediments that were deposited on hard substrate created a mobile substrate and prevented macro-algae deposition).

All shoreline protection works (against beaches erosion and for tourist activities) caused changes in the movement of littoral currents, being created areas with low dynamic of water bodies and thus eliminated rheophile/oxygenophile species in these areas.

Table 2. The decrease of the number of macrophyte algae species during 1977-2007 (data after Sava, 2007) [Sava., (2006)]

Phyllum	**After data:**		
	Bavaru 1977	**Vasiliu 1980-1995**	**Sava 2007**
Chlorophyta	31	22	16
Phaeophyta	14	9	5
Rhodophyta	41	24	10
Total	**86**	**55**	**30**

Today only about one third of the total number of macro-algae species is encountered, compared to species cited 50 years ago; this has allowed the mass development of cosmopolitan, opportunistic, short life cycle species, especially belonging to the group *Chlorophyta* (green macro-algae); the most significant decrease is recorded for red (31 species in this group no longer being found on the Romanian seaside in the past 50 years) and brown macro-algae species (9 species). An important ecological niche for the development of marine benthos on hard substrate of the littoral part from the south of Constanta was represented by the "field of *Cystoseira barbata*"; currently in this field have left only small "oasis" with a much reduced surface [Sava et. al., (2007)].

5. CONCLUSIONS

The most important features of macro-algal communities in the southern Romanian Black Sea Coast are:

- reduced number of species in groups of red and brown macro-algae;
- proliferation of opportunistic species of green macro-algae group, with short life cycle and which can develop impressive biomass in a relatively short time; these few species occupies 80% area of shallow sea bottom;
- reduce the area occupied by perennial macro-algae, *Cystoseira* and *Phyllophora*.

To improve the existing situation is necessary to popularize the importance of species (rare species and especially of perennial ones) on one hand, and to recover large amounts of macro-algae biomass produced during summer on the other hand.

ACKNOWLEDGMENT

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PART III

Taxonomic Investigations and Conservation Methods for Wild Plants

PLANTS OF THE BIBLE AND BOTANICAL FINDINGS ON THE SHROUD OF TURIN

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Abstract

The Bible is rich in symbolic proverbs and prophecies related to plant life and their place in the natural environment and ecosystems. We should bear in mind that an audience of farmers and shepherds could easily understand symbols tightly connected to their life. For example, Isaiah (34, 13) says: "and thorns shall come up in her palaces…" in the original text written in Hebrew, SIRIM is the name mentioned for "thorns"; this plant is Sarcopoterium spinosum. In three words in Hebrew the prophet describes a whole process of plant succession and the audience thinks of a very long natural process of abandonment taking place there. The palaces will be destroyed, and if built up from bricks, after a long time they will return to be soil rich in nutrients. This is the substratum of ruderal annual plants which out-compete the regular annual flora of the area; after several dozens of years the nutrients will be leached and annuals grassland will prevail there. Sarcopoterium spinosum will start growing at the margins of the cultivated land and gradually replace the annuals. All this process which may take dozens or hundreds of years is described in the Bible in just three words in Hebrew.

"And God gave Solomon wisdom…and he spoke of trees from the cedar tree that is in Lebanon to the hyssop of the walls" (Kings A, 5, 13). Cedrus libani (the cedar) is regarded throughout the Bible as a symbol of pride; the hyssop (identified as Majorana syriaca; Hyssopus officinalis does not grow in the Middle East) is the symbol of modesty. Both have lignified stems and are therefore regarded in the Biblical times as "trees". The hyssops (shrubby fragrant Labiatae-Lamiaceae) supply spices, used for tea-like beverages, and their uncovered stems may be used for fire, and yet it is small and have gray color. We should therefore bear in mind that "species diversity" was a well appreciated issue in Biblical times.

The Biblical tumble weed (identified as Gundelia tournefortii) and its life cycle are used as a symbol to the instability of Sanakherib, the king of Assyria, conquering the land of Israel (Isaiah 18, 13). Like the Gundelia, the threatening thorny plant which is nearly disconnected from its roots, Sanakherib is killed by his sons upon returning to his homeland.

Gundelia tournefortii, hundreds of year later, might have been involved with the "Crown of Thorns". Its image is clearly seen on the right shoulder of the body of the Man of the Shroud of Turin. Together with two leaves of Zygophyllum dumosum and several flowers of Cistus creticus we have geographical indicators for the area where the Shroud arrived from. Observing the distribution maps of the three species, one may see that Jerusalem-Hebron area is the only place on Earth where people could put not-wilting plants of the species mentioned above on- or near a dead-man's body. Nine of the species identified by their images on the Shroud share their blooming time in March-April. There are images of hard ferocious thorns of Rhamnus lycioides and of Ziziphus spina-christi and of a reed, possibly Arundo donax, mentioned in the New Testament in relation to the Crucifiction.

QUALITATIVE STUDY OF THE VASCULAR FLORA OF THREE INSULAR ENVIRONMENTS CONCERNING THE WEST COAST OF JIJEL

(GRAND CAVALLO ISLAND, PETIT CAVALLO ISLAND AND GRAND CAVALLO ISLET) (ALGERIA)

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Abstract

The particular microclimate covering the islands allows the development of an adapted flora to the extreme conditions. This study aims to characterize qualitatively the vascular vegetation of three insular environments of the West coast of Jijel (Grand Cavallo, Petit Cavallo, Grand Cavallo islet).The results show that the island Petit Cavallo is the richest environment in vegetable species (77 species). Its vegetable cover is very similar to that of the island Grand Cavallo (60.13%). The therophytic taxa characterize the three islands with respective rates 54.4%, 38.96 % and 35.29% for the island's Grand Cavallo, Petit Cavallo and the Grand Cavallo islet. The whole of the islands and islets is covered with low vegetation, herbaceous, ruderal, with predominance of therophyts because of the multiple disturbances in particular by the invasive presence of breeding seabirds including the Yellow-legged-gull (*Larus michahellis*) (the number of registered couples varies from 53 to 610 depending on the study site). These affect the dissemination of diaspores, where a vegetation rather zoochory (41.55% to 52.94%). This avian population contributes by their several displacements to change the vegetation's quality also the quantity.

Keywords: Island Flora, diversity, Jijel, Yellow-legged-gull.

I. INTRODUCTION

Islands are considered as "natural laboratories", which are undeniable to study the ecological processes, and more especially those relied to termination or implantation of species. The small island ecosystems are very fragile, because of their reduced specific diversity and the presence of rare species. They usually suffer from disturbances that affect them. The latter are responsible for profound changes in stands structures (new, invasive or endangered species) [Whiteheard and Jones (1969)]. The threats to biodiversity in the world and specifically in insular areas are indisputable. Islands of Algeria are also concerned, despite their weak areas. In this context, any attempt to protect these systems, requires a prior knowledge of their

biodiversity, and specifically the phytodiversity [Patrick (2002)]. This work aims to characterize the flora of the islands, in order to_evaluate of the site, and to study its evolution compared to the different disturbances, including those caused by colonies of nesting seabirds, like Yellow-legged-gull *(Larus michahellis*), whose number is becoming increasingly important.

II. PRESENTATION OF THE STUDIED AREA

The Algerian coast stretches over 1200km of varied enough coastline: rocky coasts, sandy coasts and some lagoons; however it's characterized by scarcity of islands [Moulai (2005)]. There are 38 islands and islets most of which is not sufficiently studied (physiographic parameters, fauna and flora interests, threats, status, history and resources) [Jacob and Courbet (1980)] and [Boukhalfa (1990)]. The investigated area covers 60 km of linear coastal; it contains three insulars stations that are Grand Cavallo island, Grand Cavallo islet and Petit Cavallo island (Fig.1).

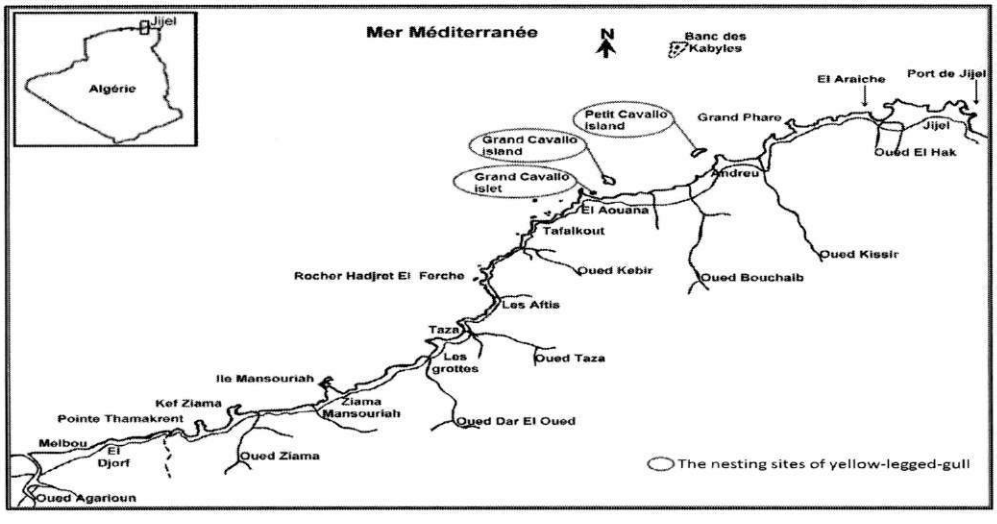

Figure1: Geographic location of the investigated area with the three insular sites

The three insular sites are refuge and nesting sites for the Yellow-legged-gull (*Larus michahellis*) [Bougaham (2008)].

-Grand Cavallo island: located at 950m of the shore and covering 6ha of area. It's maximum altitude does not exceed 50m. It's vegetation is "matorral type" mainly composed of *Pistacia lentiscus*, Phillyrea *angustifolius* and a nitrophile flora as *Lavatera cretica* and *Urtica membranea*.

- Petit Cavallo Island: located at 750m of the shore and covering 4ha of area, with a maximum altitude of 10m (fairly flat terrain). It's vegetation is of high matorral type, composed of *Pistacia lentiscus, Phillyrea angustifolius, Olea europea, Ficus carica, Opuntia ficus- indica* and a nitrophile flora like *Crithmum maritimum, Myrtus communis* and *Daucus carota*.

- Grand Cavallo Islet: at 50m of the shore, it has an area of 0.15ha and a maximum altitude of 30m. Vegetation: Clumps on the tops, composed of *Pistatia lentiscus, Phyllirea angustifolius* and *Chamaerops humilis*. Herbaceous Vegetation, located lower: *Inula viscosa, Bellis annua, Ariplex prostata, Halimione portulacoïdes*

1-Climatological aspects

As the islands climatic data do not exist, we use those of the nearest continental stations, considering the weak distance of our little islets from the shore.

- Pluviometry: 185mm in annual average with a minimum of 19mm in summer.

- Wetness (Humidity): quite stable, its values fluctuate around 75 percent (in marine environment).
- Temperatures: fluctuate between 26° for the warmer summer months and 10° for the coldest winter months.

1-1-Sampling

The earliest inventories of vascular plants have been performed in 2006 then completed in 2008 by Bougaham [Bougaham (2008)]. The sampling was systematic for the whole island and prospecting are distributed between March and June. The taxa identification is based on the New flora of Algeria [Quezel and Santa (1963)]. The reported taxa are then characterized with vital attributes, according to the approach of Medail and Vidal (1998). For each kind of taxa, we tried to give the following information: biogeographically type [Gamisans and Jeanmonod (1963)], biological type [Raunkiaer (1934)], spread mode [Vander Pigl (1982)] and demographic strategy C S R of Grime [Grime (1974)].

III. RESULTS

1-Specific richness

Table1: Specific richness of the studied sites

Sites / Parameters	Petit Cavallo Island (site1)	Grand Cavallo Island (site2)	Grand Cavallo Islet (site3)
Number of taxa	96	79	21
Number of families	40	31	12
Class	76 Dicots 20 Monocots	61 Dicots 18 Monocots	17 Dicots 4 Monocots

The whole composition of vascular flora in those sites currently contains 96, 79 and 21 species, for Petit Cavallo Island, Grand Cavallo Island, and Grand Cavallo Islet, respectively (table1). All the listed species are angiosperms, related to 40, 31 and 12 families, according to sites 1, 2 and 3, respectively. Thus, the richest families are the Asteraceaes, the chenopodiaceaes, the Fabaceaes, Poaceaes, Liliaceaes and Oleraceaes. Note that Gymnosperms are totally absents.
Despite their small size, our studied areas show an interesting specific richness. It reflects the habitat diversity, particularly in relation to disturbances generated by seabirds (especially by Yellow-legged-gull).
These results are similar to those obtained by Paradis and Piazza for the Corsica islands [Paradis and Piazza (2002)] and by Medail and Vidal for the islands of Marseille (France) [Medail and Vidal (1998)].

2- Functional analysis

2-1-Biological type

The flora structure of a station can be characterized by its biological spectrum that indicates the rate of each biological type. Their main interest is that they reflect the environmental conditions by the structure of vegetation.

The general appearance of our sites is characterized by rather low vegetation.

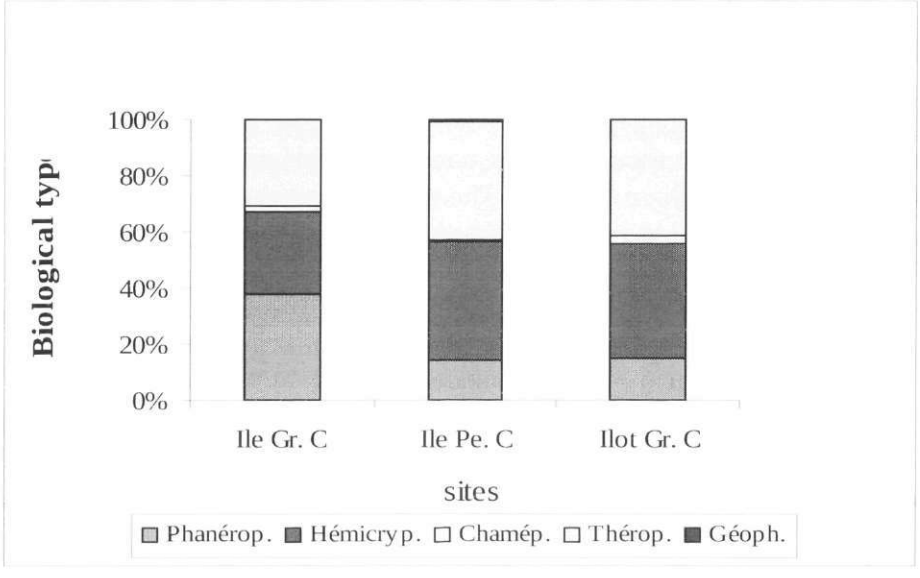

Figure 2: Biological type frequency for the three studied sites

Therophyts *(Fumaria capreolata, Stachys ocymastrum, Hordeum murinum, Coronopus didymus, Lotus ornithopoides, Hyoseris radiata, Hyoscyamus albus...)* and the hemicryptophyts(*Urginea maritima, Arundo donax, Lavatera cretica, , Lobularia maritima, Crithmum maritimum, Daucus carota* ...) show a co-dominance, with the rates of 42.1 % and 35.33% respectively, followed by phanerophyts represented by *Smilax aspira, Pistacia lentiscus, Ficus carica et Phyllirea angustifolia* (fig.2). Therophyts and hemycryptophyts taxa are conventionally considered as privileged by disturbances caused by zoopopulations, particularly because of the openness of the environment [Noy-Meir and Al (1989) in Vidal (1998)]. According to [Emberget (1966)], hemicryptophyts dominate among the most exposed environments to disturbances. The degradation of these environments would be accompanied by an enrichment of the vegetation coverage in therophyts (annuals species), that resist to the hard conditions of the environment. They have a limited ecological interest, because of their short life cycle, which take only a few weeks or days [Chaeb (2003)]. [Bonnet et Al (1999)] found similar results in the archipelago of Frioul, with a dominance of therophyts.

2-2-Biogeographically type

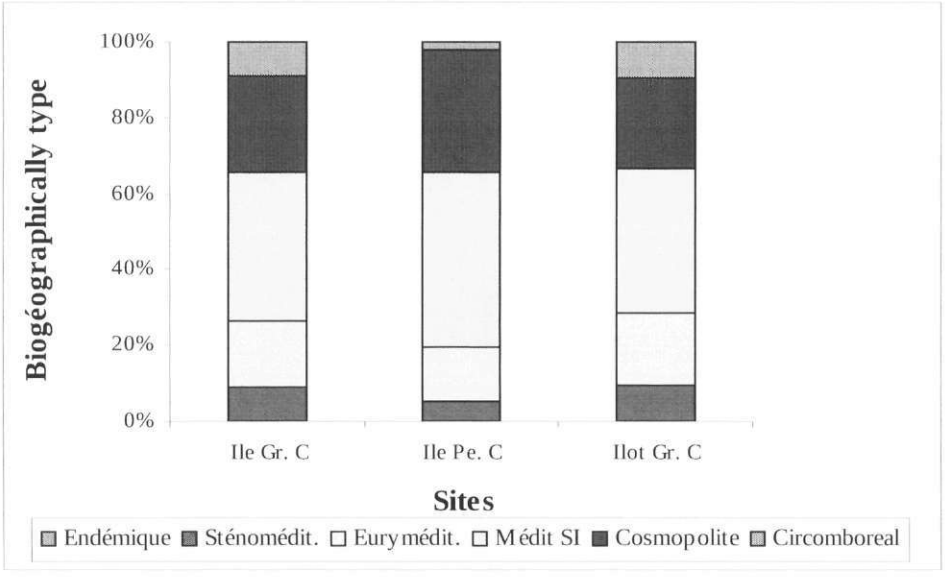

Figure 3: Biogeographically type frequency for the three studied site

From a phytogeographical point of viw taxa with Mediterranean affinity reign throughout our sites (45.83%, 39.24% and 38.09%) (Fig.3). This particularity impact on the type of vegetation that settle on these sites. Indeed, Mediterranean climate accentuates the drastic nature of the disturbed areas by birds, drought and evaporation. Cosmopolitans are also quite important, they are very good colonizers of any type of environment.

2-3-Spreading mode

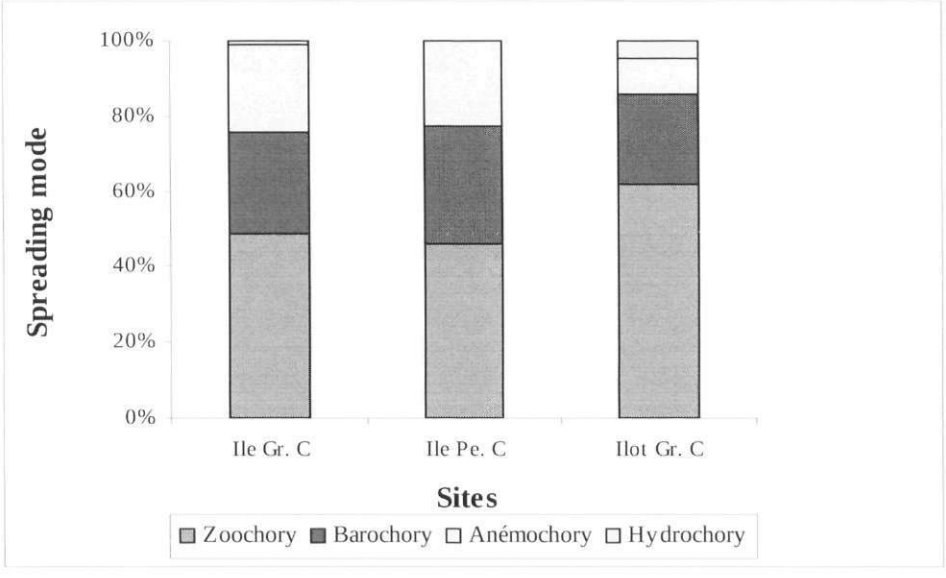

Figure 4: Spreading type frequency for the three studied sites

We note a striking dominance of the zoochory (dispersed by animals) spreading mode (51.94 %) compared to barochory (dispersed by gravity) ones which are positioned after with 27.22%, followed by the anemochory (dispersed by wind) (18.41%); hydrochory (water-

dispersed plants) (2.01%) are insubstantial (Fig.4). Zoochory dominance can be explained by the large number of Yellow-legged-gull (*Larus michahellis*) that attends to these island environments to get shelter and to reproduce safely. These vertebrates carry and disperse diaspores by their countless trips between the island sites and the continental environments. Transportation may be external (external zoochory or epizoochory), when diaspores are attached to plumage, legs or to surface of birds. That transportation type represents the highest rate [Duhautois and Hoff (2000)].

Transportation is internal (endozoochory or active zoochory), when diaspores are ingested by birds. Yellow-legged-gull constitutes a very important active agent. Indeed, by [Bougaham (2008)], wastes of plants with many types of diaspores (related to the reported flora on the studied sites), are found in the Yellow-legged-gull regurgitation balls. According to the same author, the composition of these birds' regurgitation balls is dominated by inorganic and vegetal wastes, with frequencies ranging from 68.4% to 100%. The wind vector (anemochory) found in some taxa can be explained by the ease of movement of diaspores between the islands and the continent, knowing the weak distance that separates them. No taxa with anthropochory spreading have been recorded, this may be due to the fact that these environments are not manned and therefore poorly attended.

2-4- Adaptative strategy of Grime

For all our small islands, ruderal vegetation is dominant, and it represents 45.57%, 42.71% and 23.81% for the Grand Cavallo Island, Petit Cavallo Island, and Grand Cavallo Islet, respectively (Fig5).

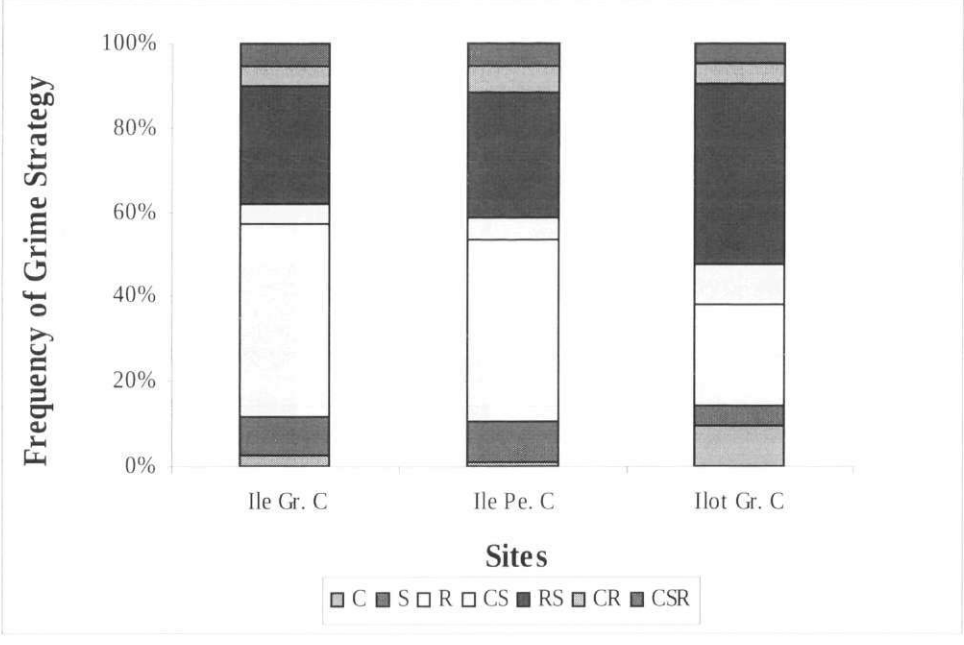

Figure5: Frequency of Grime Strategy type for the three studied sites

According to [Grime (1974)], the ruderals species grow in habitats subjected to frequent and intense disturbances. They present a growth rate and a rapid life cycle associated with a significant production of diaspores. Moreover, due to the disturbances related to climate, the action of nesting seabirds, in particular yellow-legged-gull (*Larus michahellis*) is undeniable. Thus, the coastal areas where the yellow-legged-gull are stationed know the extension of

ruderal species, halo-resistant like *Lavatera arborea*, *Lobularia maritima*, etc. The proliferation of some vegetal species like *Sonchus oleraceus* and *Urtica urens* is characteristic of degraded environments. Furthermore, the maritime influence (salinity gradient), characterizing the island environments, encourages the development of typical salt-tolerant species like *Crithmum maritimum*, and halo-resistant species like *Asteriscus maritimus*. This fact is justified by the large zoopopulation, including the avian population, by repeated trampling and soil enrichment with nitrogen and phosphorus substances, and finally under the effects of excreta and Guano's rejects.

IV. CONCLUSION

The biology of conserving some sites, especially insular areas, is a global concern. In this context, the development of conservation strategies necessarily involves information on the status of biodiversity. Plants are very good indicators of environmental quality, their trend of evolution and their specific ecological situations [Duautois and Hoff (2000)].

The plant communities identified in our sites are fairly common to other small Mediterranean islands. We most often find low halophytic vegetation that grows at the expense of high vegetation*: Crithmum maritimum, Atriplex prostrata, Chenopodium album, Chenopodium chenopoïdes, Halimoine portulacoide, Lotus angustissimus, Lotus cytisoide, Daucus carota, Dactylis glomerata*, etc.

In this paper, we used some recent botanical inventories, and this could not lead to clearly define the dynamics of vegetation over time. However, our floristic data are used in order to analyse, through several parameters, the relationship between the vegetation type and the fauna that lives there. Our data also allowed studying the nesting seabirds like Yellow-legged-gull that knows a rapid and constant growth. Yellow-legged-gull is the most abundant seabird in the Mediterranean [Thibault and Al (1996)]. [Moulai (2006)] shows in his work, that Yellow-legged-gull is the most frequent and common bird on the coast of Jijel. It is the only kind of seabird that nests on the coast of Jijel (Algeria). Furthermore, the important growth of the Yellow-legged-gull number is clear and surprising. Thus, the number of couples increased from 32, 22 and 0 in 1978, to 610,395 and 53 in 2007, for Grand Cavallo Island, Petit Cavallo Island and Grand Cavallo Islet respectively [Bougaham (2008)]. The Yellow-legged-gull proliferation generates a set of ecological disturbances that deconstructs the original vegetation [Vidal and Marthe (2003)].

As we could analyze the organic substances contained in their waste, we show that Yellow-legged-gull cause the nitrification of the areas that they attend. They are also responsible for a significant trampling and uprooting of plants for making their nests. Furthermore, some authors like [Bioret and Al (1991)], underline the effect of droplets of salt water made by the bird feathers. The resulting vegetation is then less specific, as this is the case for our sites. Understanding the organization of plant communities in our sites is far from guaranteed. However, the obtained results show a trend to the therophytisation and ruderalisation of vegetation.

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STATUS OF NATURAL WOODY PLANT SPECIES COMPOSITION & DIVERSITY AT MALALA RIVERINE FOREST

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Abstract

An assessment of woody plant species composition and diversity was conducted at Malala riverine in northern Tanzania in December, 2008 to identify woody plants assess role of humans on the natural woody plants, and identify eco-tourism ventures. 10m x 20m plots were set at river banks. The woody plants were identified and counted for their frequency. Angle of slope was determined. Global Positioning System was employed for coordinates. Photographs were taken using digital camera. Habitats, human activities, and fauna observed were recorded. The conspicuous human activities were agriculture, collection of fodder, firewood, stones, sand, and cutting for poles, The grown crops were Zea mays, Phaseolus vulgaris, Musa spp. The described habitats were; banana and coffee farms, natural riverine forest, grassland dominated with Pennisetum purpureum. The identified native woody plants were more than exotics. However, natural woody plants dominated the very steep slopes of river bank. The flat to gentle slopes were occupied by farms. Human activities and state of slope determined the woody plants composition and diversity. The valuable timber trees identified were Newtonia buchananii, Albizia schimperiana, Cordia africana, Rauvolfia caffra, including only one exotic tree called Grevillea robusta. The fauna were mammals and reptiles. Eco-tourism ventures were waterfalls, big rocks, riverine vegetation.The existing indigenous woody plants are due to the topographical nature, and thus, the steep slope river sides contain the riverne forest, while the rest is severely degraded as a result of human needs for landy. More study is encouraged to find out the overall plant species composition and diversity at Malala riverine forest.

Keywords: woody plants, Global Positioning System, Malala forest, Tanzania

1. INTRODUCTION

Tanzania is a country with high diversity of woody plant species forming an attractive and valuable part of our natural heritage, of which are getting depleted at an alarming state, also threatened by extinction from the everlasting demand for wood materials, and or uncontrolled development of settlements. More than 90% of Tanzanians economy depends on crop farming, which mostly encourage clearing the vegetation. Some of the crops like tomatoes [*Lycopersicon esculentum*], require sticks to support them in order to be ensured of reliable yields. The extraction of sticks takes place in gentle slope areas where human beings can

reach easily and hence degradation of natural vegetation and even extinction of natural plants in our environment.

Most native wood plant species have become endangered, and even extinct in human settlements or have been complemented with the exotics (Beentje, 1994), when it comes to a need for trees coverage in villages or big towns. Riverines or riparian habitats are among of the most fragile areas worldwide. Riverian is a vegetation found along river banks, springs (Harris & Harris, 1997). The woody plant species include:

- **Shrubs:** Woody [breakable] plants with slender stem, usually multi-stemmed [e.g. *Hoslundia opposita, Lantana camara]*

- **Lianas:** These are woody climbers [e.g. *Caesalpinia decapetala,Pterelobium stellatum]*
- **Trees:** Woody plants with height more than three metres, and a diametre of not less than five centimetres: Usually with big stem called a trunk, and usually growing singly, such as: *Rauvolfia*

caffra [MSESEWE], *Araucaria heterophylla, Cedrella odorata,* Terminalia mantaly, *Pterocarpus angolensis* [MNINGA]

The conservation of plant resources in the tropics is dependent upon many factors, among of them being an increasing understanding of ecology and social context of conservation particularly in the interface between wilderness and production lands (Maunder *et al*, 2002).

Importance of riparian vegetation cover

Protection of soil erosion, habitat for wildlife, research purposes, protection of water loss through evaporation, minimizes siltation of rivers & finally lakes, improves tourists industry, and source of fire wood, timber & wild food e.g. fruits.

Problem statement & justification

Our vegetation environment is depleted due to development activities, especially agriculture. The found natural woody plant species at river banks are not there deliberately. It is because they are not at human beings reach. However, we can proud ourselves that we at least have few natural trees unlike other areas. And nothing has been done to justify this situation. This work aimed at assessing the reasons why there are forest patches still left in some areas and not throughout along the riparian area.

2. OBJECTIVES

The overall objectives **were to** assess factors leading to the natural wood plant species composition & diversity at Malala riverine forest.

The specific objectives were to identify the found woody plant species, to describe the habitats, to describe the role of human beings towards the existing natural wood plants, and to

identification of eco-tourism ventures found in the area as the best income generating activity that conserves & sustains the environment.

3. METHODOLOGY

Study area

This work was done at Malala riverine from Akeri KKKT-Church to Tengeru-Moshi Tarmac road [30^0 22^l South, and 36^0 48^l East (Polhill, 1988): Altitude: 1245-1320m a.s.*l* [Altimeter].

Climate

Just like Arusha Municipality, Akeri enjoys an excellent weather throughout the year with long rains between March and May. The average day time temperature ranges from 16.20C to 250C, and the nights are usually chilly (AICC General Information, 2007)

Materials and methods

10m x 20m plots were set on both sides of the river bank [facing east & the side facing west]. All found tree species were identified using scientific names and counted for their frequency. The scientific names have two parts, the generic part and specific part (Newton, 2003). Angle of slope was determined [F, G or VS]. GPS was employed for latitude and longitude. Altimeter was used for altitude.

Photographs were taken using digital camera but they are not shown in this paper for technical reason.

Habitat, human activities & fauna

Habitats, human activities, and fauna found in the area were identified.

4. RESULTS AND DISCUSSIONS

Human Activities were documented

Agriculture: main crops: *Coffea arabica* [Coffee], *Musa* spp [Bananas], *Zea mays* [Maize], *Phaseolus vulgaris* [Beans]. Cattle keeping [zero grazing]. Few employed by government and private companies.

Habitats found

The observed habitats were: Banana [Musa spp] farm, rocky natural riverine forest & or riverine forest, grassland dominated with *Pennisetum purpureus* [Elephant grass]

Wood plant composition and species diversity

The overall list revealed that there were more native wood plants [61] than exotics [14], as can be referred in table two.

Native wood plants dominated the very steep slopes of the area. The flat to gentle slopes were farms [Banana farms], and mostly dominated by exotics as in table 1. Human activities were found to be the major activities responsible for altering the habitats & wood plant species composition. However, the state of slope also determined the wood species type composition & diversity.

Table 1: Total Number of species per plot, category, habitat for every plot and altitude.

Plot no.	Natives	Exotics	Habitat	Slope	Altitude [m]
1AFE	8	6	Banana farm	Flat to gentle	1245m
1BFW	12	2	Natural riverine forest	Very steep	1245m
2AFE	6	2	Natural riverine forest	Very steep	1250m
2BFW	5	6	Banana farm	Flat to gentle	1250m
3AFE	12	1	Rocky natural riverine forest	Very steep	1280m
3BFW	14	1	Natural riverine forest	Very steep	1280m
4AFE	15	1	Rocky natural riverine forest	Very steep	1320m
4BFW	13	1	Rocky natural riverine forest	Very steep	1320m
5AFE	16	1	Natural riverine forest	Very steep	1320m
5BFW	6	5	Pennisetum purpureus grassland	Steep to gentle	1320m

Plot one to two [2AFE] got more native wood species than exotics, while plot two [2BFW got more exotics than natives. All the rest plots were mostly dominated by native wood plants, even though were at various levels.

The identified plant species are as tabulated below.

Table 2: List of plant species identified.

S/NO	SCIENTIFIC NAME	ORIGINAL STATUS	
		Native	Exotic
1	*Agelaea pentagyna*	V	
2	*Alangium chinense*	V	
3	*Albizia shimperiana*	V	
4	*Alchornea cordifolia*	V	
5	*Arundinaria alpine*	V	
6	*Bersama abyssinica*	V	
7	*Bridelia micrantha*	V	
8	*Brugmansia candida*		V
9	*Caesalpinia decapetala*		V
10	*Casearia battiscombei*	V	
11	*Cedrella odorata*		V
12	*Celtis africana*	V	
13	*Chaetacme aristata*	V	
14	*Clausena anisata*	V	
15	*Clerodendrum johnstonii*	V	
16	*Clutia abyssinica*	V	
17	*Combretum pentagonum*	V	
18	*Cordia africana*	V	
19	*Croton megalocarpus*	V	
20	*Cussonia holstii*	V	
21	*Dalbergia lacteal*	V	
22	*Dombeya kirkii*	V	
23	*Dovyalis abyssinica*	V	
24	*Dracaeana afromontana*	V	
25	*Dracaena usambarensis*	V	
26	*Ehretia cymosa*	V	
27	*Euclea divinorum*	V	
28	*Ficus exasperate*	V	
29	*Ficus ingens*	V	
30	*Ficus sp.*	V	
31	*Ficus sur*	V	
32	*Ficus sycomorus*	V	
33	*Filicium decipiens*		V
34	*Galiniera saxifraga*	V	
35	*Greville robusta*		V

36	*Grewia sp.*	**V**	
37	*Heinsis diervilleoides*	**V**	
38	*Lantana camara*		**V**
39	*Maesa lanceolata*	**V**	
40	*Manihot glaziovii*		**V**
41	*Mimusops kumel*	**V**	
42	*Montanoa hibiscifolia*		**V**
43	*Morus alba*		**V**
44	*Musa sp.*		**V**
45	*Newtonia buchananii*	**V**	
46	*Olea capensis*	**V**	
47	*Oxyathus speciosus*	**V**	
48	*Pavonia urens*	**V**	
49	*Persea americana*		**V**
50	*Phyllanthus sp.*	**V**	
51	*Piper capense*	**V**	
52	*Psidium guajava*		**V**
53	*Psychotria ripari*	**V**	
54	*Pterolobium stellatum*	**V**	
55	*Rauvolfia caffra*	**V**	
56	*Rhoicissus tridentata*	**V**	
57	*Rhus longipes*	**V**	
58	*Rothmania urcelliformis*	**V**	
59	*Salacia madagascariensis*	**V**	
60	*Schrebera alata*	**V**	

Valuable timber trees

The identified valuable timber trees were: *Olea capensis* [LOLIONDO –in kiswahili], *Newtonia buchananii* [MKUFI in kiswahili], *Albizia schimperiana* [MRUKA- in Kiswahili]. These may be the most common ones, however, there may be more others as it has been known that human beings are now ready to extract timber from any possible tree found due to the shortage of wood resources.

Fauna

The identified fauna included:

Mamals: Blue monkey [Tumbili], Black and white Colabus monkey [Mbega], Rock hyrax [Pimbi]. **Snakes included the** Green mamba. **Birds consisted of**:

The identified birds were: African marsh owl, Grey backed camaroptera, Silvery cheeked hornbill, Black duck, Pale chanting goshawk, Lizard buzzard, African common bulbul, Mountain wagtail, and Hartlaub's taraco.

Ecotourism ventures identified

The found and recorded ecotourism services at Malala River were: Waterfalls, nivce looking rocks, attractive vegetation.

Factors affecting the woody plant species diversity & composition Continued

Extraction of materials for timber & firewood, collection of fodder materials, lack of environmentally friendly income generating activities in the area, such as eco-tourism business, shortage persistent sustainable riparian conservation awareness education, and lack of research of the flora & fauna & environmental degradation in general.

Slope, the areas where there is very steep slope, there are more natives than exotics and the vice versa is true. Human disturbance is less at very steep slope than at flat to gentle.

Importance of riverine forest

The remaining natural riverine forest patches comprise of an encouraging floral and fauna diversity that needs to be studied well for their dominance [of which this study did not take into account], also the riverine is suitable for eco-tourism activities as sources of income as well as the best way of conserving and sustaining our environment, the available living organisms are important for study & research purposes, and thus, they have to be documented for the present and future generation needs, indigenous plants should be planted along the river bank to ensure the natural vegetation scenery, are suitable areas for beekeeping: hence this idea should be established & implemented.

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WILD SPONTANEOUS MARINE BIOMASS ON THE ROMANIA COAST OF THE BLACK SEA

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Abstract

"EVERITHING IS CHANGING, NOTHING IS WASTE"
Publius Ovidus Naso - "Metamorphoses"

There is a huge potential of biomass, which can be included in the flow when dealing with improving the usage of the existing resources and increasing the productivity. The production of bio-fuels from algae is considered as the most efficient method for fuels production from vegetable substances. The marine biomass (plankton and algae) is an unexploited source until now. We are developing fundamental researches over the possibilities of marine biomass usage in agriculture as an eco-fertilizer. The usage of marine biomass in agriculture contributes to sustainable development which integrates an environmental, an economic and a social dimension.

Keywords: marine biomass, sustainable use, research and development, agriculture.

A. INTRODUCTION

The biomass contains all the forms of animal and plant material, grown on the terrestrial area, in water or on water, as well as the substance made through biological development [D.O. Hall (1981)].

Biomass is the biodegradable part of the products, dump goods and agriculture wastes, including the plant and animal substances, forestry and related industries, and also the biodegradable part of industrial and urban wastes.

The concept is very complex and includes: plant biomass or phytomass (plant organism); animal biomass; microbial biomass; aquatic biomass. In the plant biomass can be differenced: epigee biomass (parts of the plant situated on top of the ground), hipogee biomass (parts of the plant situated underground), woody biomass. In the last decades it's used often the notion of energetic biomass.

The organisms from Terra participate in different ways at the total production of biomass.The primary bioproductivity in the waters of seas and oceans is owed to the phytoplancton (in the european area, this is predominantly composite by microalgae and less by macroalgae) and superior marine plants. The phytoplancton assures a law productivity, around 0.5 t dry biomass ha-1/year -1 values that can get to 0,8-3,0 t/ha-1/years-1 in favourable conditions (what represents about 50 % from biological production of coast waters). In artificial cultures of marine algae the productivity can rise till 50 t of dry biomass ha-1/ year-1 and after some sources the most high production of biomass was experimental obtain at algae – near 100 t dry biomass ha-1/year-1.

Ocean and marine vegetation is dominated by algae, rocky shores being abundantly covered with macrovegetation that is almost exclusively seaweed. Although the Black Sea shore is not very long and the conditions of the water are particular compared with other seas, we can find here some species that develop large biomass that make them suitable for harvesting and utilisation in different ways;

[D. Sava, M. D. Samaragiu, G. M. Paraschiv (2007)].

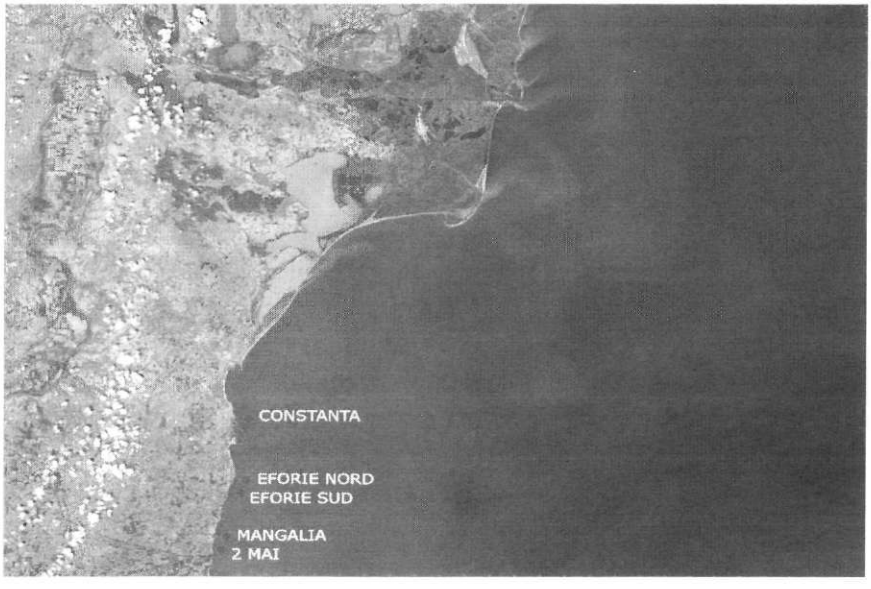

Figure 1. Macro algal sampling points at the Romanian Black Sea shore

B. BLACK SEA ECOSYSTEM – EVOLUTION OF THE MAIN BIOTIC COMPONENTS

The Black Sea is one of the most fascinaiting marine ecosystems from the world, almost unique through this fascination. Having a very large water catchment area and in the same time a limited exchange of waters with others seas and oceans, the Black Sea becomes extremely vulnerable at the impact of the human activities developed on the land. The Black Sea has the biggest water catchment area in the world, covering one third from the Europe surface. Every year, the tributary rivers overflow over 350 km3 of water, 85% deriving from the three big rivers: Danube, Dnestr and Dnepr.

Phytoplankton

The reaches Phytoplankton can be found at a deepness of 0-50 m. Dominated are the silicon algae. The green algae and the blue- greenish algae are slack represented. The Phytoplankton is well developed in the littoral area and slack developed offshore. In the sea, in the areas were the flowing waters are influx exist a mix of mildly and marine algae. It's observed in the phytoplankton a pronounced seasonal variation.

Dinoflagellates have a maximal development in the worm season (June-august), and the diatoms in the cold season(December -February). The maxim biomass was market out in the months June and November.

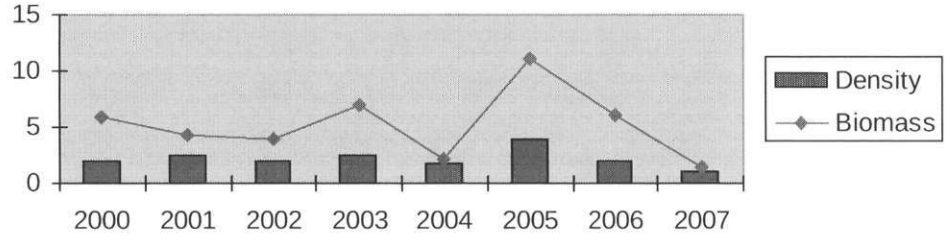

Figure 2. Multiannual evolution of phytoplankton numerical densities and biomasses in the Romanian Black Sea Coast.

Zooplankton

The Zooplankton, poorer in species than the Phytoplankton, is composed of protozoa, coelentera, worms etc. On seasons, the richest Zooplankton is encountered in winter, and the poorer, in summer. Especially, in the second part of the autumn the Zooplankton has a continuous vertiginous growth.

On spring and summer time the Zooplankton is diminished qualitative because of his consumption by the spawn of fish. The Zooplankton is diminished quantitative on the vertical.

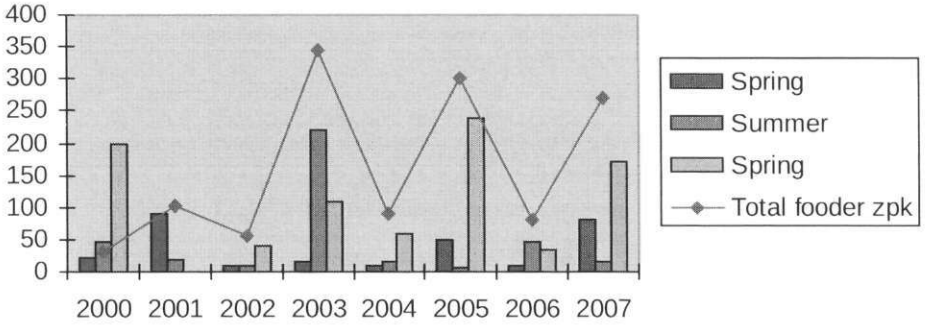

Figure 3. Multiannual and seasonal evolution of the fodder zooplankton biomasses at the Romanian Black Sea littoral

Zoobenthos

The zoobenthos is formed by animal populations witch live up to deep of 180-200 m. Depending on depth, meet certain polichaet, mollusks, crab, fishes. By type of the substrate it creates a variety of bent biocoenosis. Some plant species and animals live on rocks (litophile

biocoenosis), others on sand (psamophile biocoenosis), on shore (pelaphile biocoenosis); [M. Moldoveanu, V. Abaza, L. Boicenco, A. S. Bologa, C. Dumitrache, E. Dumitrescu, S. Nicolaev (2004)].

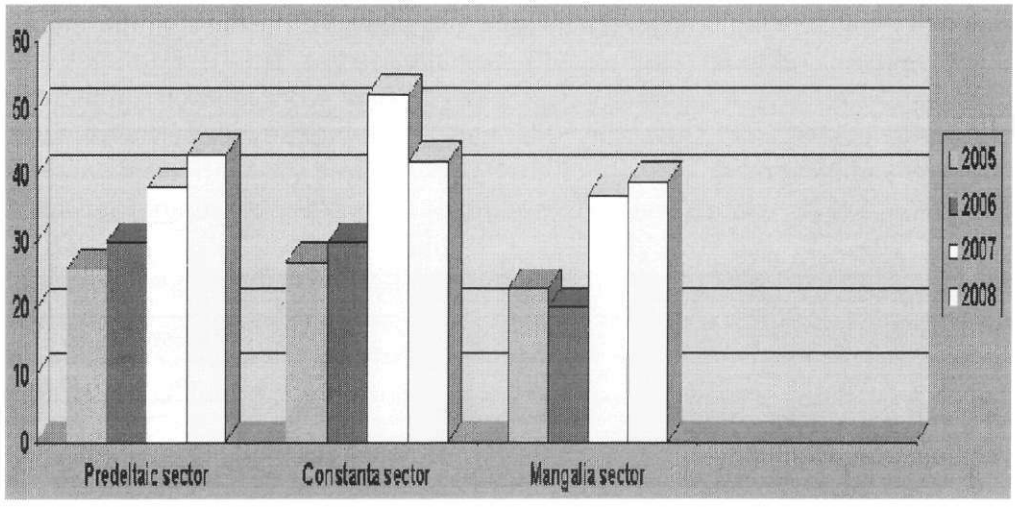

Figure 4. Diversity of macrozoobenthos registered in the main Romanian Black Sea sectors

C. THE BIODIVERSITY OF THE ROMANIAN BLACK SEA COAST

Taxon	Nr. of species	% from total marine species at Romanian littoral	% from total Black Sea species
Bacillariophyta	459	12.8 %	75.5 %
Ciliophora	277	7.75 %	65.3 %
Copepoda	192	5.30 %	57.3 %
Annelida	181	5.07 %	70.15%
Pyrrophyta	81	2.26 %	35.2 %
Bacteria	116	3.24 %	71.6 %
Pisces	108	3.02 %	63.5 %
Amphipoda	96	2.68 %	66.6 %
Nematoda	103	2.8 %	48.13%
Rotatoria	84	2.35 %	62.2 %

Figure 5. Biodiversity in Romanian marine waters: dominant groups

Comparatively with other seas, the biodiversity of the Black Sea is somehow different. Most of the Black Sea species are immigrants from Mediterranean, who reach the Pontic basin 10000 years ago, after the reopening of Bosphorus strait. Since then, the Black Sea suffers a process of "mediterranisation".

A meromictic basin unique in the world, Black Sea is in fact a "pocket" with a particular flora and fauna, originated mostly from Mediterranean. But the number of mediterranean species who settled down in Black Sea and replacing the preexisting ponto-caspian species is small – many Mediterranean species could not survive in the particular conditions of the Black Sea - and the Black Sea ecosystems are more fragile, more sensible to changes comparatively with mediterranean ones.

More than 5600 species included in 70 systematic units of superior order – plants and animals - were mentioned from the marine associations in the whole Black Sea. The richest represented groups in the Black Sea are are Bacillariophyta with over 550 species, Ciliata - over 400 species, Copepoda - over 300 species, Rhizopoda, Annelida, Gastropoda with over 200 species for each of them, then Pyrrophyta, Rhodophyta, Nematoda, Rotatoria, Ostracoda, Amphipoda, Bivalvia, Pisces – all with over 100 species. At Romanian littoral, from those species, only 3570 were mentioned; [M. Skolka, G. araschiv, M. Smargiu, (2005)].

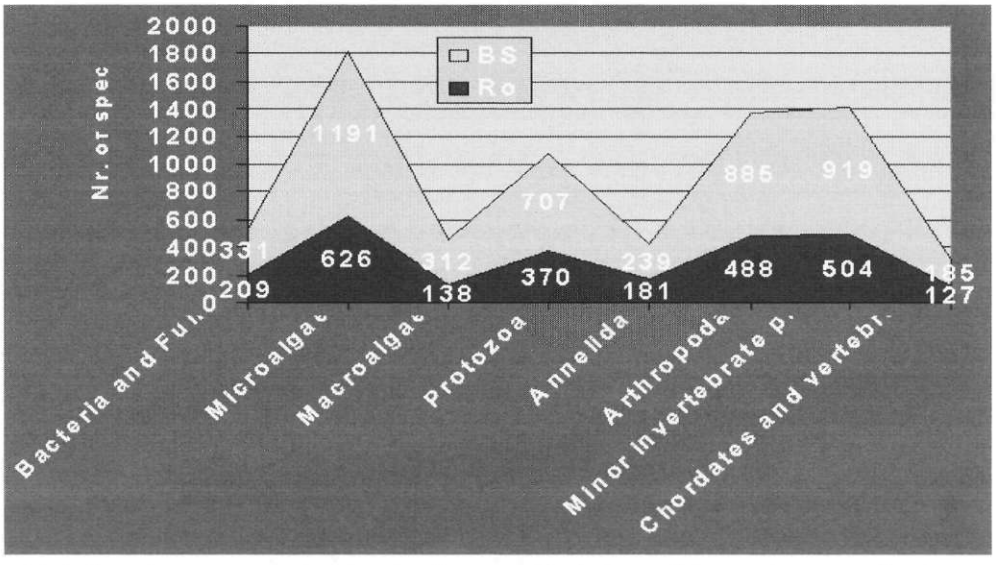

Figure 6. Biodiversity - comparative situation between Black Sea and Romanian coast: dominant groups

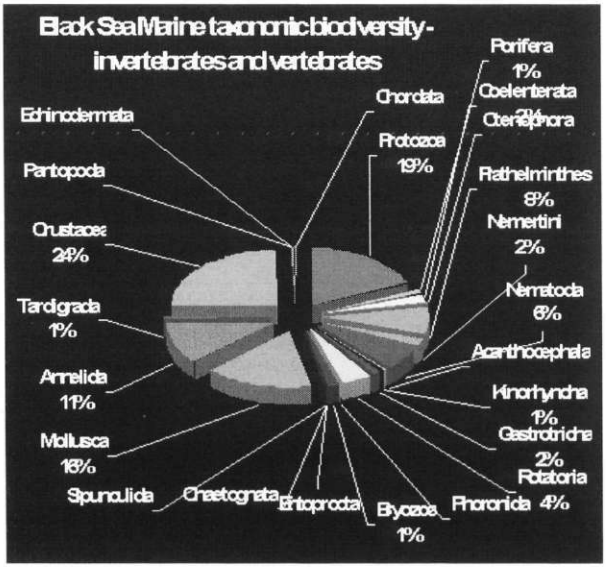

Figure 7. Taxonomy biodiversity-invertebrates and vertebrates

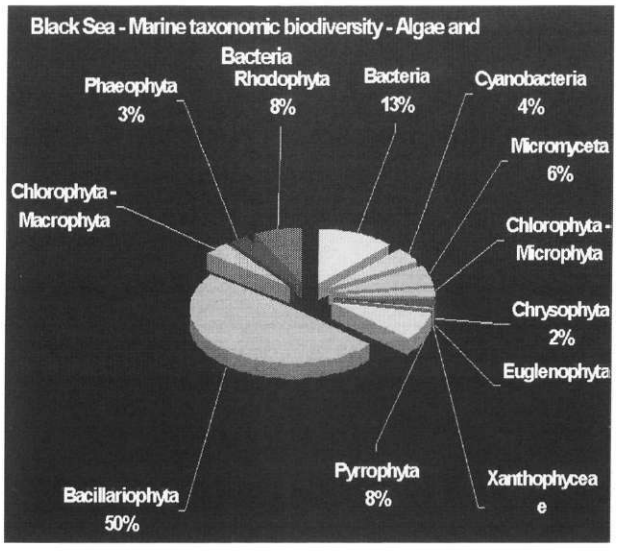

Figure 8. Taxonomic biodiversity-algae and bacteria

D. USAGE OF MARINE BIOMASS

The Romanian littoral abounds in marine algae that can be improved. Along the year 2009, from the Romanian littoral was collected a quantity of 35.000 tones of algae. Comparative, in the year 2008 were collected 25.000 tones of algae, and in year 2007 – 38.000 tones; [http://www.mareaneagra.net/ecosistem.htm].

The diversity of marine biomass from Black Sea represent an enormous and unique source for the natural products with potential in the development of the
Bio fuel industry (bio diesel), the pharmaceutical industry, cosmetics and nutritive supplements industries, medicine, agro-chemicals industry, sustainable agriculture.
As a reaction towards this situation and towards the fact that an industry that should produce bio-diesel from the algae is not yet developed, we are developing at the moment fundamental researches over the possibilities of algae and marine biomass usage in other fields then bio-diesel production: pharmaceutics, agro-chemical, and agriculture.
One of the important projects developed at this time is researching the possibility of making from algae and marine biomass an eco- fertilizer, for a agriculture which will support the sustainable development.

We are study the possibility of creating a new, innovative compound formed from marine biomass and other biomass waste.
The usage of algae in agriculture contributes to sustainable development which integrates an environmental, an economic and a social dimension.

This new dimension of algae usage can be considered as a key element for a sustainable development and for improving the environment quality because it uses "eco-efficiency" that can empower us to use nature for economical activities (agriculture) necessary for human needs (welfare), and to maintain an equitable access to environment utilization for the present and future generations;

[M. Nastac, A. Resteanu, T. Negreanu-Pirjol (2009)].

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LEAF EPIDERMIS MORPHOLOGY: A NEW TOOL FOR TAXONOMY OF TAMARIX AFRICANA POIR

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Abstract

The epidermis is a key tissue in the water economy especially for the native species of arid areas characterized by drought and salinity. The presence of salt-secreting structures like salt glands represents a protective mechanism to salinity of different plant including tamarisks. The present research aims to study the leaf epidermis of several Tamarix species coming from natural habitats of southern Italy. In spring 2008 samplings of flowers and green twigs were carried out from the middle portion of three axes. At least ten plants per population were selected. The identification of Tamarix species was based on the analysis of some flower traits as reported by Baum (1978). In these populations two species (*T. gallica L.*, *T. africana Poir.*) are mostly represented. The leaf epidermal surfaces were investigated under light and electron microscopes in order to discover and evaluate taxonomically useful traits. Stomatal density, guard cell length and salt glands density varied from species to species. Results showed that *T. africana* differs from *T. gallica* in the following characteristics: lower stomatal density (29-46 and 74-117 per mm^{-2}, respectively) and larger stomata (23-30 µm against 11-19 µm). A similar trend was reported in all natural populations studied. Other morphological traits related to stomatal complexes type and shape of salt glands will be discussed. Then, a preliminary comparison between morphological and molecular data confirmed the taxonomic value of the leaf epidermis features. In conclusion, our morphological data could be used as a new tool for *T. africana* identification without flower traits study.

Keywords: leaf epidermis morphology, stomata, salt glands, Tamarix taxonomy

EX SITU CONSERVATION OF THE RARE AND THREATENED MOSS *CAMPYLOPUS OERSTEDIANUS* (DICRANACEAE, BRYOPHYTA)

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Abstract

The rarest Campylopus species in Europe is Campylopus oerstedianus (Müll. Hall.) Mitt., which occurs in the form of isolated patches (small "populations") at only a dozen localities. The range of *C. oerstedianus* extends from Costa Rica to Jamaica and North Carolina in the New World. The very scattered distribution suggests a circum-Tethyan range (margins of the Caribbean and Mediterranean seas). The species is considered to be rare and threatened in Europe, where it occurs in South-Eastern Switzerland, Northern Italy (7 small populations very close to each other), in the Pyrenees with few populations in Spain and France, populations in North-Eastern France (Vosges Mts) and the Massif Central and one population in Greece (Northern Chalkidiki). Recently, it has also been reported from Sicily. The records outside of Europe (ie. circum-Carrebean) are older more than 50 years. Its European range can be considered as scattered subatlantic-supramediterranean.

Since the species is known only without sporophyte, and no diaspors in Europe, it is highly threaten of extinction by microhabitat destruction. So, the ex situ conservation is urgently needed. In vitro establishment and axenically culturing for this species were developed and the propagation condition gave results in multiplying the bryophyte plantlets for introduction and reintroduction.

The problems and results achieved so far in axenically culture of *C. oerstedianus* and its propagation are given and discussed.

Keywords: moss, *Campylopus oesterdianus*, conservation, ex situ

PART IV

Models and Issues of Sustainable Use of Wild Plants

SUSTAINABLE MANAGEMENT OF WILD PLANT RESOURCES THROUGH THE APPLICATION OF FAIRWILD STANDARD PRINCIPLES IN BOSNIA AND HERZEGOVINA

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Abstract

The FairWild Standard, that combines all essential elements of the International Standard for Sustainable Collection of Wild Medicinal and Aromatic Plants (ISSC-MAP) and the original FairWild Standards of the FairWild Foundation, finds wide application through various voluntary certification schemes, offering a framework for sustainable resource collection, for resource management authorities, and providing tools for the implementation of intergovernmental agreements.

In South-east Europe, a major source of wild medicinal and aromatic plants (MAPs) collected in Europe, a FairWild Standard implementation project was conducted in Vlasenica Region in the eastern part of Republic of Srpska (Bosnia and Herzegovina [BiH]). From 2008 to 2010, TRAFFIC, through co-operation with a medicinal and aromatic plant-producing company and the local forestry authority, evaluated the available resources of a selected wild aromatic plant (Wild Garlic *Allium ursinum*), conducted training in sustainable collection techniques for harvesters, and developed the management plan for this species to ensure its survival and non-exhaustive use. Among the major outcomes of this implementation project is the involvement of TRAFFIC in the discussion and redrafting of the Rule Book of Conditions for Utilization and the Methods of Collection of Other Forest Products in Republic of Srpska (BiH), introducing measures to enforce sustainable resource management practices.

The FairWild implementation project in BiH serves as a model that can be replicated in the region. This paper describes the FairWild Standard implementation experience inBiH and offers a wider approach to conservation and sustainable use of plant resources in Europe.

Keywords: Sustainable management, wild plant resources, FairWild Standard, Bosnia and Herzegovina, Allium ursinum

1. INTRODUCTION

Over one fifth of species of known wild-collected medicinal and aromatic plants (MAP) used in traditional and modern medicinal systems throughout the world are threatened with extinction from the wild due to a combined over-harvesting, land-conversion, and habitat loss [Schippmann *et al.* (2006)].

The current paper describes the FairWild Standard (FWS) and highlights its relevance as a tool to support resource management authorities, harvesters' organizations, governments, and inter-governmental organizations in developing sustainable management strategies for wild plant resource collection and use. The paper first introduces the FairWild Standard history, principles and application in various implementation scenarios. It then describes the experience of implementing the Standard in the Vlasenica area of Republica Srpska (Bosnia and Herzegovina [BiH]), and provides conclusions and recommendations on its use in the broader context of the South-east European region and beyond.

2. ECOLOGICALLY AND SOCIALLY SUSTAINABLE COLLECTION OF WILD PLANTS: FAIRWILD STANDARD

The development and use of conservation measures and tools to ensure sustainable collection and use of wild plant resources is of paramount importance for the survival of plant species and the preservation of livelihoods of people depending on harvesting of plants for their income and well-being. While this need was recognized widely, particularly through the Global Strategy for Plant Conservation [GSPC (2002)] and European Strategy for Plant Conservation [ESPC (2002)], the number of available tools and practical field implementation of these tools is limited.

Within Target 3.1 of the ESPC *'Best practice for the conservation and sustainable use of medicinal plants (and other sociologically important plants) identified and promoted to relevant policy makers'* [ESPC (2002)], the FairWild Standard, through its precursor International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP), is recognized as the "best practice" tool and approach to the conservation and sustainable use of medicinal plants. Since the merger of ISSC-MAP with the FairWild Standards, additional emphasis has been placed on establishing socially equitable and fair trade relations between employers and collectors, respecting the code of practice of the International Labour Organization (ILO) and ensuring the better social sustainability of wild collection. The FairWild Standard is proposed as the unique and effective tool for plant conservation and ensuring sustainable livelihoods.

FairWild principles and supporting guidance documentation for conducting resource assessment (RA), trainings, and development of management plans (MP) were tested in field conditions in a number of countries and environments around the world. In Brazil, BiH, Cambodia, China, India, Nepal, South Africa and Lesotho, FairWild principles were implemented in field projects to estimate and demonstrate sustainability of wild collection for over ten medicinal and aromatic plants.

2.1. FairWild Standard in a nutshell

The FairWild Standard in its current form appeared after a merging between the previously available FairWild Standards (Ver.1.0)–mostly focusing on the establishment of fair trade and ensuring social sustainability of wild collection–and the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants, with a strong focus on the ecological sustainability of wild collection (See Figure 1)

Figure 1. FairWild Standards and International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants: Requirements

The requirements of the FairWild Standard are summarized in six principles, covering a range of issues including ecological sustainability, fair relations along the trade chain, quality of labour conditions, compliance with regulations, and business practices. Table 1 brings together the principles and outlines what the requirements include.

FairWild principles	**FairWild Standard requirements**
Wild-collection and conservation requirements	— Wild resources maintained — No negative environmental impacts
Relationship between collectors and collecting station	— Fair contractual relationship with collectors — No discrimination — No child labour — Fair trade benefits for collector communities
Fair labour conditions in collecting and processing companies	— Fundamental principles and rights at work — Good healthy working conditions
Obligations of FairWild companies towards their suppliers and buyers	— Sustainable sourcing practices employed — Fair trade practices: fair pricing and fair trade premiums paid to source
Legal and ethical requirements	— Compliance with laws, regulations and agreements — Customary rights respected
Management and business practices	— Good management and business practices applied — Transparent cost-calculation and benefit-sharing throughout the value chain

Table 1. Requirements of the FairWild Standard (Source:www.fairwild.org/requirements)

A number of *FWS implementation scenarios* were developed to provide a wide range of application possibilities and target a number of stakeholder groups.

1. For companies, associations and international organizations, FWS principles may serve as the basis for voluntary codes of practice and internal standards.

2. There is a particular role FWS principles may play in providing input in the development of resource management schemes for local, regional and national authorities. This was tested successfully in a number of projects globally, including in India, Lesotho and BiH.

3. The FWS allows instrumental support and input into legal frameworks and policies, including those concerning the establishment of conservation policies, sustainable trade regimes, and other relevant regulations. In particular, FWS contributes to the development of Non-detriment Findings methodology used in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and constitutes an important approach to help achieve GSPC Targets 3, 11, 12 and 13. The FWS supports GSPC and the Convention on Biological Diversity (CBD) by presenting sound principles and criteria for sustainable wild collection based on the GSPC and on current Access and Benefit Sharing (ABS) provisions, combining ecological, social and fair trade requirements.

4. For businesses along the wild plant trade chain, the FWS represents a unique tool for sustainable wild collection and management, focusing on sustainable business practices, and providing a basis to ensure transparency and traceability along the trade chain. In particular, for the private sector, third party certification under the FairWild label is of interest and allows communities and businesses to confirm and communicate to the public that their harvesting practices meet the verifiable FWS sustainability criteria. The number of companies interested in FWS certification is growing and the first FWS-certified products appeared with their labels on the Canadian, EU and US markets in 2009.

These numerous scenarios provide opportunities for involvement of all major stakeholder groups in the sustainable management of wild plant resources, and introduce a measurable benchmark for sustainable resource use.

2.2. FWS implementation process: Theory

There are a number of milestones along the road of successfully applying FWS principles. The initial *situation analysis* (SA) provides the background and description of the collection area, selected species, information on habitat and distribution of species, regulatory background for wild collection, identification of stakeholders and current collection activities, as well as providing a basis for conducting the *resource assessment*.

The resource assessment (RA) includes both desktop and field work, consolidating available information about species and area, and providing information about the quantity (standing stock) of the target resource by estimating both resource density (number per unit area) and abundance (total number in a specified area). The RA also includes yield and regeneration studies, which estimate the total and sustainable harvest yield of a target resource in a determined area and the time required for seedlings to replace harvested individual plants. Part of the RA is to assess the harvesting impact by providing information about the effects of specific harvest treatments (different intensities, frequencies, and methods) on the target resource (reproduction, growth, survival, vigour, yield, and quality). This information is later used to define a sustainable harvest protocol for the target resource that takes into account site-specific variables. The RA report consolidates all the aforementioned information to develop recommendations on periodic monitoring and necessary harvest adjustments. Based on the recommendations and conclusions, the *management plan* is developed in consultation with relevant stakeholders, and harvesters and resource management authorities are trained on sustainable harvesting methods. For the implementation of the FairWild Standard, guidelines for the resource assessment [Leaman and Cunningham (2008)] and the development of management plans for sustainable collection of wild plants [Winkler (2010)] are available.

In addition, a number of steps need to be introduced to ensure the social sustainability of wild collection, including, *inter alia*, transparent cost calculations along the supply chain, documented fair trading practices, and healthy working conditions. Good management practices need to be introduced

as well, ensuring compliance with all relevant legislation. To support interested parties in leading them through the process of applying the FWS, a number of guidance documents were developed by the FairWild Foundation and partners.

This approach to the application of FWS principles and the use of guidance documents was tested in the FWS implementation project inBiH. The following section describes the FWS implementation experience on the ground in the Vlasenica area of the Republic of Srpska and recommends the use of the FWS as the tool for sustainable management of wild plants in the South-east European region and beyond.

3. MEDICINAL AND AROMATIC PLANTS COLLECTION IN BOSNIA AND HERZEGOVINA

Bosnia and Herzegovina (BiH) is located in South-east Europe and is exceptionally rich in plant diversity. At least 160–170 species of medicinal and aromatic plants are native to BiH and most of these are under collection [Kathe et al., (2002)]. Currently, 231 species are in national and international trade in the country. Of these, seven are endangered, 49 are vulnerable, and eight are rare [Donnely and Helberg (2003)], totalling 64 species at risk from unsustainable harvesting. Examples of such species include *Gentiana lutea*, *Arnica montana*, *Arctostaphyllos uva ursi* and *Orchis* spp. In the majority of cases, traditional wild collection is still a predominant activity, with over 100,000 harvesters collecting as groups in rural areas [Duerbeck (2002)]. There are over 50 companies of major importance to the subsector (collection and trade in MAPs) and over 250 companies are involved in processing MAPs into value-added natural products, such as essential oils, spices and teas. Uncontrolled exploitation of resources driven by the poverty of local people and loss of habitats are the main threats to the sustainable use of MAP resources and business development in the MAP sector.

The experience of implementing the principles of sustainable wild plant collection and use in BiH focused around two major topics: field implementation of the FairWild Standard in the Vlasenica area of the Republic of Srpska, and support in the review of the legislation of the Republic of Srpska, based on the FairWild Standard principles.

3.1. Legal background of wild collection in Bosnia and Herzegovina

Politically decentralized and organized as a federation, BiH consists of two governing entities, the Federation of Bosnia and Herzegovina (FBiH), and Republika Srpska (RS), with a third region, the Brčko district, being administered by both. Each of the BiH entities is responsible for developing their own legislation (which makes the country regulations fairly complicated). This, in particular, defines the specific features of BiH legislation that regulates the use and trade in MAPs.

The institutional arrangement of MAP resource management is also affected by the country's political structure: two separate ministries in each entity are responsible for various aspects of management: while the Ministry of Agriculture, Forestry and Water Management regulates issues of collection of wild-growing plants and MAP cultivation, the Ministry of Health regulates the trade in herbal medicinal products. Most of MAP species are collected on public land, and utilization of non-timber forest products (NTFP) in each entity is regulated under separate Forestry Laws and Rule Books with detailed provisions related to the sector. In this institutional and legislative environment, enforcement of legislation poses the biggest challenge.

The forestry laws in BiH provide only a framework and guidelines for the conservation of biodiversity and sustainable use of natural resources; detailed provisions are not provided but are defined through the sub-laws and Rule Books. The existing traditional knowledge and practices of MAP collection and use in BiH are abundant; the challenge, however, is to translate the traditional practices into a regulated system of sustainable use of wild collected plants. While no easy solutions to improve the

regulation and sustainable functioning of the BiH MAP sector are present, the following steps can be taken in order to minimize overharvesting and unsustainable practices:

1. Compilation, improvement and enforcement of legislation; and

2. Permanent training of all stakeholders within the MAP sector (collectors, processors, traders, government officials) in principles and practical steps to achieve sustainable collection and use of wild plants.

The FairWild standard can provide the basis for the development of legal provisions in support of the sustainable use of MAP resources. From 2008 to 2010, TRAFFIC was invited to comment on the revision of the *Rule Book of Conditions for Utilization and the Methods of Collection of Other Forest Products* – the regulation detailing the provisions of the utilization of forest products in the Republic of Srpska.

TRAFFIC's recommendations and proposals for the revision of the Rule Book were related to the development of management plans, licensing procedures, maintaining wild MAP resources, baseline resource assessment, monitoring, training of collectors, respect of customary rights and fair business practices. FairWild Standard principles and criteria served as a basis for defining articles in the Rule Book that concretized the practical steps to implementation of sustainable systems for wild collection. TRAFFIC also reviewed international, federal, and RS laws related to the environment to ensure that the NTFP Rule Book did not contradict other legislation, such as those related to CITES, CBD, the RS Law on Nature Protection, and the RS Law on Forestry.

The Rule Book entered into force in 2010 in the Republic of Srpska. It defines groups of products included under the definition of NTFPs, identifies responsible entities for the management of wild NTFPs, and defines procedures and rules for establishing harvest quotas, the selection of harvesting techniques and the procedure for devising management plans for species utilization and population monitoring. Important new measures concern the establishment of new licensing procedures and controls over commercial collection, the introduction of a list of plants approved and forbidden for commercial collectors (the first list of its kind), and introduction of obligatory annual plans for NTFP use, based on ecological sustainability. Species of particular conservation concern, which are put on the list of species forbidden for commercial collection, include medicinal plants such as *Arnica montana*, *Arctostaphylos uva-ursi* and *Gentiana lutea*.

Sustainable wild collection can become a viable practice in BiH only if the management principles are incorporated into the legislation and enforced efficiently. The introduction of sustainable collection and use principles in the Rule Book provides the starting point for the effective conservation, sustainable, fair and equitable use of wild plant resources. Another means of establishing sustainable wild collection practices in BiH is through the voluntary use of the FairWild Standard principles by companies collecting and producing medicinal plants, working in strong co-operation with forest authorities managing natural resources on public land.

3.2. FairWild Standard implementation in Vlasenica area

Vlasenica was selected as a project implementation area in BiH. It is a municipality and town in the eastern part of BiH and offered an opportunity to apply the FairWild Standard, particularly its ecological component, ISSC-MAP, which could be easily replicated in other areas of the whole region and the whole country. The Standard was tested in co-operation with a private sector company experienced in harvesting and trading in MAP, and which was already certified with organic and social FairWild standards. Wild Garlic *Allium ursinum* was selected as a target species, being of a great economical importance for stakeholders from the project region.

In the two-year project duration, a series of steps were taken to co-operate with forestry authorities and the private sector in developing the sustainable resource management model. Initially, the *situation analysis* of MAP collection practices in BiH and the Vlasenica project region was conducted, followed by a number of *training workshops* at the local and state level in order to

introduce core stakeholders from the BiH MAP sector to the Standard, methodology of resource assessment, monitoring, sustainable collection methods, and management planning through participatory process.

During project implementation, a *resource assessment* for Wild Garlic was conducted for the first time in this area, providing baseline information for sustainable collection practices [Bundalo (2009)]. The resource assessment was conducted in co-operation and with the participation of the local forest authority. Since its completion, the RA has formed the basis for issuing collection permits. The *Management plan* for the area was later developed through the interaction with forestry authorities and other stakeholders. The Vlasenica *Allium ursinum* Management Plan (VAMP) was developed to enable the implementation of sustainable collection practices for *Allium ursinum* in accordance with the FWS in the Vlasenica region. The main goal of VAMP is to ensure the long-term survival and sustainable use of *Allium ursinum* for commercial purposes, whilst taking into account the needs and rights of all stakeholders, including the local community, that depend on this resource.

VAMP specifies certain specific management activities that must be undertaken to achieve its goals, including improvements in collection practices and licensing procedures, an increase in controls over collection (including preventing illegal harvesting), as well as continuous monitoring. Information necessary for the compilation of the management plan was collected from the local community, collectors, local forest authority, companies and the resource assessment report.

Responsibility for implementation of the principles and components of VAMP, once approved by them, lies with the local forestry authority, as the resource management organization, and with the private partner company (one of three main users of Allium species in the region) for implementation of the FairWild Standard. Continuous monitoring of species is a part of the FWS implementation.

4. WILD PLANT CONSERVATION IN EUROPE: POINTS OF CONCLUSION AND DISCUSSION

There is a growing demand for wild collected plant ingredients, particularly for satisfying the demand of European, US and Japanese pharmaceutical, cosmetics and food markets. South-east Europe remains among the main suppliers of selected wild plant ingredients in Europe.

This overview of available information and experience from TRAFFIC's FairWild Standard implementation project in BiH has demonstrated the applicability of the FairWild Standard in the context of South-east Europe, and its potential for other regions. The following conclusions and recommendations support the development of sustainable approaches to wild resource use in Europe:

1.To ensure the conservation of wild medicinal and aromatic plants a number of measures and schemes should be introduced, including: engagement with resource management authorities to develop sustainable resource management regulations and enforcement mechanisms; the use of voluntary codes of practice, internal standards and voluntary certification schemes in the private sector and international organizations; and the establishment of effective international trade and conservation regimes through existing policy frameworks.

2. The FairWild Standard offers a means of ensuring sustainable wild collection that can be implemented in a number of situations. It also provides support in the review of local, national and regional resource management guidelines, through providing the necessary tools to implement relevant multilateral environmental agreements, supporting resource management authorities in developing species management plans, and supporting the private sector through certification and voluntary use of sustainability principles.

3. Experience of FairWild Standard implementation in BiH suggests that there are potentially numerous opportunities to promote and introduce the sustainable wild plant management schemes.

4. Ensuring multiple stakeholders' interest and active involvement are essential for successful development and implementation of sustainable resource management practices. Such involvement and active participation should be encouraged at every level.

5. The lack of available scientific data on distribution and population size of wild plants in BiH was noted as a major obstacle in the establishment of effective species management plans. It is, therefore, of foremost importance to make this information available, and where necessary gathered through collaborative efforts of research institutions, resource management authorities and government institutions.

6. Management plans should first be established for species for which information is available, using simplified procedures for the resource assessment. This may potentially increase the number of management plans developed for wild collected species as much of the necessary baseline scientific information is already available with research institutions and forestry authorities. The distribution and sharing of such information should be encouraged, and applied to species of greater conservation concern.

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ENRICHMENT OF TOBACCO GENEFUND APPLYING REMOTE HYBRIDIZATION AND BIOTECHNOLOGICAL METHODS

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Abstract

Tobacco is an economically significant crop. Because of its narrow gene pool various improving programs have been applied. Wild Nicotiana species possess a high potential of useful features. We realized four interspecific crosses through routine hybridization technique.

N. tabacum was used as a pollinator in hybrid combinations with the wild species *N. plumbaginifolia, N. benthamiana, N. sylvestris* and as mother parent in a cross with *N. sanderae*. Some in vitro techniques (embryo- and tissue culture) were applied in order to produce viable F_1 hybrid plants and to overcome their male and female sterility. Electrophoretic analysis of seed proteins of the parental species, F_1 hybrids and regenerants from them were performed. The obtained plants with improved fertility were included in our breeding program.

Keywords: *Nicotiana tabacum, N. plumbaginifolia, N. benthamiana, N. sylvestris, N. sanderae*

1. INTRODUCTION

Tobacco is among the economically very important crop. However, it is frequently infested by various pathogens and other pests because of its poor gene pool. At present diverse chemicals are mainly used for disease and pest control, but this approach is very expensive, causes environmental contamination and is not always enough efficient. Development of new tobacco forms resistant to pathogens and insects is the optimum solution of the problem. Therefore the restoration of tobacco natural genetic diversity is a priority of the improving breeding programs of this crop all over the world.

The genus *Nicotiana* belongs to the family *Solanaceae* and includes about 70 genetically and morphologically differentiated tobacco species [Kostoff (1943); Goodspeed (1954)]. The wild *Nicotiana* species have a considerable potential of valuable characteristics which are of great interest for tobacco breeding. The transfer of certain traits from the wild species to the selected tobacco forms through sexual hybridization is usually accompanied by different types of incompatibility, which may be switched at different embryo and plant developmental phases of the first hybrid generations. *In vitro* techniques provide reliable methods to overcome that incompatibility [Zagorska and Palakarcheva (1976); Nikova and Vladova (2002)].

In this paper we summarize our results from the hybridization of four wild *Nicotiana* species with *N. tabacum*, using embryo- and tissue culture methods. Since seed proteins are principally coded by nuclear genes, their electrophoretic spectra were investigated to provide additional evidence that the wild species genes are present in the interspecies hybrids genome.

2. MATERIAL AND METHODS

Sexual hybridization was realized through routine cross techniques *N. tabacum* was used as male and wild species *N. plumbaginifolia*, *N. benthamiana* and *N. sylvestris* as female parents. *N.tabacum* participated as a mother only in the combination with *N. sanderae*. Seeds from *N. plumbaginifolia* x *N. tabacum* and *N. tabacum* x *N. sanderae* were grown *in vitro* on Murashige and Skoog (1962) agar nutrient medium (MS) for embryos (Table 1) because of their reduced germination capacity. Tissue culture method was applied to overcome the sterility of F_1 hybrids from the following combinations: *N. plumbaginifolia* x *N. tabacum*, *N. benthamiana* x *N. tabacum*, *N. sylvestris* x *N. tabacum* and *N. tabacum* x *N. sanderae*. Stem pit parenchyma from these F_1 hybrids was used as an initial material for in vitro cultivation. Explants of 2-3 cm were sterilized in 70% ethanol for 1-2 min, afterwards in 15% potassium hypochloride solution for 10 minutes and 3 times rinsed in autoclaved d H_2O. They were grown in 12 h photoperiod and t° 25°±2°C. Basic MS agar nutrient medium with supplements (Table 1) was used to induce callus, organogenesesis and rooting. The callus produced was subcultured every 30 days. Organogenesis was induced from the first to the ninth passages depending on the hybrid combination.

Table 1. List of supplements added to basic MS agar nutrient medium for different applications.

Supplements (mg l^{-1}) for:	Embryogenesis	Callus	Organogenesis	Rooting
Caseine-hydrolisate	500	500	0	0
NAA	0.05	2	0	0
Kinetin	0.05	0.5	2	0
IAA			0.5	
Ferulic acid		0	0	2
Sucrose (g l^{-1})	30	30	30	15
Agar agar (g l^{-1})	7	7	7	7
Yeast extract	500			
Inositol	100			
Gibberellic acid	0.1			

NAA = α-naphtaleneacetic acid
IAA = indole-3-acetic acid

The F_1 hybrids and the regenerants obtained were grown in a greenhouse and then in the field. Chromosome counting was made on squashed root tips preliminary fixed in Clarke's solution and stained with shiff:orceine (v/v=1:1) mixture. For meiotic investigations anthers were squashed in 4% acetocarmine. Pollen stainability was determined on temporary carmine-glycerin (v/v-1:1) preparations.

Seed storage proteins were separated in 12.5 % homogenous SDS polyacrylamid gells [Laemmli (1970)], containing 5M urea [Vladova et Al. (1996/1997)].

3. RESULTS AND DISCUSSION

3.1. N. plumbaginifolia (2n =20) x N. tabacum (2n =48)

N. plumbaginifolia Viviani belongs to the subgenus *Petunioides*, section *Alatae* [Goodspeed (1954)]. A detailed morphological characterization of this species has been given by Goodspeed (1954). Its chromosome number was determined as 2n=20 in our cytological observations (Fig. 1a).

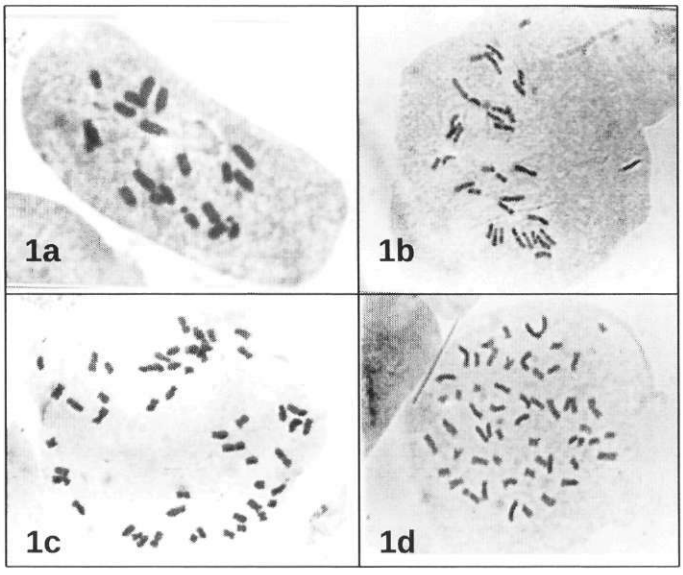

Figure 1. Root meristem metaphase plates from *N. plumbaginifolia* 2n =20 (a); F_1 *N. plumbaginifolia* x *N. tabacum* 2n =34 (b); regenerants from 7th passage 2n=51(c); 2n=54 (d)

This species was successfully pollinated with *N. tabacum* cv. Kroumovgrad 988, and formed small amounts of badly developed seeds. They germinated passably, but the seedlings perished at the cotyledon stage. Most probably, this phenomenon was due to late manifestation of interspecies incompatibility. When F_0 seeds were placed on MS agar medium with supplements, they germinated quickly and after 15–20 days green seedlings appeared. Stabilized in this way, F_1 plants reached florescence (Fig. 2).

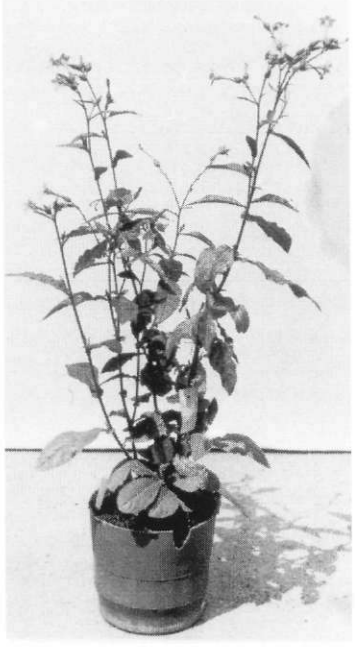

Figure 2. F_1 plants of the cross *N. plumbaginifolia* x *N. tabacum*

They combined morphological features of both parents. Their stem and leaf morphology was closely related to *N. plumbaginifolia*, while flower characteristics resembled *N. tabacum*. F_1 plants had

several thin, erect, weakly branched stems. Basal leaves were spear-shaped, assembled in a rosette. Upper ones were scanty, smaller and narrower. The flowers had normal corolla, two-loculed pistil and stamens with shortened filaments, which provoked weakly expressed longistily. F_1 hybrid plants were completely (male and female) sterile. The observed chromosome number 2n = 34 (Fig. 1b) was expected, as *N. plumbaginifolia* possessed n = 10 and *N. tabacum* had n = 24.

The reciprocal combination *N. tabacum* × *N. plumbaginifolia* was realized by Kostoff (1943). The F_1 plants were similar in morphological characteristics (habit, size, and leaf shape) to those obtained by us, but flower morphology resembled both parents. Burk (1960) observed single male sterile plants in BC_2 progeny (*N. tabacum* × *N. plumbaginifolia*) × *N. tabacum*. They possessed pollenless stamens modified into petal- or stigma-like (pistil without ovary) structures.

In our earlier experiments the tissue culture method had been successfully applied to overcome the sterility of F_1 plants from interspecific tobacco hybrids [Nikova and Zagorska (1990); Nikova et Al. (2001)]. The same method was also used for *in vitro* cultivation of *N. plumbaginifolia* x *N. tabacum* F_1 hybrid plants. Callusogenesis and organogenesis were induced in culturing *in vitro* stem segments. The chromosome number of he regenerants produced from earlier passages was close to that of the F_1 hybrid. The plantlets from the 1^{st} – 4^{th} passages were completely sterile. With increase of callus age, cell polyploidization proceeded followed by development of plants with higher chromosome number and improved fertility [Nikova and Zagorska (1984); (1990)]. Twenty-five plants from the 5^{th} passage were male sterile but with restored female fertility. They formed a sufficient number of seed capsules after backcrossing. Fourteen plants from the 7^{th} passage had 32 % viable pollen and sufficiently seeded capsules after self-polination. They were mixoploid with chromosome number 2n = 51-54 (Fig.1 c, d). This phenomenon frequently occurs in organs induced from callus [D'Amato (1978), (1991)]; Reynolds (1987); Nikova et Al. (1999)]. The results that we obtained for F_1 *N. plumbaginifolia* x *N. tabacum* regenerants confirmed the importance of the tissue culture method for induction of somaclonal variation and creation of a large variability of plant forms [Skirvin et Al. (1994); Nikova et Al. (1998)].

3.2. N. benthamiana (2n=38) x N. tabacum (2n=48)

N. benthamiana Domin belongs to subgenus *Petunioides*, section *Suaveolentes* [Goodspeed (1954)]. There are no data concerning the development of F_1 (*N. benthamiana* x *N. tabacum)* hybrids through direct hybridization. F_1 hybrid was obtained only via bridge crossing (*N. benthamiana* x *N. glutinoza)* x *N. tabacum* [Ramavarma et Al. (1978)]. We succeeded in overcoming the species incompatibility using mixed pollen from the broadleaf tobacco type Burley and from oriental tobaccos. The hybrid seeds had good germinating ability, but only a few of the plants reached anthesis. The F_1 generation was similar in stem, leaf and flower morphology to *N. tabacum,* but completely sterile (Fig.3). Tissue culture method was used to overcome its sterility. Stem segments were cultured on MS nutrient medium for callus formation. Organogenesis was induced in subculturing. The regenerants obtained from 1^{st} and 2^{nd} passages had chromosome number 2n = 46-48 versus 2n = 43 of F_1 hybrids and 2n = 32-56 of plants from 3^{rd}-6^{th} passages. The plants from 1^{st} and 2^{nd} passages were completely sterile. Some plants from 3^{rd} passage were with restored female fertility. Sufficient number of fairseeded capsules was formed after backcrossing them with pollen from *N. tabacum*. A part of the regenerants from 6^{th} passage was male and female fertile, with 46-54 % viable pollen and well seeded capsules obtained after self-pollination.

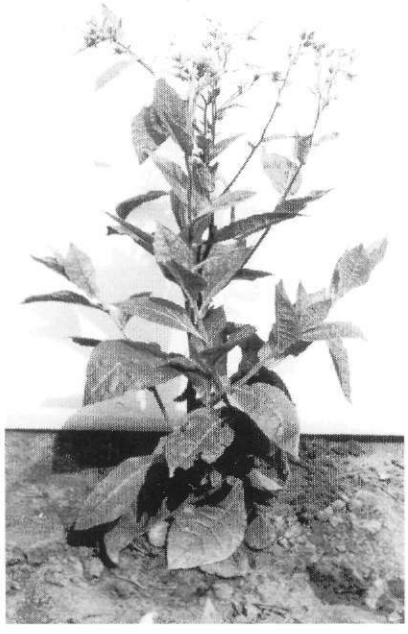

Figure 3. F_1 plants of the cross *N. benthamiana* x *N. tabacum*

3.3. N. sylvestris (2n =24) x N. tabacum (2n =48)

N. sylvestris Speg & Comes belongs to subgenus *Petunioides*, section *Alatae* [Goodspeed (1954)]. This species has been morphologically and cytologically described in details by Kostoff (1943) and Goodspeed (1954). Its chromosome number has been determined by them as 2n = 24. We successfully crossed this species with *N. tabacum* cv. Harmanliiska basma 163, obtaining very few seeds of good germination. The F_1 plants possessed traits of both parents (Fig. 4). The stems were without branching, 102-110 cm in height. Leaf number varied from 18 to 24. The racemes were branched, with characteristics of both parents. Some flowers stood straight as *N. tabacum* while others bent down like those of *N. sylvestris*. Petal pink color of *N. tabacum* was combined with very nice fragrance of *N. sylvestris*. The flowers were of medium size with flower tube length being 6.3 cm and corolla diameter being 3.2 cm (Fig. 5). Filiform filaments resembled that of the wild species.
The hybrid character of F_1 plants was supported by the chromosome number (2n = 36). They were completely male and female sterile. Similar results have been reported by other researchers [Kostoff (1943); Goodspeed (1954)]. We used tissue cultures to induce fertility in F_1 *N. sylvestris* × *N. tabacum* plants, following the scheme callusogenesis–organogenesis in order to obtain polyploid regenerants with improved fertility.

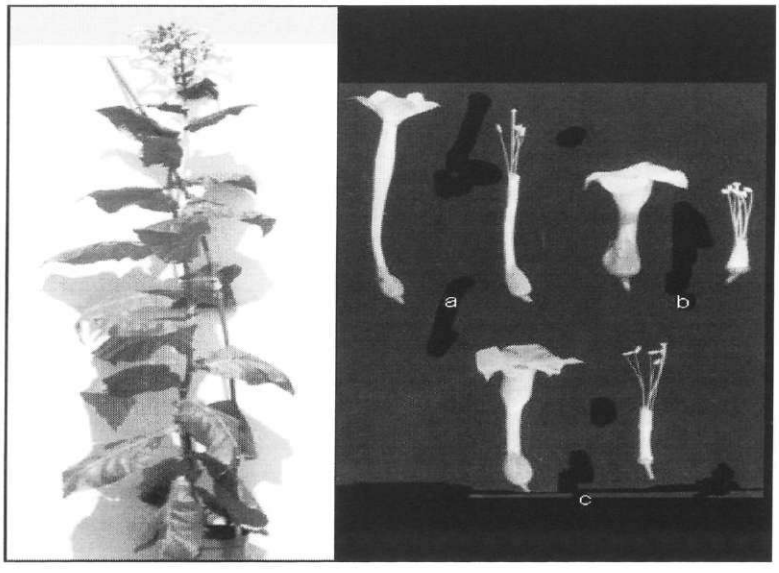

***Figure 4** (left).* F_1 plant of the cross *N. sylvestris* x *N. tabacum*
***Figure 5** (right).* Flowers of *N. sylvestris* (a); *N. tabacum* (b); F_1 *N. sylvestris* x *N. tabacum* (c)

The chromosome number of the regenerants obtained in earlier passages was similar to that of the F_1 hybrids. The plants from the 1st - 5th passages were completely sterile. With increase of callus age, cells were polyploidized and regenerants with high chromosome number and better fertility were obtained. Twenty eight plants originated from 6th passage were male-sterile with restored female fertility. They gave rise to a satisfactory amount of seeds after backcrossing. The plants from 7th passage were male and female fertile and produced seed capsules after self-pollination. Average about 30 % of their pollen was stainable. The difference in pollen viability among the plants was quite large reaching 95 % in some of them. The regenerants were mixoploid, with 2n = 51-54.

3.4. N. tabacum (2n =48) x N. sanderae (2n=18)

Nicotiana sanderae Hort belongs to the section *Alatae* [Kostoff (1943)]. It results from natural hybridization between *N. alata* and *N. forgetiana.* Small amounts of underdeveloped seeds were obtained after crossing the cultivated species *N. tabacum* (line 329) with the wild species *N. sanderae.* They germinated moderately, but the seedlings perished at cotyledon stage. When F_0 seeds were placed on MS agar medium with supplements, after 20-30 days green seedlings appeared. Stabilized in this way F_1 plants reached florescence (Fig. 6). With their straight, non-branched stems and slightly curled leaves the hybrids obtained resembled *N. tabacum*, while their flower in size (flower tube 4.5-5 cm, corolla diameter 4.5-5 cm), fragrance and violet colour were close to *N. sanderae* (Fig.7). Stamens were morphologically normal but contained completely sterile pollen. Meiosis of the F_1 hybrids was very irregular with few multivalents and many scattered univalentes during methaphase I and II, and chromosome bridges and laggards at anaphase I and II. Abnormalities amounted to 96.7% at metaphase I, 95.8% at anaphase I, 95.0% at metaphase II and 93.6% at anaphase II. A high frequency of disturbances, 95.4 % predominantly dyads and pentads, was found at tetrad stage. Most microspores had micronuclei. Such anomalies are common for crosses between genetically remote species with unbalanced chromosome composition. Disturbances in the female gametophyte of this cross also occurred as the pollination of F_1 hybrids with several *N. tabacum* cultivars did not result in fruit capsules.

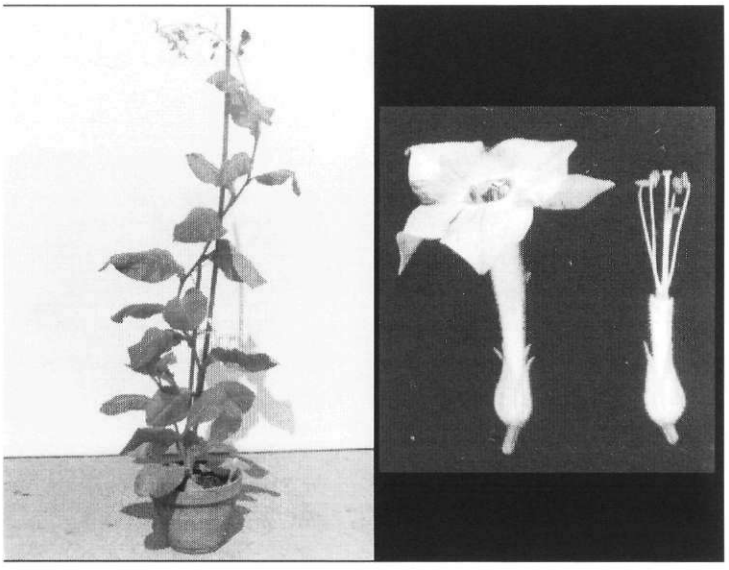

***Figure 6** (left).* F_1 plant of the cross *N. tabacum x N. sanderae.*
***Figure 7** (right).* Flower of *N. tabacum x N. sanderae* F_1 hybrid.

All *N. tabacum* x *N. sanderae* hybrids were male and female sterile as those, obtained by Ternovsky (1936), Kostoff (1943) and Dulien (1964). In our experiment the tissue culture method was used to overcome the F_1 hybrid sterility. Stem segments from F_1 plants were cultured on MS nutrient medium for callus formation. The morphogenetic potential of the callus was preserved after longer cultivation, combined with an increase in the chromosome number of the regenerants. This phenomenon is probably affected by hormone action as KIN and NAA are known to provoke polyploidization [Reynolds (1987); D'Amato (1978)]. Some of the plants from the 9th passage had 62.5% viable pollen and formed seeded capsules after self-pollination. They were mixoploid with chromosome number 2n = 42-82.

Electrophoretic spectrum of reduced seed storage proteins of the investigated F_1 hybrids and regenerants comprised traits of both parents (Fig. 8).

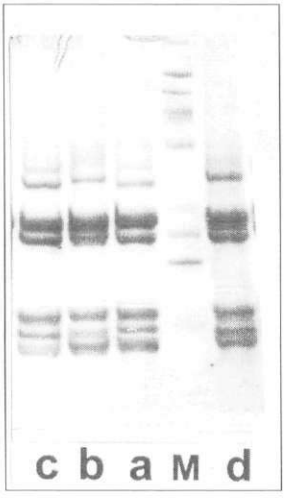

Figure 8. Electrophoregrams of seed storage proteins from: F_1 *N. sylvestris* x *N. tabacum* (a), *N. tabacum* (b), *N. sylvestris* (c), *N. sylvestris* x *N. tabacum* regenerants from 7th passage (d) and molecular mass markers (M): 205.5, 116.0, 97.0, 84.0+66.0, 55.0, 45.0, 36.0, 29.0, 24.0, 20.0, 14.2 (kDa).

This result supports the assumption that F_1 hybrid plants and regenerants carry genes from the wild tobacco species and the cultivars of *N. tabacum.*

Conclusions

F_1 hybrids from the combinations *N. plumbaginifolia* x *N. tabacum*, *N. benthamiana* x *N. tabacum*, *N. sylvestris* x *N. tabacum* and *N. tabacum* x *N. sanderae* were developed through sexual hybridization. Interspecific incompatibility was overcome with application of embryo-culture method. Fertile regenerants from the F_1 hybrids were obtained using in vitro techniques. Electrophoretic spectra of reduced seed storage proteins provided additional evidence for hybrid character of the developed tobacco plants. The attained fertilization of the interspecies hybrids evidence the potential of remote hybridization combined with *in vitro* techniques to enrich tobacco gene pool, which is one of the main requirements for building up of the variety structure of this crop.

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PRELIMINARY DATA REGARDING THE STUDY OF THE WILD PRUNUS SEROTINA EHRH. FRUITS EXTRACT

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Abstract

The aim of this paper is to establish by studies and analysis the content in polyphenolic compounds from the ethanol extract of wild *Prunus serotina fructus* through high performance liquid chromatography. Antioxidant capacity of the soluble lipid compounds, through ACL method, Analytik Jena, Germany, was quantified by comparing with the standard (constructing a calibration curve with TROLOX) and was given in equivalent units of standard. The HPLC analysis of fruits ethanol extract showed the content of polyphenolic compounds: chlorogenic acid, gallic acid and cinnamic acid. The results obtained by HPLC analysis of polyphenolic compounds from the extract, justify the antioxidant capacity research. The study and analyses showed an excellent antioxidant activity due to polyphenolic compounds.

***Keywords*:** wild, *Prunus serotina*, studies and analyses, polyphenols, antioxidant activity.

1. INTRODUCTION

Rosaceae *Prunus serotina* Ehrh. is a cherry species cultivated mainly in North America and in certain parts of Europe (Fig. 1). In Romania it commonly grows in the central area of Moldova region and it was also acclimated in Dobrogea region. The presence of flavonoids complex in the leaves and inflorescences [Olszewska, M., (2005),] and of anthocyans in the the fruits, the study of polyphenols is justified, known for their antioxidant properties. In the scientific literature are known the traditional therapeutic uses of this plant as antitussive, astringent, expectorant, sedative, digestive, tonic, however without clear antioxidant properties [Bühring et. al. (1994), Halliwell et al. (1990), Harman, (1994)].

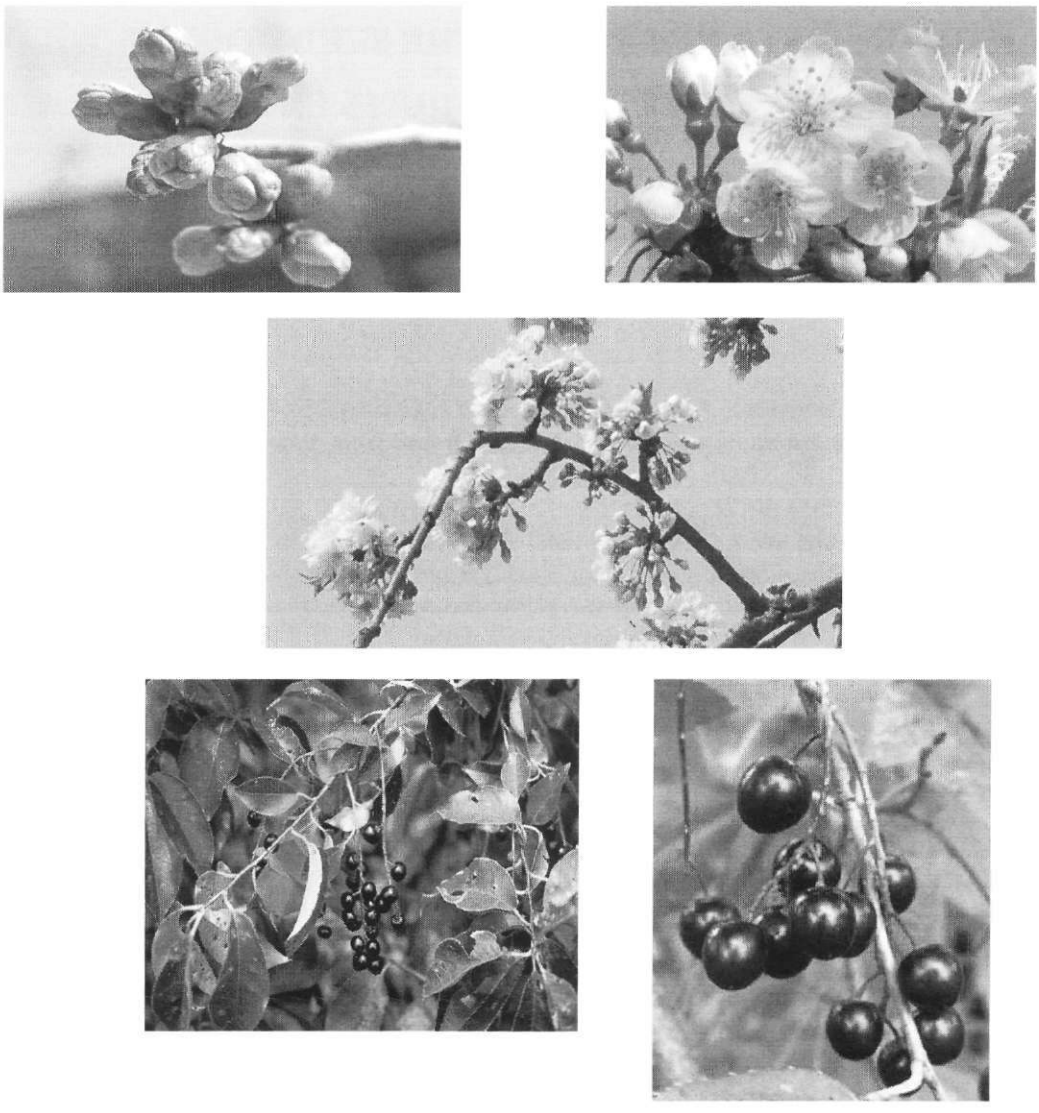

Figure 1. *Prunus serotina*

2. MATERIAL AND METHODS

The vegetal material is represented by the fruits of the species *Prunus serotina* Ehrh., collected from coastal area of Dobrogea region, in June, 2008 and 2009. Species was identified by one of the authors.

For the separation, identification and quantification of polyphenolic compounds a HPLC method, standardized according to USP30-NF25 monograph was adapted. HPLC analysis performance conditions were:

Apparatus: HPLC Agilent 1200, with quaternary pump, DAD, thermostat, degassing system, autosampler.

Performance conditions: chromatographic column type C18, 250 mm × 4.6 mm; 5 µm (Zorbax XDB or equivalent); mobile phase: solution A - 0.1% phosphoric acid, solution B -

acetonitrile, eluted in the gradient (Table 1); temperature: 35°C; flow rate: 1.5 mL/min; detection: UV, λ = 310 nm; injection volume: 20 µl; analysis time: 22 minutes.

Table 1. Work gradient of HPLC analysis

Time, min.	Solution A, mL %	Solution B, mL %
0-13	90	10
13	7	22
13	78	22
14	60	40
17	60	40
17,5	90	10
22	90	10

Preparation of test solution: 32.8 g of fresh vegetable product were extracted with 100 mL ethylic alcohol by maceration for 24 hours. Extractive solution obtained was filtered and the flask was filled up to 100 mL with ethylic alcohol.

Reference substances (solutions in 70% ethylic alcohol): E - resveratrol = 37 mg/ml, Z – resveratrol = 0.22 mg/mL obtained by exposing trans-resveratrol solution to UV, λ = 254 nm, for 12 hours, caffeic acid = 0.36 mg/mL, chlorogenic acid = 0.37 mg/mL, cinnamic acid = 0.58 mg/mL, vanillin = 0.42 mg/mL, gallic acid = 0.39 mg/mL. Reference substances were injected 6 times. Retention times corresponding to the reference substances are given in Table 2. For simplification of determinations mixtures of these were used.

Table 2. Retention times for polyphenolic compounds, reference substances

No. crt.	Phenolic compound	Retention time
1.	trans resveratrol	14,467 ± 0,017*
2.	cis resveratrol	15,751 ± 0,058*
3.	caffeic acid	4,598 ± 0,036*
4.	chlorogenic acid	3,501 ± 0,015*
5.	cinnamic acid	15,867 ± 0,007*
6.	vanillin	6,919 ± 0,051*
7.	gallic acid	0,990 ± 0,025*

* values of standard deviation obtained after statistical processing of the 6 injections

Identification and quantitative determination of active principles in the analysed solution was made by comparing chromatograms of standards mixture (Fig. 2 and 3) and tested solution. Method reproducibility was assessed by square correlation coefficients (Table 3).

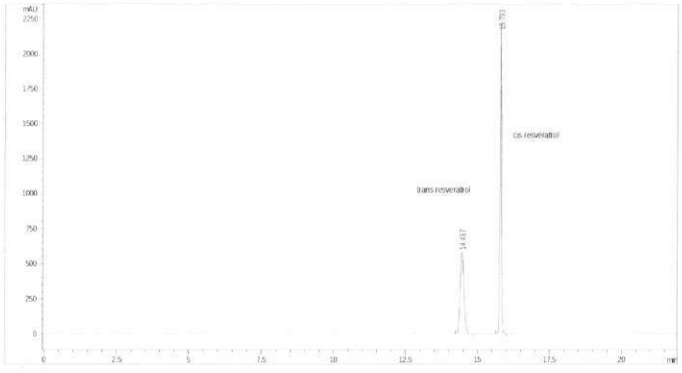

Figure 2. HPLC chromatogram of resveratrol after UV exposure

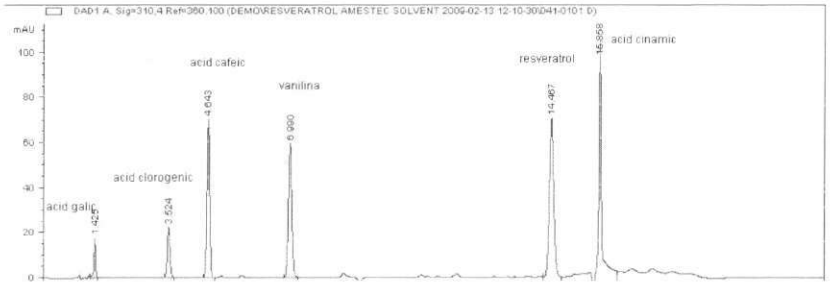

Figure 3. HPLC chromatogram of standards mixture

Table 3. Squared correlation coefficient of calibration curves

No. crt.	Phenolic compound	r^2
1.	trans resveratrol	0.99965
2.	cis resveratrol	0.99729
3.	chlorogenic acid	0.99999
4.	caffeic acid	0.99619
5.	cinnamic acid	0.99845
6.	vanillin	0.99691
7.	gallic acid	0.99537

Evaluation of total antioxidant activity of hydro alcoholic solution of *Prunus serotina fructus* was performed through photo-chemiluminescence, determining the antioxidant capacity in lipid environment (ACL), according to Analytik Jena Germany procedure, using PHOTOCHEM device coupled to a PC.

External light source is mercury lamp coated with phosphor, which ensure maximum power at λ = 351 nm and the source of free radicals is luminol.

Preparation of analyses solution: 32.8 g of fresh vegetable product were extracted with 100 mL ethylic alcohol by maceration for 24 hours. Extractive solution obtained was filtered and 100 mL volumetric flask was filled in to the mark with ethylic alcohol. 1 mL of this solution was then diluted with ethylic alcohol at 10 mL. From this solution were taken samples of 5 µL, 10 µL, 20 µL and 30 µL for analysis.

Antioxidant capacity was quantified by comparison with a Trolox standard (6-hydrohy-2, 5, 7–tetramethylchroman-2 carboxylic acid) with which the calibration curve was drawn. The calibration curve was done by measuring 4 solutions of 0.5, 1, 2, 3 nmol of

Trolox. The signal emitted by free radicals remaining in the sample which did not reacted with antioxidants samples, were measured. This reaction occurs by emission of light quanta that is registered by the detector (photomultiplier). The result is expressed in equivalent units of Trolox [nmol].

3. RESULTS AND DISCUSSION

Following HPLC analysis, were identified and quantified: gallic acid (321.64 mg%) chlorogenic acid (10.60 mg%), cinnamic acid (5.03 mg%) (Fig. 4).

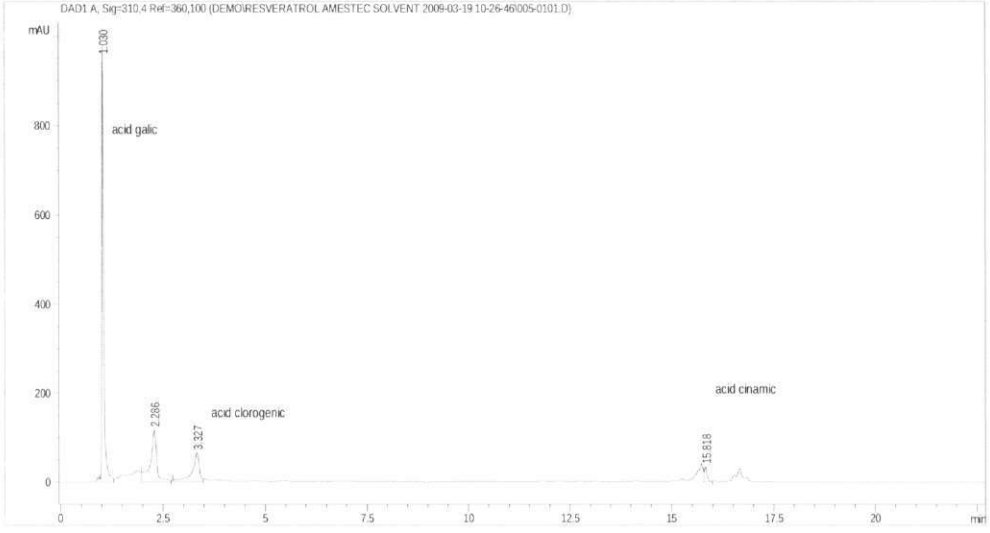

Figure. 4. HPLC chromatogram of polyphenolic compounds in the ethylic alcohol extractive solution of *Prunus serotina fructus*

The antioxidant capacity of ethylic alcohol extract from the fruits of *Prunus serotina* Ehrh. species determined by ACL method, is 2.487 µmol equivalents Trolox g % (Fig. 5).

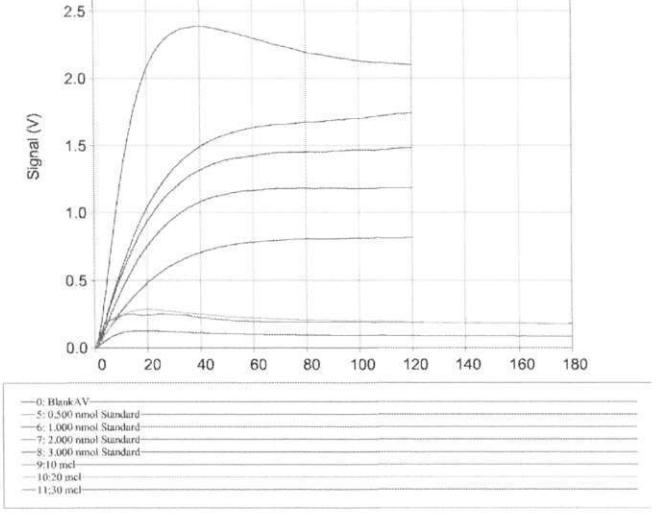

Figure 5. Antioxidant capacity of alcohol extract from the fruits of *Prunus serotina* Ehrh. species

4. CONCLUSIONS

- In the vegetal product *Prunus serotina fructus*, gallic acid, chlorogenic acid and cinnamic acid were identified and quantified.
- The determined antioxidant capacity (2.487 µmole equivalent to Trolox g %) sustain the possibility to use the *Prunus serotina* fruits in therapy due to their antioxidant activity.
- The results obtained from HPLC analysis of polyphenolic compounds extracted from fresh fruits in the study justify research orientation towards the assessment of antioxidant capacity.

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MORPHOLOGICAL AND CYTOGENETICAL ANALYSIS OF THE GENUS *MEDICAGO L.* SECT. *PACHYSPIRAE* IN SOUMMAM VALLEY AND NEIGHBOURHOODS (NORTHEASTERN ALGERIA) WITH AN EMPHASIS ON THE *M. MUREX - M. LESINSII* COMPLEX

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Abstract

The annual Lucernes are often the basis of the floristic compositon of pastures, meadows, fallow lands and disturbed landscapes. Eight wild populations of *Medicago* L. Sect. *Pachyspirae* were analysed for 80 vegetative and floral characters and 41 ripe pod traits. A mulivariate analysis of these morphological data discriminated 4 distinct groups: one group corresponding to the taxon *M. tornata* ssp. *tornata* Var. *tornata* f. *muricata* Urb.; a second group identified as *M. doliata sensu* Lesins & Lesins (1979); a third group interpreted as a complex of three species *M. truncatula-M. littoralis-M. tornata* and a fourth group recognized as the *M. murex-M. lesinsii* complex. Chromosome counts revealed that all the first three groups were with 2n = 16; *M. lesinsii* is with 2n = 16; as to *M. murex*, two cytotypes were revealed, 2n = 14 and 2n = 28. This tetraploid cytotype of 2n = 4x = 28 has never been reported in literature for plants of the genus *Medicago*. In addition, some irregularities of meiosis, such as asynchronous cell divisions, heterochromatic bridges and cytomixis, were observed at low frequencies for this *M. murex–M. lesinsii* complex.

Keywords: *Medicago* Sect. *Pachyspirae*, morphology, numerical taxonomy, cytogenetics, Algeria.

1. INTRODUCTION

Medicago L. is one of the most extensively studied genera of the *Leguminosae*. Some of the perennial species are important crop plants, such as *Medicago sativa* and *Medicago falcata* (known as Lucerne or alfalfa) of the section *Falcago*, which have long been of special interest to botanists (Heyn, 1963).

The genus *Medicago* is native to western Asia and the Mediterranean countries; through many of its annual species, it has become adventitious over wide areas in both the old and the new world (Prosperi *et al.*, 2000).

The first description of *Medicago* was by Linnaeus (1753, *in* Lesins & Lesins, 1979) who described nine species, including several botanical varieties. The first synthesis of *Medicago*, although still relatively incomplete, was by Urban (1872, *in* Lesins & Lesins, 1979). The taxonomy of *Medicago* is complex and has changed several times during the last century. The four most important descriptions have been given by Nègre (1956), Heyn (1963), Lesins & Lesins (1979) and Small & Jomphe (1989).

This genus includes mainly diploid and tetraploid species and three hexaploid taxa (*M. cancellata* M. Bieb., *M. saxatilis* M. Bieb.and *M. citrina* (Font Quer) Greuter). The basic chromosome number is x = 8, or x = 7 for some annual species (Lesins & Lesins, 1979; Gillespie & Mc Comb.1991).

According to the most recent publications (e.g. Small, 1989; Small & Jomphe, 1989; Small, 1990; Small & Brookes, 1990; Gillespie & Mc Comb, 1991 and Abdelkefi & Marrakchi, 2000), the genus *Medicago* contains 87 species of which three are shrubby, 19 herbaceous perennials and 65 herbaceous annuals. These species are classified into 12 sections, with Sect. *Buceras* (Ser.) Small and Sect. *Spirocarpos* Ser. subdivided at their turn into 4 sub-sections.

The Sect. *Pachyspirae* Urban is well delimited from other *Medicago*. The mature coiled fruits of this section are exceptionally hard and develop, during maturation, a spongy tissue on coil faces and spine bases (except in *M. soleirolii*); these features make the group fairly easily identifiable except from some forms of *M. polymorpha* L. and *M. laxispira* Heyn of Sect. *Leptospirae*, distinguishable by other characters. However, the species within Sect. *Pachyspirae* are generally very difficult to identify. In the genus *Medicago*, species are distinguished mostly by pod morphology, and these features can be quite variable in Sect. *Pachyspirae* Urban: in a same species, we can find forms with clockwise and anticlockwise coiling fruits with spiny or spineless coils.

Heyn (1963) placed eight species in the Sect. *Pachyspirae*. On intercrossing *M. soleirolii* with *M. tornata*, seeds were obtained therefore Lesins and Lesins (1979) transferred *M. soleirolii* to the Sect. *Pachyspirae* from the Sect. *Rotatae* Boiss. In 1970, Lesins *et al.* observed two cytotypes, 2n= 16 and 2n=14 chromosomes in *M. murex* Willd. At first, ranks of subspecies were attributed to the two cytotypes, *M. murex* ssp. *murex* for 2n = 16 and *M. murex* ssp. *sphaerocarpos* Bertol. for the 2n = 14. In 1985, small & Brookes raised the two cytotypes to specific ranks under the names of *M. lesinsii* (2n = 16) and *M. murex* (2n = 14). In 1990, Small described from Syria a new species *M. syriaca* , distinguishable from its allies by a combination of characters. In the same year, Small & Brookes separated from *M. rigidula* the Asian populations under the name *M. rigiduloïdes* using several morphological and palynological traits. In 1991, Small & Brookes clarified the taxonomic status of *M. sinskiae* Uljan. to which they attributed a species status. So, up-to-date, Sect. *Pachyspirae* is of thirteen recognized species.

According to Abdelguerfi *et al.* (1988), eight out of thirteen species of Sect. *Pachyspirae* are present in Algeria, but natural populations of this taxonomic group are ecologically and morphologically very polymorphic and difficult to identify.

With the present study, we contribute to assess this taxonomic diversity in The Soummam Valley and neighbourhoods (Near Northeastern Algeria) on the basis of vegetative and floral morphology as well as chromosome numbers counts.

2. MATERIALS AND METHODS

2.1 Morphological analysis

Collect of plant material for analysis was carried out in eight different stations in the Area of study: Bejaia, Tichy, Oued Ghir, Timzrit, Souk Oufella, Chemini and Ighzer Amokrane (Figure 1).

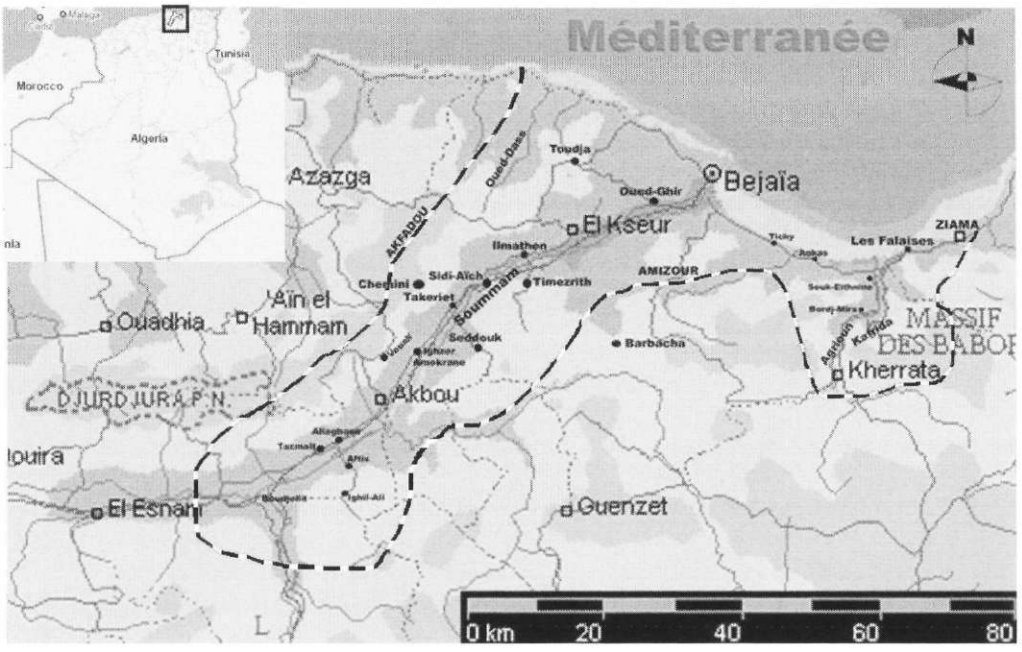

Figure 1. *Map of Near Northeastern Algeria (Encarta, 1997). The area of study is delimited by a discontinuous line (—— —— -).*

In each station, samples of whole plants (with stems, leaves, flowers and young pods) and ripe pods were made.

A total of 396 plants and 735 mature pods were analyzed for 80 characters on stems, leaves, flowers and young pods, and 41 characters of ripe pods.

The morphological data gathered were treated by a multivariate analysis (Principal Components Analysis) using Statistica 5.5.

2.2 Karyological analysis

The karyological study was performed on pollen mother cells in division._Samples of the youngest flower buds (stem apices of plant during flowering period) were collected for each species of the Sect. *Pachyspirae* and fixed *in situ* in Glacial acetic acid- Chloroform-Absolute ethyl alcohol (1:3:6). The samples of flower buds were stained using lacto-propionic orcein prepared according to Dyer (1963).

2.3 Identification and voucher specimens conservation

Plants used in the present study were identified according to Heyn (1963), Lesins & Lesins (1979), Small & Brookes (1985), Small and Jomphe (1989) Abdelguerfi & Guittonneau

(1989) and Gillespie & Mc Comb (1991). Voucher specimens are deposited in the Herbarium of the laboratory of Ecology, Department of Biology of Organisms and Populations, University of Bejaïa (Algeria).

3. RESULTS AND DISCUSSION

3.1 Morphological analysis

Principal Components Analysis (PCA) of morphological data discriminated 4 distinct taxonomic groups (Figure 2):

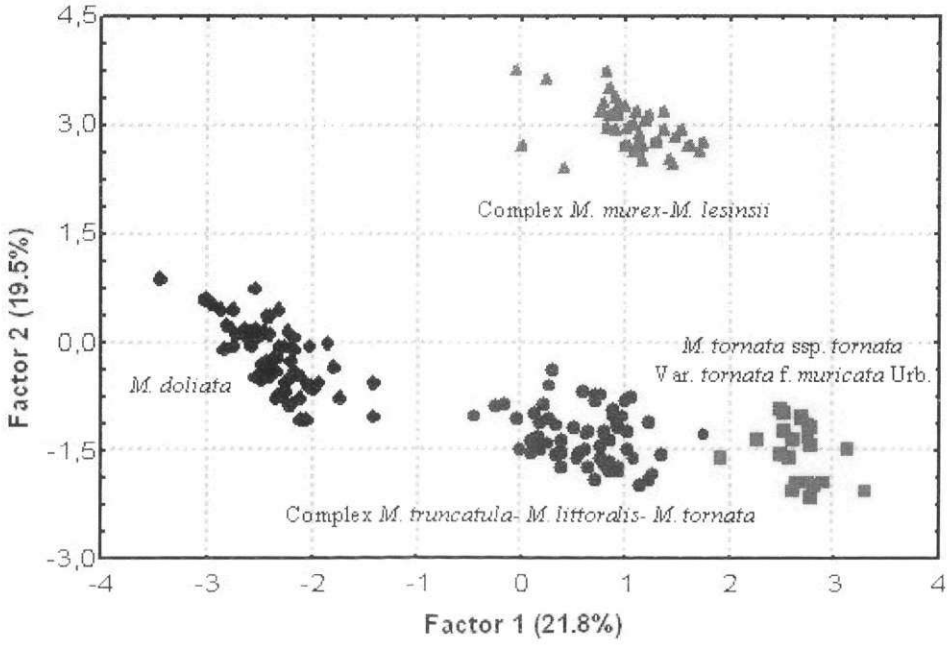

Figure 2. *Principal Components Analysis based on morphological characters (Statistica 5.5, 1997). For each factor, between brackets, are the relative eigenvalues.*

The 4 taxonomic groups discriminated above correspond to:

- *M. tornata* ssp. *tornata* Var. *tornata* f. *muricata* Urb. (Figure 3 a);
- *M. doliata* Carmignani (= *M. aculeata* Gaertn.) (Figure 3 b);
- The complex of three species *M. truncatula-M. littoralis-M. tornata* (Figure 3 e, f, g and h);
- The complex *M. murex-M. lesinsii* (Figure 3 c and d).

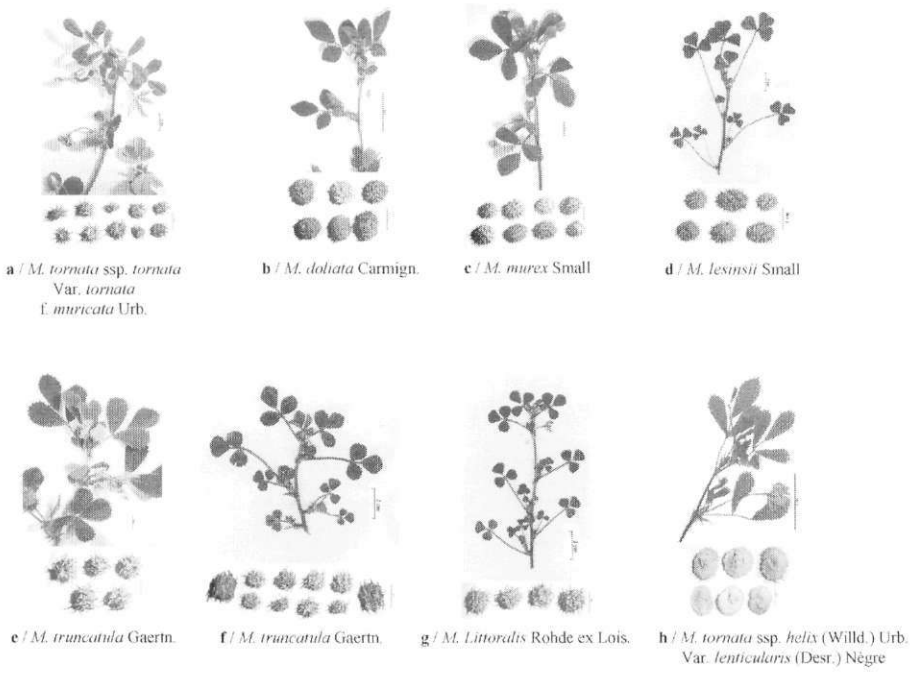

Figure 3. *Morphology of Medicago Sect. Pachyspirae species of The Soummam Valley and neighbourhoods. For each species, are represented a flowered branch and the different pod shapes. M. tornata ssp. helix (h) was not included in the multivariate analysis.*

3.2 Chromosomes counts

All the taxa morphologically descriminated above were with 2n = 2x = 16 except *M. murex* for which two cytotypes were found: A diploid cytotype with 2n = 2x = 14 as already mentioned by other authors, and a new tetraploid cytotype, 2n = 4x = 28, never reported for genus *Medicago* (Figure 4)

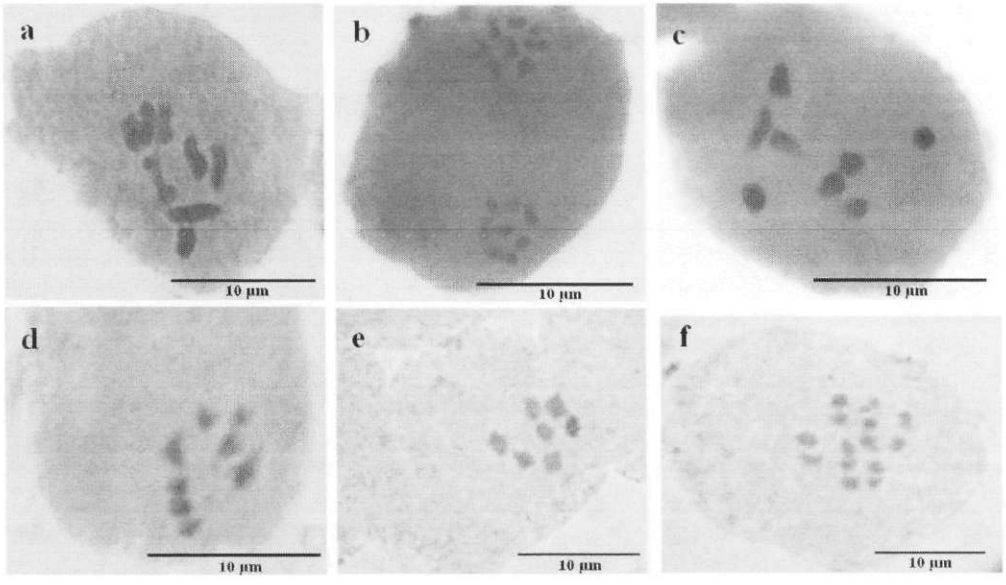

Figure 4. *Meiosis chromosomes in the studied taxa:*
a : M. tornata; b: M. doliata; c: M. truncatula; d: M. lesinsii;
e: M. murex (2n = 14); f: M. murex (2n = 28).
All the cells are in meiosis I except in b (meiosis II)

3.2 Meiosis abnormalities in M. murex- M. lesinsii complex

The study of the meiotic behaviour of the *M. murex- M. lesinsii* complex shows normal progress of meiosis, with only bivalent chromosomes (Fig. 4 d-e), in most of the analyzed cells. In some cases, at very low frequencies, some meiotic irregularities were observed:

- Asynchronous divisions (Figure 5 a): The chromosomes do not reach the metaphase plate, due probably to a mutation affecting of the achromatic spindle checkpoint (Risso-Pascotto and *al.*, 2003).
- Chromatic bridges (Figure 5 b): After their separation, the homologous chromosomes remain connected by chromatic bridges. These bridges, made of heterochromatin, suggest the presence of chromosomal inversions (Elrod and Stansfield, 2003) or unrepaired DNA breaks (Horlow and Doutriaux, 2003).
- Cytomixis (Figure 5 c): It corresponds to migration of chromatin between adjacent mother cells through plasmodesmata. According to Bellucci and *al.* (2003), cytomixis can cause formation of aberrant microspores (triads and pentads) as in Figure 5 d and e.

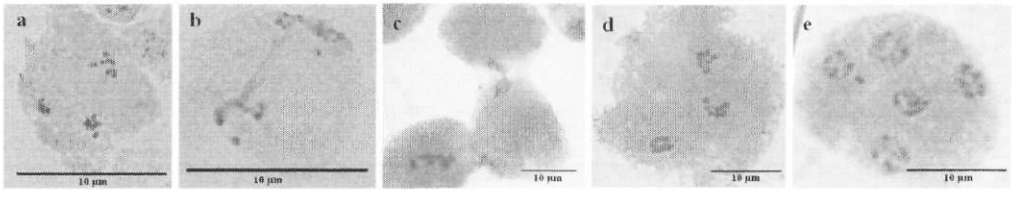

Figure 5. *Meiosis abnormalities observed in M. murex-M. lesinsii complex. a: Asynchronous division; b: chromatic bridges; c: Cytomixis; d: Triad; e: Pentad.*

4. CONCLUSION

The taxa of *Medicago* Sect. *Pachyspirae* encountered in The Soummam Valley and neighbourhoods are *M. tornata* ssp. *tornata* Var. *tornata* f. *muricata* Urb.; *M. tornata* ssp. *helix* (Willd.) Urb. Var. *lenticularis* (Desr.) Nègre; *M. doliata* Carmignani ; *M. truncatula* Gaertner *; M. littoralis Rohde ex Lois.*; *M. lesinsii* Small, and *M. murex* Small.

All these taxa are with 2n = 2x = 16 except *M. murex* for which two cytotypes were found: A diploid cytotype with 2n = 2x = 14, and a new tetraploid cytotype, 2n = 4x = 28, never reported for genus *Medicago*.

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PART V

Botanic Gardens, Reserves and Case Studies for Wild Plants

CONSERVATION OF WILD PLANTS IN EUROPE

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Abstract

Plants are the foundation upon which the rest of our biodiversity depends. Without wild plants the animal kingdom would vanish. Europe's richness in species and natural and semi natural habits is significant with its estimated 2.500 habitat types and 200.000 species of plants and animals. Europe supports over 12.500 vascular plants, 1700 bryophyte species, 2.500 lichens and at least 8.000 macrofungi.

The main factors which lead to the demise of the European flora are habitat destruction, land use changes in agriculture and forestry, direct impact by economic activities, introduction of non native invasive species, climate change and biofuels.

A thorough understanding of the conservation of the European flora is needed. There are different approaches to nature. Nature has utility, intrinsic, aesthetic and healing value.

There are several political and legislative frameworks on global and European level to help strengthening and achieving the conservation of wild plants. Implementation is a big issue. Every government has his own responsibility for the further development and implementation of the resolutions and decisions adopted within the global and European legal frameworks for nature conservation. Conservation actions must be targeted at those plants and plant habitats most in need. Specific measures should be focussed on habitat fragmentation and connectivity, the agriculture and forestry practice and policy, the invasive alien plants, sustainable development, environmental pollution and climate change.

Plant diversity conservation measures depend on the capacity available to deliver them. To be successful co-operation is needed between governments, politicians, regional and local authorities, nature conservationists, scientists, NGO's, volunteers, citizens, representatives in the field of agriculture, forestry, fishery, tourism, environment, infrastructure and health.

Communication is essential for maintaining and enhancing the quality of wild plants and biodiversity. Education is necessary to highlight the importance and plight of wild plants and to try to change human attitudes and behaviour.

Keywords: wild plants, nature conservation, biodiversity, political and legislative frameworks, stakeholders, communication, education.

1. INTRODUCTION

Plants are the foundation upon which the rest of our biodiversity depends.
They cover the land surface of our earth like a fine skin, absorbing the energy of the sun to support the web of life on our planet. Without wild plants, the animal kingdom would vanish. Indeed the life support system of the planet can only be maintained by protecting plant biodiversity. More than 360.000 plants species occur the world (*Algae* 20.000, *Fungi* 60.000, *Bryophyta* 20.000, *Pteridophytha* 10.000, *Gymnospermae* 600, *Angiospermae* 250.000).
The geography and climate of Europe provides a great diversity of habitats for plants from mountain-tops to the coasts and includes species-rich grassland, peatlands and forests.
Europe supports over 12.500 vascular plants (flowering plants, conifers and ferns; excluding the vast flora of Turkey), 1.700 bryophyte species, 2.500 lichens, at least 8.000 macro-fungi.

Europe's richness in natural and semi natural habitats is significant with its estimated 2500 habitat types. The flora of Europe is one of the best known in the world, although even here our knowledge of the total biodiversity resource is incomplete. The European plants are now being considered among the most threatened in the world: 21 % of the European vascular plant species are classified as threatened according to IUCN, 50 % of Europe's 4.700 vascular plants endemics are considered to be in danger of extinction, and 64 have already become extinct.

In some European countries more than two third of the existing habitat types are considered endangered. In addition there has been widespread loss through genetic erosion.

2. EUROPE'S BIODIVERSITY IS IN DANGER

The main factors which have led to the demise of the European flora can be summarised as:

Habitat destruction
Habitat fragmentation not only remains one of the greatest challenges to halting the loss of plant diversity but is one whose effects will increase with climate change. In order to combat these effects increasing emphasis needs to be placed on conservation actions that not only secure important plant sites but which also identify the critical factors for providing buffers, connectivity between sites, enlargement and newer concepts such as "zones of opportunity" for restoration. Both in situ and ex situ resources are vital to the successful establishment of corridors and enlargement and restoration of key sites.

Land use changes (intensification of) in agriculture and forestry
Farming accounts for 60% of the land surface of Europe. Modern agriculture practice has proved harmful to nature in general and plant diversity in particular.

There has been a spectacular decline of flowers in arable farmland across the whole of Europe. However, less intensively managed farmland, often using traditional farming practices, is of intrinsic conservation value.

Direct impacts by economic activities (mining, roadconstructions, urbanisation)
In Europe wild plants with commercial value are collected, for example fungi for food, bulbs for horticultural trade and plants for medicinal use. Over 2.000 medicinal and aromatic plant taxa are traded commercially of which two-third are native to Europe.

It is estimated that 90% are still collected from the wild.

Introduction of non-native invasive species
The spread of non native invasive species is recognized as a major threat to plant diversity, habitats and ecosystems, and hence to food production and health.

Climate change
Climate change will effect many aspects of plant conservation in the future. It threatens plants that cannot migrate due to habitat fragmentation as well as those without a sufficiently diverse genetic stock that cannot adapt to the pace of climate change.

Biofuels
All biofuels are sourced from plants and are extracted by a variety of methods. The majority, including bioethanol, biodiesel and cellulosic ethanol, require an increasing amount of land for biofuel crop production.

Although Europe was one of the first regions to address conservation of wild plants, Europe's plant life continues to decline and its conservation is not yet receiving the attention it deserves.
A thorough understanding of the conservation of the European flora is needed.

3. VIEWS ON NATURE

In a multicultural environment nature is approached in different ways. It is our cultural background that often determines our approach to nature.

Non-western cultures
Non-western cultures, for instance, do not make a clear distinction between nature and humans. In such cultures, nature is infused by holiness and has a soul, like us. It is not a separate entity, so it is possible to communicate with nature as with another person.

Asian religions and philosophies
Asian religions and philosophies of life do not strictly separate the natural and supernatural either.
In these religions and philosophies there is no difference between the Creator and his creation.
Man must understand that he carries the divine spark within. This is why Buddha taught us to consider all sentient beings as his own children.

Islam
Islam teaches us that the dominion over the heavens and the earth belongs not to us (but to Allah).
The Koran is full of verses singing his praise and painting the beauty of his creation.
There is a particularly lovely verse referring to the *birds above, spreading their wings and folding them in. None can uphold them except Allah'.*

Christianity
In Christian tradition, however, taking its cue from Greek philosophers, God created man in his image and gave him dominion over the earth and everything that's on it. Nature is there for the benefit of man. This is the human-centred, or anthropocentric view of our relationship to nature. It makes the exploitation of nature our God-given right.

In western thought where man and nature have been strictly separated nature has become degraded.
It has become a theme park, a place for a picnic, a place where you go to relax. A place we ourselves are not responsible for.

We have now arrived at a stage where it is quite legitimate to ask ourselves the following questions:

- Why should we be concerned about nature?
- Why is nature important?
- Why is nature our responsibility?
- What is our relationship to nature?
-

4. FOUR REASONS TO BE CONCERNED ABOUT NATURE

It is my firm belief that we should be concerned about nature. There are four compelling reasons for us to be concerned with nature and use it wisely. In my opinion the four reasons are:

Utility value
The first reason, and the one most easily understood I think, is, we should be concerned because nature has utility value. Nature provides us with goods and services. Like food, water, timber, clothing, medicines. Ecosystems that regulate our climate, purify the air. Without these goods and services we would not be able to survive. It is essential therefore that we manage our natural resources wisely, so we can pass them on to our descendants intact. This calls for good stewardship.

And yet, what we see throughout history, is a ruthless plundering of nature's treasures. 60 percent of our ecosystems have been shown to be under increasing pressure through unwise use. There is overfishing and unbridled logging in tropical rain forests. It is our excessive consumption and greed that is partly to blame for the depletion of natural resources. Consumption therefore, has become a moral issue.

Intrinsic value
The second reason has to do with the intrinsic value of nature. This may sound a bit complicated but what I mean is this. Apart from its amenity value for us, plants and animals, species and ecosystems, all of nature in fact, has a value in and of itself. Each and every species, whatever its size, deserves our respect because it is part of the great cycle of life. This is what our civilisation teaches us. This why nature deserves our care and protection.

Aesthetic value
There is also the aesthetic value of nature: the beauty of nature is a source of inspiration. Think of the painters, sculptors, writers and composers who, from time immemorial, have

found inspiration in nature. Who is not familiar with Beethoven's Pastoral Symphony or the beautiful paintings of Vincent Van Gogh, Pierre August Renoir and Claude Monet?

Healing value

Finally, there is the healing value of nature. Nature may restore our inner peace and balance, which is too often tested in this hectic, globalising world. We can easily get confused, in these times of uncertainty but nature has the power to bring us to our senses again.

5. POLITICAL AND LEGISLATIVE FRAMEWORKS

When we encounter problems, we often seek technological, legal or financial ways to resolve them. Such solutions may go a long way.

Conservation actions will involve a mix of policy and legislative mechanisms as well as specific measures to be undertaken on the ground. It is recognised that plants have been neglected in nature conservation. There are several political and legislative frameworks on global and European level to help strengthening and achieving the conservation and the sustainable use of plants in Europe.

Some political and legislative frameworks are:

* *Convention on Biological Diversity* (CBD, 1992) adopted in May 1992, is one of the global frameworks (more than 190 parties).
  Biodiversity includes diversity within (all) species, between species and/or ecosystems. The objectives of the CBD are the conservation of biological diversity, the sustainable use of its components and the equitable sharing of benefits arising from the use of genetic resources.

  At the 6th Conference of Parties to the Convention on Biological Diversity the Conference of Parties decides to consider the establishment of a Global Strategy for Plant Conservation;
* *The Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture* (FAO, 1996);
* *The Convention on International Trade in Endangered Species of Wild Flora and Fauna* (CITES, 1973);
* *The World Heritage Convention* (1972);
* *The Convention on Wetlands of International Importance* (Ramsar Convention, 1971);
* *UNESCO Man and the Biosphere programme* (MAB, 1970);
* *The Convention on the Conservation of European Wildlife and Natural Habitats* (Council of Europe, Bern Convention, 1982);
* *The Pan-European Biological and Landscape Diversity Strategy* (PEBLDS, Council of Europe, 1995), including the development and implementation of the *Pan-European Ecological Network* (PEEN, 1996). Important Plant Areas (IPA) can be a very simple and effective concept to identify best sites for plant conservation within the PEEN and can also be very valuable as a tool for planning and management, at practical and political levels;
* *The European Landscape Convention* (2000);
* *EU-Habitat Directive* (Natura 2000 areas), 1992 (with 27 EU-Member States);
* *The European Strategy for Plant Conservation* (2001 and 2007).

6. PLANTA EUROPA

Planta Europa (the Network of independent organisations, non-governmental and governmental, working together to conserve European wild plants) developed, with the Council of Europe with its 47 Member States, the European Plant Conservation Strategy at the third Planta Europa Conference in Czech Republic (June 2001). This document was adopted by 46 European governments and was seen as an important regional (European) initiative and was seen as a very valuable contribution to halt the destruction of plant diversity in Europe.

In 2007 at the Planta Europa Conference in Cluj-Napoca (Romania) the European Strategy for Plant Conservation was renewed. The European Strategy for Plant Conservation 2008-2014 was again fully adopted by 190 countries at the 9th Conference of the Parties of CBD in Bonn (Germany), May 2008 (and adopted by the parties to the Bern Convention / Council of Europe in December 2008).

We can conclude, there are enough global and European political frameworks, treaties, conventions, strategies, resolutions and recommendations to achieve the conservation of nature and wild plants.

7. IMPLEMENTATION

However, the implementation of all these decisions and duties seems to be very difficult. In fact, every authority will/can/should play his own role and has his own responsibility for the further development and implementation of the resolutions and decisions adopted within the mentioned global and European political frameworks for nature/plant conservation.

8. CO-OPERATION

Whether an organisation's goal is to sell soap powder or to protect valuable natural areas, it cannot reach these goals on its own. Neither government authorities nor NGO's can successfully protect nature on their own. They depend on the co-operation of a wide group of people and organisations, whose actions directly or indirectly affect nature, for instance land owners, visitors to protected areas, hunters, farmers, other government departments, local and regional authorities, foresters, tourism operators, politicians, scientists.

The fact that most of the land that is of value for plant conservation is not owned by conservation organisations means that in almost all cases other groups are involved.

A good co-operation between the national / regional authorities and the stakeholders can be considered as a crucial part of the implementation of the international duties and further development of plant conservation. This means in practice, you have to know which national and regional authority is political responsible for plant conservation and who are the stakeholders.

9. STAKEHOLDERS

In the field of plant conservation there are many stakeholders: stakeholders in the field of nature, agriculture, forestry, science, education, environment, water management, spatial planning, trade, transport, industry, tourism and all other sectors.

Plant conservation has to offer something to the stakeholders in order for them to become engaged in the process. If the stakeholders see their concerns addressed and their interests reflected in the further plant conservation measures, their support will increase.

Finding and exploring areas of common interest for the nature conservation sector and the non conservation stakeholders in the plant conservation process will be the main challenge for the future.

10. COMMUNICATION

Communication is therefore essential for maintaining and enhancing the quality of wild plants and biodiversity. Important is an open and flexible attitude towards the outsite world.

We tend to divide the nature conservation world into insiders and outsiders, into us and them. Insiders are the people that know each other in some way. They have similar perceptions of the world and are therefore more predictable to each other in their reactions and behaviour.

Professional nature conservationists are an inside group. Despite all their personal and professional differences conservationists have lot of common when it comes to the way they see nature. They have their own jargon to communicate with each other. They speak of nature in terms of ecosystems processes, important habitats and red list species.

The majority of people, we as conservationists communicate with, are outsiders to us. We may think we understand them and know why they do what they do, but we may just be thinking in stereotypes or prejudices. Hunters, foresters and farmers etc also have their own language, their own ways of doing things and their own way of looking at nature. This can be a major barrier to communication.

Communication problems are guaranteed if we as nature conservationists think of communication with outsider groups as explaining the "truth" to them, or even worse as "educating" (dictating) them.

Sometimes nature conservationists tend to believe that they as nature experts know the truth and have the only correct view of nature and nature conservation. The others will immediately feel that they are not taken seriously and there is a big chance that they will react in a hostile manner. The fact that other groups have another view of nature does not mean they are wrong.

11. EDUCATION

To conserve wild plants now and in future we need an environmentally-conscious lifestyle.

The choices we make as consumer or citizen, employer or employee, traveller or tourist often have a far greater impact than all legislative measures. If we are talking about the choices we make or environmentally-conscious behaviour we cannot get around education.

Nature education teaches us about our environment. It increases our understanding of the natural world and should appeal to people of all ages and lifestyles. It should spark an interest in nature that affects attitude and behaviour. An understanding of nature may help us to live a more fulfilling life. It may contribute to our sense of well-being and health and lays the foundation for a more environmentally-conscious lifestyle. Nature education is not a luxury. It is badly needed.

The more so, now we find that children are getting more and more alienated from nature.

85 % of our youngsters do not know anything about nature.

A German study, for instance, found that some children in Germany believe all ducks are yellow.

Apparently they have seen more ducks in picture books and cartoons than in real life. The study, which is being repeated, shows that this trend continues. The number of children believing that all ducks are yellow is growing.

We, as adults, should set an example but we don't always do so. Dutch research showed that two-thirds of our leisure time is spent on media consumption. That is five hours a day. Half the time is spent watching TV (150 minutes a day). The other two-and-a-half hours we spend surfing the web, listening to music, reading, gaming or making telephone calls.

On average adults spend 12 minutes a day being physically active outdoors and 12 minutes on sports.

Children between 6 and 12 years of age divide their time equally between school, play and the media, an average of 3 hours a day. Youngsters between 13 and 19 increasingly copy the behaviour of their elders as they grow up.

The question now is, if youngsters are not set a positive example, how do we teach them about nature and their responsibilities? How do we increase their understanding of nature and get them involved?

If this process of alienation cannot be stopped we will lose all support for future nature policies.

Because as Goethe has it: *what is not fully understood is not possessed*: people only hear what they understand. And if we have lost the sense of wonder that nature gives us, we have lost something fundamental.

Nature education increases our understanding of the natural world but to get a full appreciation of nature I think nature should be experienced. Youngsters should go out and feel what it is like to go into the sea with bare feet, try catching shrimp in all weathers, and hear young squirrels squeak in a hollow tree, list plant species and butterflies. First-hand experience always works best. And we as adults should set the example. Children learn by example. Not by being told what to do.

Let us all make an effort. Let us all work towards a greater understanding of nature. A greater understanding of nature will lead to greater understanding of our dependence on the earth's life support systems.

It is our duty to leave our descendants a better world. It is not only a duty, it is also a great challenge.

ACHIEVING TARGET 5 OF THE GLOBAL STRATEGY FOR PLANT CONSERVATION: PROTECTION OF 50% OF THE MOST IMPORTANT AREAS FOR PLANT DIVERSITY ASSURED

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Abstract

In 2010, the 16 targets of the Global Strategy for Plant Conservation are being reviewed. A contribution to this review is an assessment of progress to date with meeting Target 5, protection of 50% of the most important areas for plant diversity assured. This paper provides examples of progress towards this target from countries across the world, and outlines barriers and solutions being used to address those barriers to meeting this target. The target has been of significant value in Scotland, where it has supported the development of a new approach to increasing ecosystem resilience to environmental and climate change. This approach is used to illustrate Plantlife's delivery of wild plant conservation in changing times and the support provided by the Global Strategy for Plant Conservation in supporting conservation action for wild plants in local areas.

Keywords: Important Plant Areas, ecosystem resilience.

IN-SITU AND EX-SITU CONSERVATION OF VICTORIA'S NATIONALLY THREATENED ORCHIDS: CASE STUDIES

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Abstract

The Australian state of Victoria boasts a very high diversity in temperate terrestrial orchids and approximately 40% of the species are either endemic or now restricted to Victoria. Approximately half of the state's orchids are considered to be in serious decline or threatened with extinction. The Threatened Orchid Recovery Team (TORT) which consists of over 50 organisations was established in 1996 to plan and manage a recovery program to save Victoria's threatened orchids. Methods successfully applied include; ex-situ (sterile) propagation and cultivation, reintroduction to the wild, translocation, pollinator research, habitat management and threat mitigation, mycorrhizal research, collection and storage, microhabitat manipulation, hand pollination, seed collection and storage. This project makes a significant contribution to the protection of Australia's biological diversity and implements biodiversity conservation policies and strategies at a national, state and regional level. The extinction of four Critically Endangered orchid species has been prevented and in 2009, a species thought to be extinct and not seen since 1926 was re-discovered. Reintroduction of ex-situ grown plants has been a particularly successful technique, with some sites (ie. Caladenia cruciformis) displaying a success rate of over 90% survivals and natural pollination occurring at all reintroduction sites, even with species that have had very low natural pollination rates in the past. The project also encourages community involvement in the conservation of threatened orchids and capacity building and education are important components. Training is provided to skill the large volunteer network to assist in all aspects of orchid conservation, including laboratory work and research.

Specific recovery case studies covered included: Sunshine Diuris whose numbers have increased from only 5 wild plants in the mid-1990's to over 800 wild plants as a result of intensive site management and reintroductions. Caladenia hastata which numbered just 10 remaining plants in 1997 and through intensive site management, micro-habitat manipulation, translocation, reintroduction and conducting on-ground surveys has increased to nearly 800 plants across 6 populations and the establishment of two new populations of the beautiful Candy Spider-orchid using the results of pollinator research and reintroduction of ex-situ grown plants.

Keywords: Orchids, conservation, Australia

REGENERATING INDIAN FORESTS THROUGH MICROFINANCE

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Abstract

India has embarked upon a community involvement process to restock the state-owned forests through an Indian version of community forestry called Joint Forest Management (JFM). People's participation is structured through specially established local village level institutions called Village Forest Councils (VFCs).But the success of the Joint Forest Management program lies in the provision of alternative livelihoods to woodcutters and grazers. This article presents how the forest department of a southern state of India devised a potent tool of microfinance promotion by VFCs for weaning those who are dependent on the forest while implementing a Japan Bank for International Cooperation funded 100 Million US $ Joint Forest Management Project.

Each VFC is provided a grant of 12000 US $ for provision of productive loans to the forest dependents. Presently, extending credit is the main financial activity of the VFC. But the term Microfinance has been applied as some VFCs arrange for insurance of members and purchased cattle. The collection, processing and sale of Non Timber Forest Products is also done by the VFCs.A field study was undertaken in 27 program villages in the Tamilnadu state. Recovery and recycling of VFCs' fund were rated on a scale of 0 to 1. Forest protection and regeneration status of each programme village were also rated on a scale of 0 to 1. Data showed that there is a direct correspondence between the microfinance working and the forest protection.

The paper concludes that the success of Joint Forest Management is dependent on and is directly linked to the provision of microfinance to villagers through a people's representative body—the Village Forest Council. The forest department was successful in this unusual task of promoting microfinance even in villages where formal microfinance institutions have failed, which corroborates an earlier finding that microfinance is more workable and successful if it is properly packaged in a locally suitable development program .

Keywords: Joint forest management, microfinance, forest dependents

IMPORTANT PLANT AREAS PROGRAMME PROVIDES FRAMEWORK FOR CONSERVATION IN THE FALKLAND ISLANDS (MALVINAS)

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Abstract

Over 70% of land in the Falkland Islands is privately owned and managed for livestock grazing, primarily by sheep. The Falklands hold five globally threatened, endemic vascular plant species. Important Plant Areas (IPA) are established based on internationally accepted criteria, but carry no legal designation. This designation scheme was investigated for application to the Falkland Islands as a way of addressing issues of land ownership, threatened species and habitat conservation. To qualify as an IPA, a site must hold either significant populations of one or more globally threatened species, a particularly rich example of a given habitat type and/ or a significant proportion of a threatened habitat of global conservation value. To determine whether sites within the Falklands qualified under these parameters, targeted, standardized, geo-referenced population and habitat data were gathered and analyzed in conjunction with data from historical inventories. Key outcomes of the project are the identification of 16 candidate IPAs and the designation of a National Nature Reserve, based on its qualification as an IPA. This is the first NNR to be designated solely on its botanical importance. Data gathered also move two of the globally threatened species to a higher IUCN-threat category. Invasive plant species, livestock grazing and soil erosion are identified as the key factors threatening IPAs and a site-based approach to tackling these is proposed. IPAs have proven effective and valuable to the Falklands by encouraging dialogue with landowners and enabling prioritisation of conservation action to sites with important plant diversity.

Keywords: Important Plant Areas, Falkland Islands, land ownership, threatened species, habitat conservation, red listing

1. INTRODUCTION

The Falkland Islands is a remote archipelago situated in the South Atlantic Ocean roughly 500 km to the northeast of Cape Horn, off the coast of mainland South America. With recent additions to the flora there are now 174 vascular plant species recorded as native to the Islands [Upson in prep]. Fourteen vascular plant species are endemic to the Falklands (8 % of the total flora) and two are near endemics shared with Staten Island (Tierra del Fuego archipelago, Argentina) and South Georgia [Upson (in prep); Broughton & McAdam

(2002a)]. Six endemic species are globally threatened, one near threatened and 22 are currently recorded as nationally threatened, although this list is under review [Upson (in prep); Broughton & McAdam (2002b)]. Small population sizes and restricted ranges of many species found in the Falkland Islands make them particularly vulnerable to change. This is a recognised issue for oceanic island floras worldwide [Caujapé-Castells et al. (2010)].

The Falkland Islands are important biogeographically owing to their position between the Antarctic and South American continent. The Islands contain many species at the eastern and southern limits of their range which are therefore also likely to be at or near the limit of their tolerance for environmental factors. Such plant populations may be genetically or physiologically distinct, further justifying the need to conserve a species throughout its geographical range [Davey et al. (2005); Wigginton (1999); Lesica & Allendorf (1995)]. Therefore, in selecting key sites for the globally threatened species present in the Falklands it is important to identify those areas that are also rich in nationally threatened species.

With over 70% of land in the Falkland Islands privately owned, the fostering of good relationships with individual landowners must form an integral part of any conservation strategy. Important Plant Areas (IPA) are established based on internationally accepted criteria, but carry no legal designation [Anderson (2002)]. This designation scheme has been investigated for application to the Falkland Islands as a way of addressing issues of land ownership, threatened species and habitat conservation. This paper presents the findings of this investigation.

2. METHODOLOGY

2.1 Area of Coverage

The survey data used in the IPA selection process has been gathered from 145 of the 259 ten km grid squares (56 %) covering the Falkland Islands. In terms of actual land area coverage this represents a greater percentage than indicated as many of the un-surveyed grid squares contain islands that are only a few hectares in size.

2.2 Data Collection

The data used in this report have come from the following:

- Data gathered by the Overseas Territories Environmental Programme (OTEP) project FAL 401 (2007-2009) Falkland Island Plant Conservation Project
- Data gathered by Broughton and McAdam (2002)
- Ad hoc field observations reported to Falklands Conservation between 1989 and 2009

Field records have only been used in applying the three IPA criteria where they have been confirmed within the last 20 years. The use of any older records is stated and only used as background information.

2.3 Sites and Site Complexes

Falklands Conservation has taken an inclusive view of what comprises an Important Plant Area so that a 'site' can be either a single population with contiguous habitat within which a given species may spread or a cluster of geographically close populations of target species that share management similarities. For example the scatter of *Plantago moorei* and *Nastanthus falklandicus* populations along the southern coast of the Ten Shillings Bay area of Port Stephens farm. In other cases island boundaries have been used to delineate the IPA site as these boundaries correspond to those for areas of potential spread ('zones of opportunity'). This is again related to the commonality of management practices across a given island owned by a single individual/ organization.

2.4 Applying the Criteria for Selection of IPAs

IPAs were selected based on criteria adapted and developed from those identified in Plantlife International's site selection manual for IPAs in Europe [Anderson (2002)].

2.4.1 Criterion A – threatened species

Criterion A is intended to allow the identification of sites that are crucial to the survival of threatened species of international importance. In its fullest form, a country's Criterion A species list should include information on taxonomy, synonymy, reference floras, legal designation and the biogeographic zones where the species occur. The accepted categories for sites to meet Criterion A are that they include taxa rated with the new IUCN global red listings of CR, EN, VU (Criterion A(i)) or a regional red listing for the same designations (Criterion A(ii)) (Anderson, 2002). As mentioned above, there are six Falkland Island plant species that are threatened at a global level and therefore could be included in IPA site analysis (Table 1). The regional data criterion is not applicable to the Falkland Islands as the programme is at present being implemented purely at a national level in contrast to the European IPA programme.

Table 1: Falkland Islands Criterion A species list. All six species are endemic to the Falkland Islands.

Family	Latin name	International IUCN threat category[1]
Asteraceae	*Erigeron incertus* (d'Urv.) Skottsb.	Vulnerable D1
Asteraceae	*Gamochaeta antarctica* (Hook. f.) Cabrera	Endangered B1 ab(iii)
Asteraceae	*Nassauvia falklandica in ed.* [Upson et al. (in prep)]	Endangered D1
Calyceraceae	*Nastanthus falklandicus* D.M.Moore	Endangered B1 ab(i,ii,iii,v)
Brassicaceae	*Phlebolobium maclovianum* (d'Urv.) O.E. Schulz	Vulnerable D1
Plantaginaceae	*Plantago moorei* Rahn	Endangered B1 ab(i,ii,iii,v)

[1]These categories were submitted for review to the IUCN in 2009, except that for the *Nassauvia falklandica in ed.*

Plantlife recommends that 'all sites known, thought or inferred to contain 5% or more of the national population can be selected, or the 5 'best' sites, whichever is more appropriate' [Anderson (2002)]. This statement is qualified with the acceptance that in exceptional cases,

for example where there are less than 10 sites in the entire country or there are between 5-10 large populations of a species, up to 10 sites can be selected. All populations selected must be viable or it must be possible to return them to viability through conservation measures.

In order to apply Criterion A in the Falkland Islands the '5 best sites' approach was taken where possible. By 'best' in this case it is meant that these sites are known to contain the largest populations of a given species. Where less than five sites are known, all have been included.

2.4.2 Criterion B

A criterion B indicator list was produced however its use for the identification of IPA sites proved difficult to apply in the Falklands owing to the current coarseness of data available for analyses. Criterion B was therefore used as a secondary selection method. For all but one site, IPA boundaries were identified on the basis of Criterion A or C. These criteria set the scale of analyses and allowed potential IPA sites to then be compared in the extent to which they met Criterion B in holding high numbers of endemic, nationally threatened and rare species. This criterion subsequently provided another way of selecting sites from a larger pool and further support for the final list.

More research is needed regarding the scale at which to apply this criterion when sites have not already met other criteria. Clearly the application of the Criterion B indicator list will be most effective for IPA site selection where the reasons for the restriction of a given species to a specific habitat type are linked to factors which promote overall species richness. This is not always the case and at this stage the indicator list only gave a realistic selection for the neutral grassland indicator species, the Spider-flower *Arachnitis quetrihuensis* and Dusen's Moonwort *Botrychium dusenii*. Future analyses on the growing body of community level species composition data for the Falklands should allow a more complete indicator species list to be produced and this Criterion to be more effectively used.

2.4.3 Criterion C

Ultimately the national IPA network should represent the full range of the national Criterion C habitat list [Anderson (2002)]. Application of Criterion C for the Falkland Islands must be considered preliminary at this stage as the threatened habitats list is still being developed and there is only minimal data on area coverage for those included to date. Current satellite imagery of the archipelago would greatly aid in efforts to apply this criterion. Difficulties in gaining a regional perspective further impede attempts to use Criterion C, thus stronger research links between the Falkland Islands and mainland South America are required.

Table 2: Threatened habitats in the Falkland Islands

Broad Habitat type	Threatened Habitat
Acid grassland	Bluegrass grassland
Scrub	Fachine scrub
	Native Boxwood scrub
Coastal grassland	Mainland Tussac
	Bluegrass grassland

Initially mainland Tussac was included as a primary selector of an IPA site where it was possible to identify the sites which together contain roughly 20-60% of the national resource. Upon further consideration, this cannot be classed as a threatened habitat of global concern because the distinction between mainland Tussac and other Tussac stands, such as those on outer islands in the Falklands, is relevant only on a national scale. Mainland Tussac habitat will be considered when selecting sites of national importance at a later stage.

At present, the extent of Bluegrass grassland or *Veronica elliptica* Native Boxwood scrub in South America is unknown, thus it was not possible to assess the threat status of these habitats from a regional perspective. In the absence of such data it is assumed that their threatened status within the Falklands is globally significant. Fachine scrub covers large areas of Tierra del Fuego but is included here owing to the unique associations formed with species endemic to the Falklands.

These lack of data for habitats other than Tussac meant that the current 'best sites' were chosen. 'Best sites' were determined by area coverage of a given habitat and the diversity of criterion B species present, based on currently available data. Sites which included unique associations formed with endemic plant species within the given habitat type were also selected.

2.4.4 Threats to sites

An attempt has been made classify each threat as high, medium or low depending on the risk it poses to the integrity of each IPA site. The procedure for classifying threats is outlined by Anderson (2002). It was not possible to quantify threats such as climate change and genetic erosion and therefore these were not included in the analysis. Despite a range of causes, soil erosion was considered a single factor in the analysis, and a total of 5 partly-quantifiable factors were included in the study. Detailed information was not available for all sites and so this analysis should be considered provisional.

3. RESULTS AND DISCUSSION

3.1 IPA selection

Application of the criteria outlined above, led to the selection of 16 Important Plant Areas (IPAs) across the Falkland Islands (Table 3). Criterion A proved to be the most useful in terms of site selection in the Falkland Islands, with 14 IPAs selected primarily on the basis of this criterion. For *Erigeron incertus* and *Phlebolobium maclovianum*, there are 5 and 4 sites, respectively, that appear to contain the majority of the global population. For *Nastanthus falklandicus*, *Nassauvia falklandica in ed* and *Plantago moorei* there are under 5 sites known for each and so all were selected. For *Gamochaeta antarctica* only one site is currently known to hold viable subpopulations of this species. This project has proved vital in gathering up to date population density and distribution data for criterion A species. These data have enabled candidate IPA boundaries to be identified where previously only presence-absence data for 1 or 10 km grid squares was available.

One IPA was selected solely on the basis of criterion B and one primarily through criterion C. The use of criterion B was in general applied as a secondary procedure once the scale of analyses could be set by Criteria A or C.

Using data gathered throughout this project the Falkland Islands Government and relevant landowner designated Chartres Horse Paddock (West Falkland) as a National Nature Reserve. This was the first instance of an area being designated a National Nature Reserve solely on the basis of its floral diversity, demonstrating the effectiveness of the criteria for identifying IPAs.

Two IPAs are owned by Falklands Conservation and two are owned by the Falkland Islands Government (FIG). All other IPA sites are privately owned. Three sites have also previously been identified as Important Bird Areas [Falklands Conservation (2006)] which offers the possibility of more effective targeting of resources to the benefit of both threatened flora and fauna.

More detailed population and distribution data has allowed a re-appraisal of the global threat criteria of all endemic species [IUCN (2001)]. This has resulted in two species, *Nastanthus falklandicus* and *Plantago moorei*, being moved to higher threat categories [Upson (in prep)].

3.2 Threats to sites

An analysis of threats to plants and habitats across the 16 IPAs has shown that soil erosion and invasive plant species pose a high threat at two and three IPA sites, respectively (Figure 1). Agriculture and recreational off-roading each pose a high threat at one IPA site. Soil erosion and livestock grazing threaten the highest number of sites, with 12 (75 %) and 10 (63 %) IPA sites affected, respectively.

Livestock grazing poses either a medium or low threat to vulnerable plants at all but one of the affected IPAs, indicating that grazing pressure although present on the majority of IPAs is not high in the 'core zones' (areas where the criterion A, B or C species/ habitats occur).

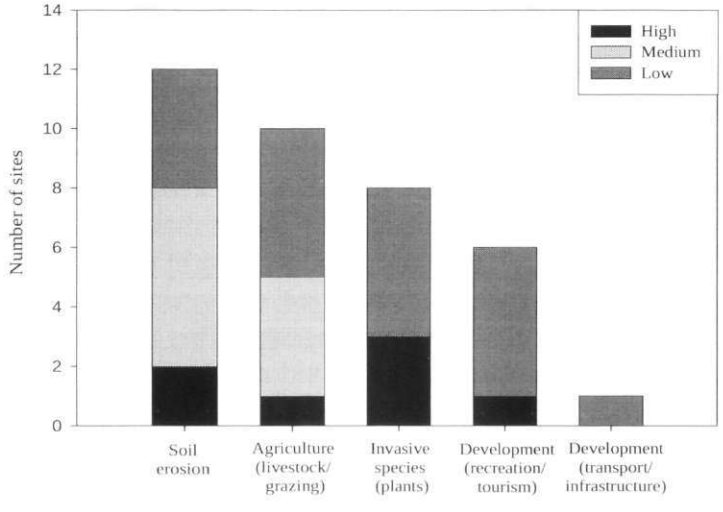

Figure 1: Main threats to Important Plant Areas

Damage caused by vehicles was grouped within the 'development (recreation/ tourism)' category because off-roading for recreational purposes is the primary vehicular threat to habitat quality at several sites. Off-roading poses a high threat to the Cape Pembroke IPA (East Falkland) because of damage to all but the 'core zone' and the increasing effects of erosion across the site as a whole.

4. CONCLUSIONS

IPAs are not a legal designation but are recognised internationally. Key benefits of identifying such sites include more efficient use of time and resources and facilitating more effective dialogue with individual landowners.

It must be remembered that there are also sites of national importance that haven't been included here but which are also important to plant conservation in the Falkland Islands. These are the focus of current field work.

The Important Plant Areas approach has proven to be a major step forward for the conservation of botanical diversity in the Falkland Islands. Work completed to date is already enabling the prioritisation of conservation actions such as the control of invasive plant species, to those sites that are most important from a global perspective.

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PART VI

Wild Plant in Scientific Research and Development

INFLUENCE OF HUMAN ACTIVITY ON FOREST PLANT COMMUNITIES, DURING THE PAST 200 YEARS, IN THE EXAMPLE OF ZIELONKA EXPERIMENTAL FOREST (POLAND)

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Abstract

Based on the analysis of different kinds of 19th century maps and comparison of the species composition of the stand and herb layer in the years 1959 and 2009, the changes in forest ecosystems were investigated. The results show the process of regeneration of oak woods (replaced by man with pine stands), from the stage of *Pino-Quercetum* association to acid oak forest (*Calamagrostio arundinaceae-Quercetum petraeae* association) nowadays. It is possible to draw the conclusion that *Pino-Quercetum* (currently named *Querco roboris-Pinetum*) is only a phase in the development of deciduous forests, at least in the investigated area, but it is not a natural forest plant community, as some authors think.

This paper shows the differences in the stand and herbaceous plant species composition in forests managed by man and the forests excluded from use. The article explains why many formerly oak woods on sandy soils are dominated by pine (*Pinus sylvestris*) in Poland now, and shows that the extension of the lifetime of the pine stand until the age of approximately 170 years, in comparison with the average lifetime of pine stands in Polish timber forests (100-120 years), is a necessary factor for the full regeneration of the acid oak forests.

Keywords: acid oak forest, regeneration

1. INTRODUCTION

Generally, forest diversity in Poland includes 5 groups: coniferous forests, coniferous mixed forests, deciduous mixed forests, deciduous forests and riparian forests. To simplify, in coniferous forests, in lowland parts of Poland, pine (*Pinus sylvestris*) dominates. In coniferous mixed forests pine dominates, with admixture of oaks (*Quercus robur* and *Q. petraea*) or beeches (*Fagus sylvatica*). In deciduous mixed forests pine and deciduous tree species (oak and/or beech) are divided fifty-fifty. In deciduous forests oak and/or beech dominate. Finally, riparian forests are divided into 2 groups: poplar (*Populus sp.*) and willow (*Salix sp.*) shrubs and oak (*Quercus robur*), ash (*Fraxinus excelsior*) and elm (*Ulmus* sp.) forests. In addition Polish forest site types are divided into lowland, upland and mountain subgroups.

This division shows well productivity of forest sites, but sometimes leads to conflicts with the environmental function of forests. This applies particularly to coniferous mixed

forests and deciduous mixed forests, which make up about 40% of total forest area in Poland [Raport (2009)].

In this paper the influence of forest management on diversity and the possibility of regeneration of the forest ecosystem are shown in the example of stands of Zielonka Experimental Forest (University of Life Sciences, Poznań, Poland).

2. THE PROCESS OF DEVELOPMENT OF THE INVESTIGATED STANDS

2.1 Materials and methods

The stands with the phytosociological documentation made by Nowaczyk (1964) were chosen for the research. The description of the stands made by Nowaczyk was compared to the results of investigations from 2001, 2007 and 2010.

The analysis of phytosociological relevés was made according to the Braun-Blanquet approach. Nomenclature of vascular plants follows Flora Europaea.

For the full analysis of collected data maps from the 19th and 20th centuries and other historical sources were used.

2.2 Results and discussion

Coniferous and deciduous mixed forests are mostly sandy sites. The traditional train of thought in such situations is as follows: If the soil is sandy, the proper tree species is pine. If pine at the age of 100 years achieves or can achieve 24 metres of height and if the soil is mesic, such type, for simplicity, is named mesic coniferous mixed forest. In such type, beside pine, oaks or beeches, in different quantitative ratios, can occur too, but we always assumed that in the same site conditions, when the pine achieves 24 m of height, oak achieves no more than 18-19 metres. It depends on the site requirements of oaks, and when the requirements are not met, the growth of oak is limited. Finally it provides some feedback, because making a decision about coniferous mixed forest type indicates the priority role of pine, but simultaneously typical forest management for pine does not allow full development of oaks to be achieved. With reference to the investigated stand, the situation was as below.

Currently the investigated stand is composed of pine about 200 and oak about 90 years old. This means that the beginning of the investigated stand dates back to the first decade of the 19th century and that the pine may have grown alone over 100 years. At this stage the monoculture of pine may have looked like a classic coniferous forest. If it were a typical timber forest it would have been cut when the oak was entered into the lower layer and the next generation of pine would have been planted once again. But fortunately this moment coincided with transfer of the forest area to Poznań University, and the stand was excluded from exploitation.

At the turn of the 1950s and 1960s, Nowaczyk (1964) described the stand and carried out 4 phytosociological relevés (table 1), classifying the plant association as *Pino-Quercetum* and the forest site type as a coniferous mixed mesic forest. Such a plant community is currently termed *Querco roboris-Pinetum*.

The concept of *Querco roboris-Pinetum* was introduced by Matuszkiewicz (1982), who described this association as a "natural oak-pine forest community, on sandy-clay soils, in the mesic and partially humid coniferous mixed forest site type". Subsequently the term *Querco roboris-Pinetum* was very often used in many Polish publications, e.g. Wojterska (ed.) 2001, Wika et al. 2004, Matuszkiewicz J.M. (ed.) 2007, but some authors raised

objections about the content (Pallas 1996) or the name of the association (Brzeg, Wojterska 2001). In addition it is necessary to pay attention to some objections of an ecological nature. If we assume that *Querco roboris-Pinetum* is an oak-pine forest, we must assume that oaks can squeeze pine out step by step from the stand, because oaks regenerate well under a pine canopy, but pine does not regenerate under the crowns of oaks, which depends on the light requirements of both tree species. The investigated stand is here a good example.

Since 1959-1961 the composition and structure of the stand have changed a lot, especially after gales in the 1980s and 1990s, when pines step by step disappeared, but the proportion of oak increased. Nowadays it is mainly an oak stand classified as acid oak forest (*Calamagrostio arundinaceae-Quercetum petraeae* association) and as a deciduous mixed mesic forest as a forest site type. This means that *Querco roboris-Pinetum* was only one of the phases in the process of regeneration of the deciduous forest.

Table 1. Comparison of phytosociological relevés made by Nowaczyk and authors

↑ = new species, ↓ = disappeared species Inv. = invasive species

No. of record		***1***	***1a***	***4***	***4a***	***13***	***13a***	***13b***	***14***	***14a***
No.of forest section		26f		26f		27a			28a	
Date		1960	2010	1961	2010	1959	2010	2010	1959	2001
Age of stand		V		V		VIII			VIII	
Height of tree layer (a1) in m		27		26		30			30	28
Height of tree layer (a2) in m						20			18	24
Cover tree layer (a1) in per cent)		80	80	75	80	75	5	95	70	20
Cover tree layer (a2) in per cent)							70	-		65
Cover tree layer (a3) in per cent)										5
Cover of shrub layer (b) in per cent		40	90	50		<5	-	-	<5	5
Cover of herb layer (c) in per cent		70	1	70		70	60	5	80	80
Cover of moss and lichen layer (d) in per cent		50	<1	60	15	10	-	10	20	20
Area (in sq.m.)		200	400	400	400	400	400	400	300	400
Ch. Cl. Vaccinio-Piceetea,										
Hylocomium splendens	↓	1		+						
Dicranum scoparium	↑				+					
Ch. O. Vaccinio-Piceetalia										
Picea abies a1			1							
Picea abies b		+								
Picea abies c		+								
Vaccinium myrtillus		2		2	1	3	1	+	3	+
Vaccinium vitis-idaea	↓			1		+			1	
Pleurozium Schreberi d	↓	2		3		2			2	
Ch. All. Dicrano-Pinion										
Dicranum undulatum	↓	2								
Pinus silvestris a1		5	4	4	4	3	+		3	2

DS. All.: Dicrano-Pinenion										
Luzula pilosa		1		1		1		+	1	+
Sorbus aucuparia b		1		1						
Sorbus aucuparia c				1	r	+			+	
Ch. Ass. et D. Ass (*) Peucedano-Pinetum										
Chimaphila umbellata	↓	r		r						
Peucedanum oreoselinum (*)	↓					r			+	
Polygonatum odoratum	↓					r			r	
Solidago virgaurea	↓								+	
Ch. Cl. Quercetea robori-petraeae										
Hieracium murorum	↓	1		1						
Quercus petraea a1			1		2					
Quercus petraea a2			1		+	3	4	5	3	4
Quercus petraea a3										1
Quercus petraea b		3		3		+			1	1
Quercus petraea c		1		1		1			1	1
Pteridium aquilinum						1		+	+	
Calamagrostis arundinacea		+			+	2	4	+	2	4
Melampyrum pratense	↓	1		+		+			1	
Pseudoscleropodium purum[d]		2		2	2	1			1	2
Ch. Cl. Querco-Fagetea										
Brachypodium silvaticum	↓					r			r	
Carex digitata							+		r	r
Melica nutans		+		1		+	1		1	+
Poa nemoralis	↑									+
Ch. O. Quercetalia pubescenti-petraeae										
Campanula persicifolia	↓					r				
Ch. All. Potentillo albae-Quercion petraeae et D.Ass. Potentillo albae-Quercetum petraeae (*)										
Potentilla alba	↓								r	
Vicia cassubica	↓			+						
Betonica officinalis (*)	↓					r				
Convallaria maialis (*)	↓					1			1	
Rubus saxatilis	↓					1			2	
Ch. O. Fagetalia sylvaticae										
Atrichum undulatum d						r				+
Dryopteris filix-mas	↑						r			+
Milium effusum	↑						+			
Viola reichenbachiana (=silvestris)	↓	+							1	
Ch. All. Fagetalia sylvaticae										

Fagus sylvatica a3	↑									+
Others										
Achillea millefolium	↓	+		+						
Agrostis vulgaris						+			+	+
Anthoxanthum odoratum	↓	1		1		1		+	1	
Betula pubescens c		r		r						
Betula pendula a1			2		2					
Betula pendula b		1								
Brachythecium curtum [d]	↑		+		1			2		1
Bryum capillare[d]	↓								r	
Campanula rotundifolia	↓			+		+			1	
Carex hirta	↓			+						
Cerastium arvense	↓			r						
Deschampsia caespitosa	↓					r				
Dryopteris carthusiana (=*spinulosa*)			r		r	+		r	+	+
Euphorbia cyparissias	↓	r		+						
Festuca heterophylla	↓	+				1			1	
Festuca ovina		2		2	1	1			1	
Fragaria vesca		1		1		2			2	r
Frangula alnus c	↓			r						
Galium boreae	↓			+		2			2	
Galium mollugo	↓	+				+			+	
Galium rotundifolium	↓					r				
Hieracium pilosella	↓	1		1						
Hypericum perforatum	↓	+								
Hypnum cupressiformae d	↑				+					
Impatiens parviflora	*Inv.*									+
Linaria vulgaris	↓			+					+	
Lupinus polyphyllus	↓			r						
Moehringia trinervia			r		r	1		+	+	+
Mycelis muralis		+				1	+		1	+
Pirola secunda		2		1	1					
Poa pratensis	↓	+		1						
Polytrichum attenuatum d								+	r	
Potentilla erecta	↓					+			+	
Prunus serotina b	*Inv.*		5		4					1
Pyrus communis c	↑									r
Rosa canina	↑							r		
Rubus idaeus c		+		+		+			+	+
Rumex acetosella	↓	2		+						
Senecio silvaticus	↓	r							r	
Silene nutans	↓			r						

Thymus serpyllum	↓			+						
Trifolium alpestre	↓			r						
Urtica dioica	↑									+
Veronica chamaedrys	↓	+		1		1			1	
Veronica officinalis		1		1	r	+			+	
Vicia sepium	↓			+						
Viola canina	↓			1		1			+	
Viola riviniana	↑				+			r		+

2.3 Conclusions

During the last 200 years the process of development of the investigated stands has gone in 2 directions. The stands, whose development runs continuously since the beginning of the 19th century, turned from a pine monoculture phase, through the community described in the literature as Querco roboris-Pinetum, into an acid oak forest (Calamagrostio arundinaceae-Quercetum petraeae). So we can say that in the studied case Querco roboris-Pinetum was only a phase in the development of the stand, but not a sustainable natural plant association, as the literature says. In the place where the stands were cut and pine was replanted, *Pinus sylvestris* dominates again.

As opposed to timber stands, the forests left to natural processes remained resistant to the entry of invasive species, such as black cherry (Prunus serotina) – one of the worst invasive species in Poland. The presence of black cherry in oak forests is slight but under the pine canopy reaches 90 per cent now.

The change of tree species composition, from 1959 to 2010, although quite natural and leading to environmentally positive results, caused a reduction of species in the herbaceous and moss layers, when oaks shaded the forest floor.

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BOTANICAL SURVEY FROM THE ISLAND OF GAVDOS AND THE BIOLOGICAL RESEARCH STATION "ZORA" IN LENTAS (SOUTH CRETE)

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Abstract

The presentation introduces the Biological Research Station "Zora", which is situated in South Crete (Lentas). It is an Austrian initiative which tries to encourage scientific research in Crete.

Mainly it will focus on organizing collaborations of foreign biologists with Greek scientists.

Furthermore, we will provide financial support and guidance in completing a diploma or dissertation thesis and organize ecological excursions for biologists.

OUR STATION IS RUN ON A NON-PROFIT BASIS. BIOLOGISTS FROM ALL COUNTRIES CAN USE THE FACILITIES AND ACCOMMODATION FREE OF CHARGE.

The results of our previous excursions (2008, 2009) showed also a lot of interesting topics where future research is badly needed. For example, one of the most common ant species cannot for sure be identified as Messor meridionalis (ANDRE, 1883). Especially for the insects there is a lot of revision needed.

In plant science, 15 years after the publishing of the "Excursion flora of Crete" (Schönfelder/Jahn 1995) more than 100 additional plant species have been found on Crete and Taxonomy has partly changed. An amended version of the "Flora" needs to be published soon.

Furthermore, first results from a botanical survey on the Island of Gavdos will be presented. The southernmost European island belongs to Crete and contains unique vegetation types also with phytogeographical relationships to North Africa.

Keywords: Key words: Crete, Gavdos, Lentas, Vascular flora, Scientific Research

STATUS AND DISTURBANCES ENDANGERING MANGROVE TREE SPECIES , AT CHUMBAGENI DEEP SEA SHORE IN TANGA MUNICIPALITYS' COAST - TANZANIA

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Abstract

An assessment of tree species was carried out at Chumbageni deep sea shore in Tanga in March, 2008 to assess the mangrove tree species composition, diversity and or dominance, also to identify the disturbances existing in the area. A total of 8 plots were set at an interval of 100m. Trees were measured for their diameter at breast height [preferred at 1.3m above ground], identified for their scientific names and counted for their frequency. Latitude and longitude were recorded using Global Positioning System, and altimeter was used for recording altitude. The observed disturbance was recorded. Index of dominance formula [$C= \sum(ni/N)^2$ was applied to calculate the tree species dominance. A total of 19 tree species were identified including only three mangrove tree species, namely the: Avicennia marina [Mangrove tree], Azadiracchta indica, Carica papaya, Delonix regia, Dicrostachys cinerea, Ficus sur, Leucaena leucocephala, Musa sp., Opuntia vulgaris, Pithecelobium dulce, Rhizophora mucronata [Mangrove tree species], Ricinus comunis, Senna siamea, Sonneratia alba [Mangrove tree], Terminalia catapa, Thevetia peruviana, Ziziphus mucronata. Sonneratia alba was observed to be the most occurring tree species [figure 1], followed by Pithecelobium dulce, Aviccenia marina, Leucaena leucocephala, Rhizophora mucronata, Opuntia ?vulgaris, Musa sp., Thevetia peruviana, Ricinus communis, Senna siamea, Ficus sur, and all the rest got the same dominance index number.

The habitat was mangrove forest. And the identified disturbances were human activities such as cutting for poles, fishing materials, clearing for construction of huts mostly at the edge of bare of mangrove sea shore. Tanzania coastal area habors unique vegetation type which provides enormous amount of materials such as breeding sites for fish, firewood, honey bee fodder

Tanzania has valuable vegetation types which provide a variety of materials including wood and non-wood products ranging from the coast to the inland. The mangrove forests provide materials and services such as, shade, soil erosion protection, shade. To minimize the sea shore rapid degradation among of the recommendations are made that, local knowledge should be followed on how to rescue the coastal vegetation, .collection of various woody materials should be done sustainably, construction of huts or houses close to the sea shore should be discouraged through educating the community, alternative areas for collecting fishing woody materials should be set, environmental friendly income generating like ecotourism should be established and implemented, lastly, more research is needed to document the living organisms found.

1. INTRODUCTION

Mangrove refers to as tropical shrub or tree which grows in salt water swamps in the estuaries of rivers. Mangrove forests cover muddy tidal marshes, lagoons and estuaries (Collin, 2001). In Tanzania, Mangrove is a type of evergreen forests found at the saltwater coastal belt of Indian Ocean, at some river mouths such as Pangani and Rufiji, and consists of *Avicennia marina, Xylocarpus granatum, Rumnitzera racemosa, Heritiera litoralis, Ceriops tagal, Rhizophora mucronata, Sonneratia alba,* and *Bruguiera gymnoryza.*The potentiality of the mangrove forests species is internationally known for provision of materials like poles, firewood (Bryce, 1967). We human beings are fortunate to have diverse regions and a wide variety of our coasts which enable interested naturalists or holiday makers to pick the type of outdoor activity or scenery preferred. Similarly, each of the coastal plants and animals has chosen a habitat with the optimum conditions for its particular its species (Lbke & Moor, 1988). Plants and wild animals cannot choose their habitats as easily as people can do. They are usually restricted to the regions in which they have become adapted.

However, the natural environment of our beautiful coasts has been modified or changed by human activities such as construction or houses, roads, cultivation, cutting of materials for poles, firewood, and timber. This situation has led to change in species composition, diversity and or density.

The objectives of this information is to describe the mangrove tree species composition, diversity and or dominance, and some of the factors endangering the floristic environment at Chumbageni Deep Sea Mangrove Forest, also to highlight the invasion of exotic tree species ratio at the edge of mangrove forest. Trees form a very important part of most natural and artificial landscape. They are remarkable organisms, commanding respect and admiration for their beauty, size, hardness and longevity (Wyk & Wyk, 1997). To study tree diversity and learn about the very special place they occupy in nature and in human culture is an enriching experience.

2. METHODOLOGY AND MATERIALS

Study Area

The study was conducted at Chumbageni Deep Sea shore mangrove forest, an area of about 1km running from the Chumbageni deep Sea port towards north west. It is situated at Tanga municipality at $5^0 15^l$ S and $39^0 15^l$ E , altitude 1- 5m above sea level.

Procedures and data analysis

Eight [8] 15m diameter plots were employed at a distance of 100m from one plot to the next, of which all found tree species with ≥ 5 cm DBH [at 1.3m from ground] were measured and height, identified for their scientific names, counted for their frequency. The disturbances noticed were recorded. The photographs were taken whenever necessary. Also, the species diversity was calculated applying the species dominance formula [$C= \sum(ni/N)^2$], then was computed for each tree species density

Results and discussion

Habitat

The habitat was Disturbed mangrove forest due to mostly human activities such as cutting for poles, fishing materials, clearing for construction of huts mostly at the edge of bare of mangrove sea shore.

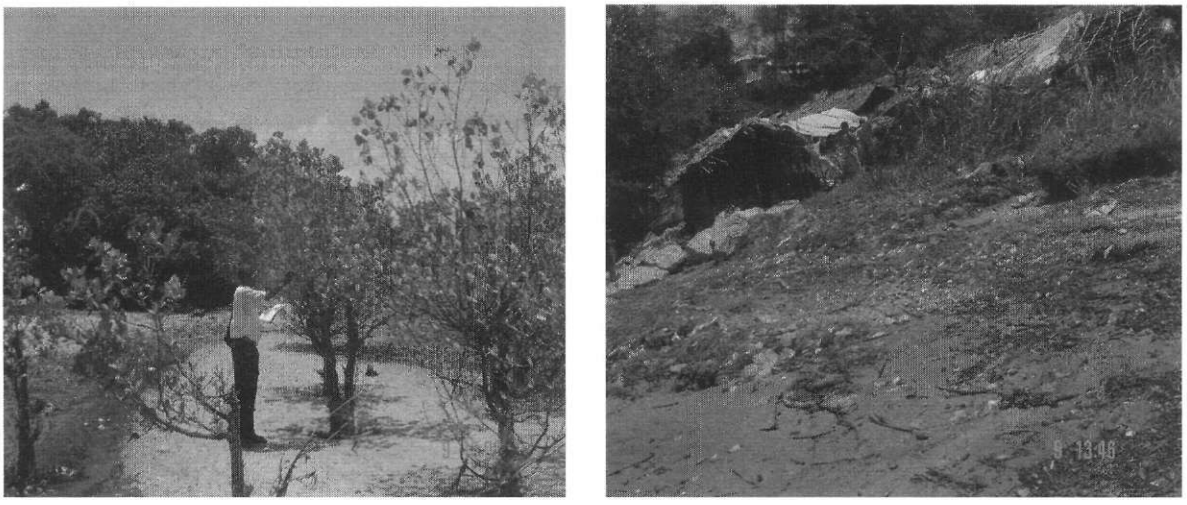

Figure 1: Part of Mangrove forest dominated by *Sonneratia alba*, and the disturbed area of the shore by small Food selling people [bult temporary huts] at Chumbageni Deep Sea Shore.

Tree species composition

A total of 19 tree species were identified including only three mangrove tree species. Namely the species were: *Avicennia marina* [Mangrove tree], *Azadiracchta indica, Carica papaya, Delonix regia, Dicrostachys cinerea, Ficus sur, Leucaena leucocephala, Musa* sp., *Opuntia vulgaris, Pithecelobium dulce, Rhizophora mucronata* [Mangrove tree species], *Ricinus comunis, Senna siamea, Sonneratia alba* [Mangrove tree], *Terminalia catapa, Thevetia peruviana, Ziziphus mucronata.* Sonneratia alba was observed to be the most occurring tree species [refer figure 1], followed by *Pithecelobium dulce, Aviccenia marina, Leucaena leucocephala, Rhizophora mucronata, Opuntia ?vulgaris, Musa* sp., *Thevetia peruviana, Ricinus communis, Senna siamea, Ficus sur*, and all the rest got the same dominance index number or density [refer table 2].

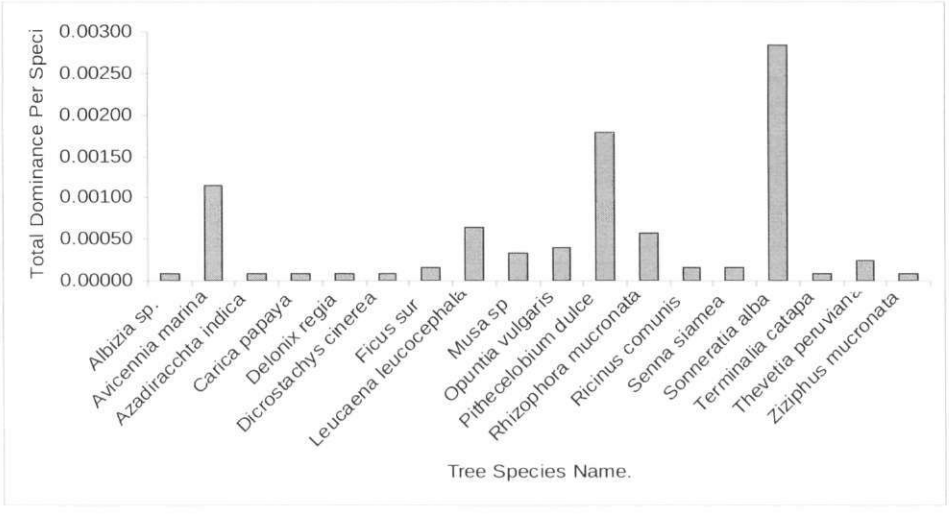

Figure 2: Trees Species and their Total Dominance Disturbances identified at Chumbageni Deep Sea Shore

Among of the identified disturbances were degradation of the area as a result of human activities, which are:

- Extraction of wood materials for repairing the fishing boats, and fishing hook sticks.
- Firewood collection,
- Clearing for small scale farming [growing pawpaws, Cassava, and bananas,
- Introduction of exotic trees which later change the natural environment and spread slowly through the mature seeds such as *Pithecelobium dulce, Senna siamea, Azedarachta indica,*

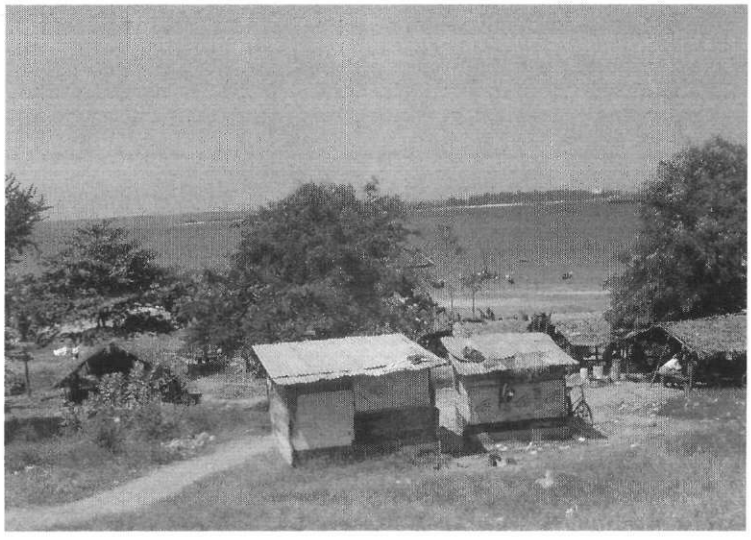

Figure 3: Huts bult at the Shore of Chumbageni Deep Sea Shore [North-West of the Part Offices].

3. CONCLUSION

Tanzania has a valuable vegetation types which provide a variety of materials including wood and non-wood products ranging from the coast to the inland. Also, Tanzania has many plants that produce nectar and pollen that attract honey bees [Ministry of Natural Resources and Tourism, 2004], of which mangrove forests are among of the areas favouring the honey production. Mangrove forests provide goods and services like poles, firewood, medicinal materials, shade, protection of soil erosion at the sea shore, eco-tourism, employment, and also sites or habitats for sea animals breeding. However, the mangrove forests are situated at the environment where other activities such as fishing have to take place too. Including their importance for various purposes directly and indirectly, the mangrove habitat is being degraded at an alarming condition.

Factors endangering the Mangrove forest at Chumbageni deep Sea

- Poverty, which always leads to depends on mangrove materials by the surrounding community,
- Just like in other vegetation types there are the culture and or belief that the forests were created by God and have to be used,
- Regular cutting for poles for building the temporary huts at the sea shore,

Recommendations

- Environmental conservation education should be encouraged regularly.
- More trees should be planted outside Mangrove forest ti minimize pressure on the existing coastal vegetation.
- Construction of houses or huts at the coast should consider the acceptable distance from the sea shore.
- Sea wage systems should be controlled to sustain the sea shore environment.
- More study is encouraged to assess the impact of the human activities taking place in the area to rescue the existing living organisms, and persistence of natural scenery for future generation.
- Introduction of exotic plants should be controlled.

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CONSERVATION OF WILD ALPINE PLANTS OF KANCHENJUNGA CONSERVATION AREA: POTENTIALS AND PROBLEMS OF COMMUNITY-BASED CONSERVATION

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Abstract

The Eastern Himalaya stands out as being one of the globally important sites representing the important hot spots of the South Asia. Kanchenjunga Conservation Area along with its lowlands is floristically rich with over 2000 species of flowering plants of which several are endemic to the Himalaya. The site's biodiversity in combination with the indigenous knowledge and traditional practices provides a great scope for research. The current research, carried out in alpine areas (between 4000m-5350m) of Ghunsa and Simbuwa/Yangma watersheds of KCA in its first expedition (two more expeditions to follow), documented over 300 species of flowering plants including endangered, threatened and endemic plant species viz. Aconitum species, Bergenia species, Dactylorhiza hagagirea, Neopicrorhiza scrophulariiflora, Rheum australe. Important Plant Areas (IPA) for the conservation such plants are delineated. Three human-induced pressures have been identified as overarching threats to the high wild plant diversity of the region, common throughout the study area: overgrazing, wild plant collection and trade, and growing tourism. Community-based conservation strategies to conserve wild alpine plants of KCA in the face of changing global climate are discussed as global climate change may affect alpine environments more immediately and more drastically.

Keywords: wild alpine plants, conservation, Eastern Himalaya, hot spots, community-based conservation

LOCAL RESOURCES FOR FOOD AND INCOME SECURITY: DISTRIBUTION, DIVERSITY, AND ETHNO-BIOLOGICAL VALUE OF WILD EDIBLE FRUIT PLANTS IN EASTERN INDIA

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Abstract

The paper features distribution and exploitation of wild edible fruits and their contribution to rural household's food and income basket in eastern India. An inventory of wild fruit plants growing in forests and farm land across eastern state of Orissa in India was conducted resulting documentation of 56 species of wild fruit plants belonging to 27 families and 40 genera considered edible by 64 indigenous tribal groups and forest fringe dwellers. Interviewing, and observational data on the ethno-pharmacological use of wild fruit plants, and preference and choice of wild fruits for consumption and value added products for sale was investigated. Cultural, economic, ethno-biological significance of plants for 48 species was recorded across different agro-climatic zones. Diversity, distribution assessment study of edible wild fruit plants made over 49 sample plots across five forest zones revealed survival and growth status of the underutilized edible fruit species. 6 wild edible species recorded to be sparse, 5 noted as rare, while 2 observed to be endangered. The extractor's dependence on wild plants for food and income in a subsistence agricultural region was derived from the volume of products traded and collected for consumption. The study brought to fore the need for agro-biodiversity conservation through reforestation measures by identifying promising species for domestication and threatened species of the region.

Keywords: India, ethno-pharmacological use, wild edible fruits, agro-biodiversity.

INVESTIGATIONS IN THE STATUS OF PORTULACA MICROSPECIES AND REEDS IN CRETE

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Abstract

My scientific involvement with Portulaca oleracea (s.l.) started in 1978 when I collected leaves of that plant and soil samples in sodic soils in Nicaragua. I found that the quantity of Na in the plants ash is positively and significantly correlated to that of the soil. I compared small seeds of P. oleracea from Nicaragua and Guatemala and large seeds from California. Finding three ploidy levels (2n=18, 2n=36, 2n=54) in my seed collection we found (Danin et al., 1978) that in fact there are at least 9 taxa in what is regarded as one vegetatively similar cosmopolitan species. Additional six taxa were recognized by their by epidermal cell morphology and size of the seeds. In each of the large islands Tenerife, Crete, Cyprus, Rhodes, and Sicily, a taxon new to science was discovered. We treat this polyploid complex in the way Greuter et al., (1984: p. x) handle complicated complexes during, what seems to be, a long process of investigations. We therefore followed the principle of "microspecies" used by OPTIMA in Med-Checklist. All the microspecies are described and displayed in Danin, Domina & Raimondo (2008). Five microspecies were recorded in Crete after studying 43 populations by seven individuals per population. The microspecies new to science from Crete is Portulaca zaffranii Danin. Additional five taxa in my collection are "waiting" for their turn to be described. When such a study will be done for all continents and as many islands as possible, we may have a better idea concerning the evolution of the polyploidy complex.

Investigations in the reeds identity and distribution in Crete, I found that two species related to Arundo plinii Turra occur here (Danin, 2004). A. plinii is endemic to Bologne area in the Po river valley. Two different independent species were erroneously sunk into synonomy. Hence the two species of that group found in Crete are A. collina Tenore, and A. mediterranea Danin

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PART VII

Wild Plant in Health Science, Cosmetics and Pharmacology

NATURE AS A SOURCE FOR DRUGS AND DRUG DISCOVERY

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Abstract

Throughout the ages, humans exploited nature for their basic needs, for the production of foodstuffs, fragrances, flavors, and, more importantly, medicines. Plants have formed the basis of sophisticated traditional medicine for thousands of years. Natural compounds isolated from plants and microorganisms and their analogues are important tools for investigation of biological processes like cell adhesion, cell migration, signal transduction and cell proliferation. These investigations opened the way for discovery of innovative anti-cancer drugs, immune suppressants, as well as agents for treatment of central nervous diseases etc.

In my lecture I will discuss some historical aspects and I will also present some new developments in the area of natural products-based drug discovery.

***Keywords**:* Natural products, Plants, Drugs, History

NEW ZEALAND NATIVE PLANTS – CAN WE USE THEM AS NATURAL ANTHELMINTHICS?

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Abstract

New Zealand has a large natural pharmacopeia, with its diverse flora comprising over 1900 species of indigenous vascular plants, 1600 of which are endemic. Complimenting this diversity within the Maori culture there is a wealth of traditional knowledge as to the use of plants for human health and for healing. As the first Maori arrived in New Zealand around 1000 years ago, with only dogs and the small Polynesian rat on board their canoes, there is not a strong ethnopharmocological tradition with respect to livestock in New Zealand.

Today there is an increasing interest in organics and mounting pressure from overseas markets to demonstrate responsible systems of production, preferably with low chemical input and minimal environmental impact. Many farmers in New Zealand are also grappling with parasite resistance and an inability to keep stock healthy under intensive systems.

Our project promotes a novel philosophy and approach to agricultural production by searching for native plants with anthelminthic properties which can be grown and browsed on farm. Extracts of 99 species were assayed for likely activity against *Dictyocaulus* the lungworm, 11 species were identified as having some anthelminthic properties. Five species were then tested in red deer infected with a known dose of lungworm.

Not only do native plants with antiparasitic properties boost animal health and production they also provide multiple benefits for animal welfare and environmental management. But most importantly they give farmers an economic incentive to plant or retain native species.

Keywords: antiparasitic, native species, New Zealand, lungworm, red deer

1. INTRODUCTION

Maori probably arrived in New Zealand approximately 1000 years ago, although there is some evidence of an earlier people . They arrived by canoe with dogs, the small Polynesian rat and a range of plant foods. Of those, the cabbage tree (*Cordyline terminalis*), bottle gourd (*Lagenaria siceraria*), sweet potato (*Ipomoea batatis*) and taro (*Colocasia esculenta*) have survived. When James Cook arrived in 1769 he traded cabbages, potatoes and turnips with the indigenes and on a subsequent voyage in 1773 he introduced small numbers of pigs, poultry and two sheep. European settlers and stock followed in increasing numbers and large areas of indigenous bush were cleared for farm land.

The Maori were generally acknowledged to be a healthy race on arrival of the Europeans, Brooker and Cambie quote a Dr Newman commenting in 1879 "From a medical point of view, the Maoris are a singularly uninteresting race."

Within Maori culture there is a wealth of traditional knowledge as to the use of indigenous plants for health and healing. Remedies and medicines deriving from native plants are known as "Rongoa". The medical knowledge, the wisdom and the healing powers of the tribe were held by the tohunga or expert practioner. It seems that the Maori carried few parasites, a review by Andrews records roundworm (*Ascaris lumbricoides*) and threadworm (*Enterobius vermicularis)* as being the two endoparasites of note.

Although there is a wonderfully diverse flora in New Zealand, and a good tradition of herbal medicine there is little in the way of ethnoveterinary practice. Sheep, cattle, goats and then deer were introduced by the early settlers and literature describing any traditional veterinary practice is sparse. There are records of stock poisoning caused by consumption of native species, e.g., in which deaths are attributed to Tutu (*Coriaria species*), Ngaio (*Myoporum laetum*) and bracken (*Pteridium esculentum*) and ill health is attributed to a number of other species.

Today there is an increasing interest in organics and mounting pressure from overseas markets to demonstrate responsible systems of production, preferably with low chemical input and minimal environmental impact. Many farmers in New Zealand are also grappling with parasite resistance and an inability to keep stock healthy under intensive systems. In addition the New Zealand government has ratified international agreements, such as the Convention of Biological Diversity and made high-level statements that commit energy and action to a vision of triple bottom line outcomes in which "economic, social and ecological sustainability must be simultaneously attained". However the details of how to change and the pathways for implementing change are frequently lacking, despite general agreement that improving biodiversity in agricultural landscapes is vital to New Zealand's ecological and economic sustainability. Even with increasing animal health problems, falling stock prices and changing market demands many farmers, facing opportunity costs and no guarantee of ecological or economic benefits, are unwilling to abandon current management strategies. For those who wish to move to lower input farming systems susceptibility of stock to parasites is one of the major barriers which confront them.

Our project promotes a novel philosophy and approach to agricultural production by searching for native plants with anthelminthic properties which can be grown and browsed on farm. Not only does this create an on-farm pharmacy it also provides multiple benefits for animal welfare and environmental management. But most importantly, it gives farmers an economic incentive to plant or retain native species.

In the search for antiparasitics the lungworm (*Dictyocaulus* spp.) was used as a model. Lungworm is the most important parasite of farmed deer in New Zealand and

infections are a major barrier to lower intensity farming methods. Animals infected with lungworm show few symptoms; they may cough but are often simply found dead, their airways filled with nematodes.

Due to the expense involved in animal trials a lungworm assay was developed to screen plants for antiparasitic activity and thus identify candidate species. A literature search revealed few traditional references to antiparasitics amongst New Zealand native plants, however there is a good botanical relationship between South America and New Zealand. A database of all South American plants with anthelminthic properties mentioned in the global literature was constructed and species of plants with a history of anthelminthic usage were cross referenced to find related species in New Zealand. Any plants with known toxicity were removed from the list as were those that were unlikely to either be browsed or recover from browsing. Extracts of 99 species were assayed for likely activity against *Dictyocaulus* species. From the results of the assays five species were chosen for *in vivo* trials in which deer infected with known doses of lungworm were offered the browse.

2. MATERIALS AND METHODS

Larval assays

Extracts of 99 species were assayed for likely activity against *Dictyocaulus* species. An extract of Chicory (*Cichorium intybus*) was also assayed, as it has been suggested Chicory may have anthelminthic properties and it is increasingly included in pasture mixes by farmers in New Zealand.

Ethanol extracts of the plants were prepared, dried and resuspended in Dimethyl suphoxide (DMSO).

The assays were conducted in 48 well tissue culture plates using the method of Johnson and Taylor (submitted). All plates were laid out in the same manner and two extracts were analysed per plate. A concentration gradient from 5% through 0.001% ran from left to right. The control wells each contained 450µl of either water or anthelminthic (Cydectin® Oral Drench for Sheep containing 0.1% Moxidectin) and 50 µl of nematodes suspended in water. On completion of the plating out exercise each assay well contained a total of 500 µl of water, plant extract and nematodes. A dilution series was carried out across the plate so that concentrations of 5%, 1%, 0.01% and 0.001% of the extract were obtained. The dilutions were always done first and then pipetted onto the worms so that the accuracy of the concentrations was always maintained. All tests were performed in triplicate. In addition to the water and anthelminthic dilutions a concentration series of DMSO alone was prepared to provide evidence of any interaction of DMSO with either the larvae or the plant extract.

The numbers of motile larvae and immotile larvae were counted on all plates at specified time periods, within 1 hour of exposure, 24 hours after exposure and 48 hours after exposure. Each plate was studied for a period of 5 seconds and all larvae were counted as motile or immotile in that period. The plate was always read from left to right and top to bottom.

In vivo trials

The five native species listed in Table 1 were selected for *in vivo* trials to assess their anthelminthic potency. A group of animals fed meadow hay acted as controls. Each group of 6 newly weaned, parasite free, red deer was allocated a browse species. Each group was

penned separately indoors and in addition to a diet of hay and deer nuts was given free access to their allocated browse to accustom them to eating it. Browse was fed fresh daily. During this time the deer were trained to walk to individual boxes, consume feed and walk back to their pen. After a period of 29 days when the animals were confirmed as parasite free, moving quietly and easily to the boxes and consuming the browse in their pens they were infected with 2000 lungworm and individual recording began. Browse was no longer offered in the pens, only in the boxes, so that individual intakes could be recorded. Each animal was offered 200g of the allocated browse; the leaves were removed from the twigs in an effort to present each group of animals with a similar feed option. Nineteen days post infection the animals were faecal sampled to test for parasites, they were sampled daily until the end of the trial at day 30 post infection. They were then slaughtered and the number of lungworm present in the lungs counted.

Table 1. Species of New Zealand native browse tested for anthelminthic activity.

Species	**Common name**	**Maori name**
Aristotelia serrata	Wineberry	Mako mako
Carpodetus serratus	Marble leaf	Putaputaweta
Coprosma repens	Coprosma	Taupata
Myrsine australis	Red matipo	Mapou
Weinmannia racemosa	Kamahi	Kamahi
Meadow Hay		

Statistical analysis

Larval assays

The data was analysed using a generalized linear model to binomial proportions with a logit link function, a model was fitted for the proportion of larvae motile after 1 hour on 0%, 0.01%, 0.1% and 5% extract for each of the data blocks. To allow for a possible interaction of DMSO either with the extract or the larvae a further analysis was performed comparing the effect of each plant extract with DMSO alone. The factors modeled were the dilutions and the effect of extract in DMSO vs. DMSO. (Genstat10.2, Lawes Agricultural Trust, Rothamstead)

In vivo trials

An analysis of variance, adjusted for covariates, was used to assess the effects of browse consumption on infection. The data were log transformed prior to analysis and stage of infection (pre infection, pre patency, post patency) and tag number (reflecting an animal's intake of browse) were used as covariates. (Genstat10.2, Lawes Agricultural Trust, Rothamstead)

3. RESULTS

Thirty seven of the 100 plants tested using the lungworm assay indicated a likely anthelminthic activity and 11 showed a consistent advantage over DMSO after 1hours exposure. The species with a consistent anthelminthic activity are listed in Table 2.

Table 2. Species of New Zealand native plants assayed for possible anthelminthic activity against lungworm (*Dictyocaulus* spp.) that are likely to be effective and which showed a consistent activity after larvae had been exposed to an extract for 1 hour. Common and Maori names from Eagles Complete Trees and Shrubs of New Zealand unless otherwise indicated . Note that neither a common nor Maori name may exist for a particular species.

Species	*Common and Maori names*	*Consistently effective after 1 hour*
Aristotelia serrata	Wineberry Mako mako	Yes
Blechnum fluviatile	*Creek fern, kiwikiwi	Yes
Coprosma crassifolia		Yes
Coprosma macrocarpa	Karamu	Yes
Coprosma perpusilla ssp. Subantartica		Yes
Coprosma recurva		Yes
Cortaderia fulvida		Yes
Cortaderia toetoe	Toetoe	Yes
Lophomyrtus obcordata	Rohutu	Yes
Myrsine nummularia	Creeping matipo	Yes
Weinmania racemosa	Kamahi	Yes

*Ferns of New Zealand

In the animal trials Red matipo reduced larval output. There was no significant difference ($p<0.001$) with Marble leaf or Kamahi but the levels of larval output were lower than those in the control group throughout the experiment. The group given *C.repens* showed no difference in larval output initially but larval levels dropped below the controls at the end of the experiment. The animals on the Wineberry diet produced higher levels of larvae than the control group throughout the trial.

When the lungs were dissected fewer immature larvae were found in all the browse groups compared to the control group. Red Matipo had the least followed by Kamahi, Marbleleaf, then *C.repens* and Wineberry. The lungs from animals fed Red matipo contained less mature lungworm than the control group as did Marbleleaf, Kamahi and *C.repens*, Wineberry contained slightly more adults than the control.

4. DISCUSSION

This study has begun the process of searching for plants indigenous to New Zealand that may have anthelminthic properties. It has shown that by a process of literature review, assays and animal trials it is possible to identify candidate species.

The interpretation of the results of any screening assay should be made with great caution. In this study although thirty seven plants showed some activity, the assay is simply an indication of an effect of the extract on a particular nematode species. It is likely, given that these plants have a relationship to other plants with anthelminthic activity, that they will exhibit some antiparasitic effect; however there is also a chance that they won't exhibit activity against a particular parasite. For example, of the thirty three *Coprosma* species tested in this assay only seventeen showed some activity against *Dictyocaulus*. A bioassay such as this is just a tool for tracking promising plants, particularly when the literature is sparse.

There are inherent problems when attempting to test plants *in vitro*, as the extract only contains a portion of the active chemicals likely to be present in the entire plant. The method of extraction, for example polarity, steam, ethanol, will affect the composition of the extract to be tested and the extraction process may disrupt valuable synergies. In addition the distribution or even presence of active chemicals within the edible portions of the plant may change with season or the year.

The assay procedure itself although simple, is subjective. Martin and Le Jambre developed one of the earliest motility assays to investigate the effects of Levamisole and Morantel on *Ostertagia* spp. They observed the motility of third stage larvae at 24 hours and scored them as normal or paralysed . After some discussion as to variable results arising from this test Johansen amongst others reviewed it and noted that a deviation from 24 hours gave very different results in terms of the numbers of motile larvae observed . As the reversion of immotility has been noted by several researchers, the larvae in this assay were observed at three time points, 1hour, 24 hours and 48 hours after exposure to extract and only those plant extracts in which a continual significant depression of motility was noted have been recorded as possibly having an anthelminthic effect.

Whilst the assay was being conducted it was noticed that certain extracts consistently produced unusual effects. The wells containing *Polygonum vaccinifolium, Rumohora adiantiformis* and *Epilobium crassum* turned brown, the larvae in *R. adiantiformis* moved more slowly. The wells with extracts of *Coprosma microcarpa, C. areolata, C. repens, C. obconica, C. acerosa, C.lucida* and *Pseudopanax edgerlei* became gelatinous but only in the case of *C. obconica* were the larvae observed to be moving noticeably slower. *C. robusta* produced a gelatinous green slime, and *C. grandiflora* and *C. acutifolia* an algal like deposit in which the larvae clumped. *Laurelia novae zealandiae* produced thick streaks through the wells and *Hoheria angustifolia* green deposits, which disappeared within 24 hours. The wells containing *Asplenuim polydon* bubbled. It must be presumed that some interaction occurred between the chemical constituents of the wells, the nematode, the air and /or diluents. Given all the evidence it would be expected that an amount of variation in motility and non motility counts would occur but overall if the motility was significantly reduced then a plant is likely to have anthelminthic properties with respect to *Dictyocaulus* spp.

The assay produced some results and provided a starting point, however assays are not conclusive and are probably parasite and plant specific. Githiori quotes a number of papers in which plant activity is reported against one species of parasite but not against another, e.g. *Myrsine africana* fruit may be effective against *Taenia solium* and *Bunostomum trigonocephalum* but have no effect against *Oesophogostomum columbianum.* Equally a species of parasite may be affected by extracts from one plant yet not from another, e.g. *Haemonchus contortus* was unaffected on exposure to *Myrsine africana* leaves but extracts of *Hedera helix* reduced *Haemonchus contortus* burdens in sheep. There is validity in the assay system but attention must always be paid to the model used and its relevance to both the parasite and the host. To achieve a degree of confidence the assay should be repeated for each major parasite and repeated with extracts produced using a number of methods so that the parasite is exposed to the widest range of secondary compounds produced by the particular plant. McGaw surveyed 70 extracts made from 24 plants that are traditionally used as anthelminthics in South Africa and found some potential activity in 25 extracts, of which nine were hexane, nine methanol and seven water. In only one plant species was anthelminthic activity recorded for all three extracts and that activity was weak.

Ideally results from an assay should be evaluated *in vivo* in the specific host animal before any recommendations are made. The *in vivo* trial for the selected plants in this study

was designed to eliminate as many of the confounding elements associated with feed choice experiments as possible. Hence animals were initially housed and settled indoors on a diet of hay and nuts and they were exposed to the allocated browse for a period of time to overcome any possible adjustment problems. By feeding each animal individually it was possible to associate intake with worm burdens. The groups were fed on a rotation so they did not become accustomed to being offered browse at a particular time. Red Matipo was chosen as a trial plant as the assay indicated it may have some effect and the Myrsinaceae have a reputation for efficacy in Africa and India. Matipo proved to be palatable and efficacious. It is also reasonably easy to grow and once established can be browsed.

Wineberry should also have been efficacious but had no effect on burdens of *Dictyocaulus*, in fact the largest number of adult lungworm were recorded from animals fed Wineberry. This result may reflect the changes in secondary compounds that occur throughout the year. Lungworm is largely a parasite which occurs in greatest numbers in autumn; this determined the timing of the trial. Wineberry is one of the few deciduous native plants in New Zealand, during the period of trial the Wineberry leaves were noted to be changing colour and towards the end of the trial fresh foliage was hard to find on occasion.

Marbleleaf had no apparent immobilizing ability in the assay, but had a huge effect on motility. The larvae were observed to move and spin at much faster rate than would be expected for first stage *Dictyocaulus* larvae (Johnson personal observation). Feeding Marbleleaf did reduce the parasite burden, although the result was not significant.

Kamahi and *C. repens* both had some effect on parasite burdens as suggested by the assay. *C. repens* grows very easily and can be kept shrubby by frequent browsing. Kamahi, once established could be pruned or browsed.

Although the principle has been demonstrated, a large number questions still remain e.g. how does an anthelminthic plant work, would an animal require continuous exposure, or just exposure at key points? Does the bioavailability of the different compounds alter over the year, where do they act in the animal, how do they work? Enough exposure must be given for the active ingredients, whatever they may be, to reach sufficient concentrations in the animal and to act. Do they act directly on the parasite; do they act on the gut making the environment uncomfortable for the parasites? They may act indirectly, boosting the immune system so that the host can deal with invading nematodes more effectively.

A large amount of literature has accumulated in recent years about the efficacy of certain herbs and shrubs as anti-parasitics e.g. The use of alternative forages to help control worm burdens and enhance production has been explored in New Zealand but the adoption of forage strategies has not been universal and anecdotally there has been difficulty in maintaining swards containing these species.

Logically if there is difficulty in maintaining pastures containing non indigenous species we should look at introducing native species back into the farm. The advantages are manifold, a broader diet, coupled with increased trace element, anti-oxidant and mineral availability, shade and shelter, feed banks in times of shortage, erosion control, riparian planting and the enhancement of habitat for other native species.

It is likely that a whole system approach will be the most beneficial, in which animals are offered plants with probable health and nutrition benefits, including antiparasitics, routinely as part of their diet and thus native species are routinely included in farm planning. It is possible to incorporate browsable belts which contain therapeutic species in to a farm plan and compliment them with aesthetic or rarer species. Medicinal paddocks or strips can be sown and utilized as required, particularly in times of anticipated challenge or when an immune boost is required. By creating an on farm pharmacy native species are given value

and farmers have an economic incentive to plant them. A management system that enhances both animal health and the local ecology, with the consequent on flow to ecosystem services is simply common sense.

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CRETAN HERBS AND POPULAR MEDICINE: HISTORY AND PERSPECTIVES FOR SUSTAINABLE MANAGEMENT

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Abstract

The island of Crete is a botanical paradise. Studies have shown that the island is among the richest botanical ecosystems in Europe. Because of its geological history, specific climatic conditions and soil quality, there is a high proportion of endemic species (those found only in Crete) in the flora (159 of approximately 1735 species in total). There are many endemic pharmaceutical and aromatic plants including Dittany *Origanum dictamnus* (Dictamnus or Erontas in Greek), the sage *Salvia pomifera* (Faskomilia) Mountain Tea Sideritis *syriaca* (Malotira), Small-leaved Origano *Origanum microphyllum* (Antonaida) and *Thymbra calostachya* (Throumbi). Others like the thyme *Coridothymus capitatus* (Thymari) and Marjoram *Origanum vulgare* (Rigani) have a wider distribution.

Cretan herbs have 4000 years of history. With regard to the pharmaceutical characteristics of Dittany, Aristotelus said that if a hunter hit a wild goat with an arrow and wounded it, the animal would find the herb and eat it, after which the arrow would drop out and the wound would heal without infection.

During excavations in a Minoan palace, archaeologists found a storehouse containing pots with burnt but well-preserved remains of herbs ready for export. The Minoans progressed beyond the simple use of herbs by extracting essential oils where the active ingredients are concentrated. The oldest laboratories for essential oil extraction ever found were discovered at Phaistos and Hamalevri in western Crete. Vases containing residues of cosmetic mixtures consisting of clove oil, dill, beeswax, honey, olive oil and resin were also found, along with jars dedicated to the beauty of Minoan ladies. According to inscriptions found at Knossos, it seems that aromatic essential oils and cosmetics were among the principal exports of ancient Crete along with foods and medicines.

For many centuries, because of a lack of physicians and medicines, herbs have been the basic constituents of different preparations used in popular Cretan medicine to cope with various illnesses and diseases. One example is the so-called 'kefalifi' preparation which contains beeswax, olive oil, mastic and herbs and was used to treat various dermatological problems such as wounds, burns, eczema, skin irritations etc. In addition several villages had famous perfumiers (aromatades) who, after the distillation of the Greek spirit raki was finished, extracted various essential oils from herbs like *Salvia pomifera*, *Origanum* species etc. The perfumiers travelled around selling these 'miraculous' essences using special standard measures and advertising the pharmaceutical virtue of each herb wherever they went. Dittany (Origanum dictamnus) is used as a case study to show the sustainable use of a threatened endemic species.

Keywords: Cretan herbs, essential oils, popular medicine, history, sustainability.

1. INTRODUCTION

In herbal medicine, herbs are all those plants that have some unique property or properties such as fragrance, pharmaceutically active compounds, cosmetic use or dye.

Crete is a botanical paradise. Studies have revealed that the Cretan ecosystem is one of the richest in Europe. The unique climatic conditions and soil quality on Crete have resulted in the presence of a large number of medicinal and aromatic plants.

Because of its geographical history, the Cretan flora contains elements of several phytogeographical areas [Fielding and Turland (2005)]. Former land bridges linking Crete with southwestern Turkey and southern Greece mean that the Cretan flora contains both Asiatic and European species. Other species occur elsewhere only in northern Africa. Crete finally separated from mainland Greece about 5.6 million years ago. At one stage since then Crete was partially submerged, leaving only islands that correspond roughly with the three main mountain areas of the White Mountains (Lefka Ori) in western Crete, Psiloritis (Ida) in central Crete and Thripti in the east. Today these mountain massifs remain 'botanical islands'. The long isolation of Crete and its mountains has led to the evolution of a high level of endemism. The Cretan flora contains about 1735 native species [Turland Chiltern and Press (1993), Fielding, Turland and Mathew (2005)] of which 159 are endemic – 9.2% of the native flora. This wealth is best understood if one considers that Great Britain has about thirty times the land area but fewer native species and very few endemics. Many of the endemic species on Crete are confined to very limited areas and small populations, making those with herbal properties particularly vulnerable to over-collection.

2. HERBS IN MINOAN CRETE

The use of herbs and oils has a history of over 4000 years in Crete. In excavations at the Palace of Archanes a warehouse was found with jars containing charred but well-preserved herbs which were ready for export. The Minoans progressed beyond the simple use of herbs by extracting essential oils where the pharmaceutically active constituents are concentrated. There were laboratories to make perfumes in several Minoan palaces during the 14th and 13th centuries BC. There is evidence of a laboratory to make perfumes and ointments in the royal palace of Kato Zakros (first half of the 15th century BC) where residues were found of ointments together with many utensils of various shapes and sizes. The oldest laboratory for the distillation of essential oils ever found was discovered near Phaistos and Hamalevri in western Crete. It contained pots with residues of mixtures consisting of oil of cloves, dill, beeswax, honey, olive oil and resin which were destined to enhance the beauty of Minoan women. Inscriptions on tablets found at Knossos by Arthur Evans contained references to twelve kinds of resin, seeds and aromatic oils which were derived from the Cretan flora, such as coriander, *Cyperus esculentus*, sage, rock samphire (*Crithmum maritimum*), mastic (the gum obtained from *Pistacia terebinthus*) and 'lidano'or ladan resin (see below). The Minoans used a wider variety of flavours than the Mycenaeans. Besides the above-mentioned plants, they also exploited crocus, lily, iris, myrtle, marjoram, fennel, dill, the flowers and fruits of quince and the resins of quince, cedar, Cretan pine and cypress. It is very probable that Minoans manufactured a special aromatic oil from sage, rose petals and the flowers of spiny broom (aspalathos). The Minoans imported cinnamon, balsam, henna, myrrh and spikenard from Egypt, Lebanon, Syria and Cyprus. They exported raw materials such as cypress wood and many other herbs, and also finished products like olive oil, almond oil, ladan resin,

aromatic oils and ointments. Cretan herbs were well known in Ancient Egypt – they are mentioned in several documents from the 18th and 19th dynasties.

Ladan resin (the common Greek name for the resin since antiquity and which is derived from the Semitic 'ladan ekkrimatodes') was probably the most important plant product of Minoan Crete. It comes from the glandular plants *Cistus creticus ssp. creticus, Cistus incanus, Cistus villosus* and *Cistus ladanifer*. Leaves of all species are covered with glandular trichomes (hairs) that secrete an oleoresin. The Minoans used the resin in incense, in therapeutic ointments, and for colouring their perfumes red. It is likely that most of the resin was exported. The myrrh mentioned in the Bible (Psalm 45:8, Song of Solomon 4:14) is believed to have been a mixture of myrrh and the oleoresin ladan. It was also one of the three gifts the Magi brought to Jesus Christ (Matthew 2:11). Myrrh resin was also used as a stimulant tonic and even today it is used as an antiseptic in mouthwashes as well as to treat sore gums and teeth.

Another very important plant was the Cretan endemic, dittany (*Origanum dictamnus*) which is the flower symbol of Crete. The Greek name Diktamos comes from the word Dikti and means the shrub of Dikte. Other Greek names are Erontas, Stamatochorto, and Attitamos. It was the sacred plant of Artemis Diktynna and its essential oil has a wide range of tonic and stimulant properties. It was used in the manufacture of therapeutic ointments and aromatic wine (Diktamitis wine). Oil of dittany diluted with bergamot oil was offered to the gods, the kings and priests of Minoan Crete and also Mycenae and Pylos from the 15th to 13th centuries BC.

3. FOLK MEDICINE

Over the centuries, due to the lack of doctors and medicines, herbs were the main ingredients in the preparation of a variety of traditional recipes used by the Cretan people to treat the various diseases that afflicted them. Dittany was used to treat a wide variety of problems in younger people and to rejuvenate old people. Chamomile was boiled and used to treat stomach problems. Origano was used to treat stomach ache. Wild artichoke boiled with lemon oil was given at night to regulate bile. Boiled marjoram was used for psychological disorders and heart problems. Sage, collected in May and boiled, was used to treat asthma. Boiled cypress leaves were given to diabetics. The most famous recipe was the beeswax ointment 'Keraloifi', which contained beeswax, olive oil, mastic and herbs and was used to treat various skin problems such as wounds, burns, eczema etc. Another ointment known as God's ointment (Theiafaloifi) was prepared primarily in the west of Crete. It is a mixture of ladan resin made from *Cistus creticus*, hot oil and eggshell. It was used to heal acne and rheumatism.

There is a poem (Sarantavotano or Sarantadendri) that describes forty plant species (or their constituents) that can be used as therapy. These include orange and lemon leaves, lemon and mandarin scent, mountain tea, thyme, basil, sage, winter savory, mint, rosemary, chamomile, antonaida (*Origanum microphyllum)* parsley and celery. Because it was written as a poem, it was easier to memorise and in this way the knowledge about the healing properties of the forty herbs was passed down the generations. If one had a serious illness, all forty plants were boiled in a new unused pot and the resulting liquor poured into a bathtub. The patient then lay in the bath for at least half an hour. The treatment was repeated up to nine times. If the disease was not cured, it was then considered incurable.

There were also 'aromatic sellers' (aromatades) in several villages. After the distillation of the Greek spirit raki was finished, these sellers distilled essential oils from local herbs including various *Salvia* and *Origanum* species. They then travelled on foot around different areas, proclaiming the pharmaceutical properties of each type of essential oil and selling them using a small measuring scoop.

4. DITTANY: A CASE STUDY

In the past, dittany was of special economic importance as it is today. Originally collected from the wild, over-exploitation has caused its decline and even local extinction in some areas. Today the plant is protected by the Bern Convention, but the laws are not easily applicable in remote areas of Crete where there is such a long history of collecting herbs from the wild. It is also believed by many that cultivated material is not as effective as that collected from wild plants. In the past, dittany collectors worked either alone or in groups, going to different areas to ensure a large harvest. They had primitive equipment and little knowledge of climbing techniques. Secured only by a strong rope (goumenos) they 'abseiled' down near-vertical rocks to either harvest shoots, or to remove the whole plant using a pole with a metal fork at the end. In view of the risks involved, in some areas they were known as Erontades ('erontas' meaning love) because they had such a strong passion for collecting dittany that they risked their lives for it. Harvesting takes place when the plant is at the flowering stage, with the first collection at the end of May. The flowering shoots with a few leaves at their base are collected and this process is repeated monthly until August. Folklore reports indicate a collection period after July 20th when Dittany is sufficiently 'oily'. Dittany is said to be so 'angry' at that time of year that even when the air touches it, it spontaneously ignites. This ignition occurs if someone lights a match near it.

The inaccessibility of the plants and the many fatal accidents led the Cretans to begin systematic cultivation of dittany as long ago as 1920 especially near sites of natural populations. In 1923, intensive cultivation began in the villages of Lower Rethymno, Poros and Argyroupoli. Originally it was grown in pots, in cracks in the rocks and in holes in walls etc. Since 1928, cultivation has been extended to other regions of Crete especially in Archanes and Iraklion. A rapid expansion in its cultivation started in 1935 and shortly before the war of 1940 the total production of dry dittany from the area around Iraklion was about 8000 kilos. However, the German occupation forces destroyed the crops and stopped production. Immediately after the end of the war 370 farmers resumed cultivation in the villages near Iraklion and produced about 52 metric tonnes per year from an area of about 50 hectares. Most of the area's inhabitants were involved in the production of Dittany and it was their main source of income. A cooperative of dittany farmers supported by the Agricultural Bank was established in 1956 and in 1964 24 tonnes of dried dittany was exported from the port of Iraklion. However, the cooperative appears to have been weakening since 1982, and in 2009 there were only 130 members. This example does show that despite setbacks, a threatened endemic species can be utilised in a sustainable manner.

Dittany has a wide range of properties. Historically, it was used by the Dioscorides to heal the wounds of soldiers in war. Aphrodite cured Helen using dittany during the Trojan War, and she also used it to ease the pains of childbirth when exiled on Mount Idi (Psiloritis). Aristotle recounts that when goats on Psiloritis were wounded by hunters' arrows, they would chew dittany and rub their wounds with it, after which the arrows would fall out and the wounds would heal without infection. Hippocrates recommended using a patch for problems

of the gall bladder, lungs or general swelling. According to Theophrastus, during childbirth a poultice was applied to the lower abdomen many times per hour of labour to cure dystocia. Now it is used as a concoction to alleviate headaches, neuralgia, stomach and liver ailments and period pains. It is used as a poultice to relieve headaches, wounds and skin inflammations. The essential oil relieves muscular and rheumatic pains, and also skin disorders. Dittany is also used to flavour the liqueur Benedictine. Martini & Rossi, the Italian distillers, also imports several tonnes of dried dittany annually to flavour its vermouth.

5. FOOTNOTE

Much of the information in this article has been obtained by word of mouth from a large number of Cretan people, or from folklore or widely published Ancient Greek sources. In such cases it is therefore not possible to provide specific references.

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BITTER WILD PLANTS FOR NUTRITION AND THERAPY: "PSAKOTARIA" OR POISONOUS WILD PLANTS FROM A NATURALIST'S SURVEY OF THE CRETAN FLORA

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Abstract

"Your medicine is your food; your food is your medicine" said Hippocrates (460-370 BC). Greek rural populations consume more than 80 kind of herbs, notably in Crete, (Cretan macrobiotic diet) for nourishing (feeding) and treatment (prevention and physical self-medication). Previously, herbs, greens and vegetables were all in the same category. Man distinguishes useful (edible and medicinal) or toxic (poisonous or "psakotaria" in Cretan language) wild plants with testing or accidentally.

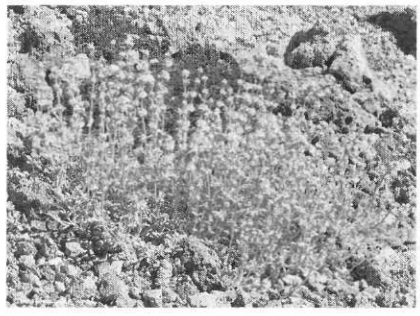
Bitter substances have been used in diet for 5000 years since Minoan period, as in Chinese and Indian traditional healing. Our knowledge of the chemical types of bitter substances is incomplete. Terpenic lactones were identified in families Compositae and bitter Gentianacae such as the Gentiana lutea, which is the bitterest of all. The principal actions of bitter wild plants are to stimulate the secretion of digestive fluids as appetizers, to create a sense of satiety, to detoxify the liver and the body, to help the bile, diuretic and tonic. Important bitter wild plants are: (1) Edible: • Chichorium intypus • Taraxacum officinale • Muscari comosus • Cunara cardunculus • Orospermum picroides • Solanum nigrum, etc. (2) Medicinal: • Berberis cretica • Centaurium eruthrea • Artemisia absinthium • Tamus cretica • Achilea cretica etc.

"Psakotaria" or poisonous plants are wild plants containing specific chemicals (alkaloids, cardioids, essential oils and resins or acids), with harmful action (toxic) to dangerous (fatal) effect for the human body, but useful for protection and survival of the plant. Local populations and animals know and avoid them. Naturalists try to identify them as they are exploited therapeutically by homeopathy. Important poisonous wild plants are: • Colchicum macrophyllum • Conium maculatum • Datura stramonium • Digitalis purpurea • Arum creticum • Aristolochia cretica • Mandragora autumnale etc.

Keywords: Cretan flora, bitter substances, poisonous plants, edible and medicinal plants, detoxification, homeopathy.

1. INTRODUCTION

Due to its favorable climate conditions, Greece presents an extremely rich flora of about 6200 plant species from which 1150 are endemic. Cretan use not only herbs, but also wild plants and the grass of the meadow (HOMER). Cretan people call Herb medicinal wild plants, such as Dittany (Stomachochorto or Origanum dictamnus) and Malotira (Sideritis syriaca) etc.



Cretan flora consists of 1 264 plant species and 198 endemic of which 12 species are threatened with extinction e.g. Origanum dictamum, Anchusa sp. Wild plants of Crete are among the most studied flora in the world (Plinius and Turnefort) [ARISTOTELES - THEOFRASTUS - CAROLUS LINNAEUS - JOSEPH PITTON DE TOURNEFORT]. Variety of wild plants names are kept the same since ancient times, e.g. Aristolochia cretica.

Cretan wild plant species are divided into endemic, floral, culinary, food, and forage, apiarian, aromatic, medicinal and poisonous. During my naturalist research will refer to two types of plants, a) bitter food and medicines for nourishment and healing, b) poisonous - toxic, the "psakotaria" for recognition and avoidance.In folk medicine, a medicinal product is prepared in the old tradition or practical prescription medicine well preserved by monks and nuns in monasteries.

2. WILD BITTER PLANTS OF CRETE

Hippocrates (460-370 BC), a descendant of Asclepius has said: "The medicine is your food, your food is your medicine."

The rural population of Greece is consuming more than 80 herbs, notably in Crete (Cretan macrobiotic diet), for nutrition (feeding) and treatment (prevention and treatment of physical disease). Previously, herbs, greens and vegetables were all in the same category.

By test or accidentally man saw a beneficial (food, remedies) or a toxic (poisonous) effect from wild plants, the latter is called "psakotaria» in Cretan dialect.

Bitter herbs (bitter substances) are used for more than 5,000 years in Minoan, Chinese and Indian traditional healing.

"Everything bitter in the mouth is sweet to the body" (tradition says). Older people consume bitter constituents from roots, vegetables or herbs, but now it has almost disappeared from the modern diet preference (sweet and savory flavors). Wild animals in sickness eat bitter herbs for cleansing the body internally. Our knowledge of the chemical types of bitter substances is incomplete.

We identified terpene, lactones, e.g. laktoukini and laktoupikrini (Chichorium) in families of Compositae and gentianides - gentiopikrini and gentiopikrosidia from Gentianacae. E.g. the Gentiana lutea, the bitterest plant in Crete.

Main activities of wild bitter herbs are:

- the stimulation of the digestive fluids - particularly appetizing effect.
- the enhancement of satiety
- the contribution to burn lipids and reduce calories.
- Mild laxative effect in detoxifying the liver and the body.
- positive action to the bile (liver) and a variety of diuretics and stimulants effects.

The reaction against the bitter substances depends on the temperament of the individual.

Examples of edible wild Cretan bitter plants are:

• Cichorium intypus (compositae) commonly (CL) *Pikroradika in Crete*

Habitat: Wasteland and dry places. Dioscorides used it as a diuretic.
Description: Herbaceous, perennial plant, leaf base and upper lanceolate pinnate, blue flowers (flowering period in July and September).
Active substances: intivine, uses: edible roots, shoots, and gravy. It cleans the liver and it is a stimulant for the bile (Galen, Agapios monk Kris). The root was used as a substitute for coffee.
Related items: Chichorium spinosum and Stamnagathi (sea radish) in Crete.

• Taraxacum officinale (Asteraceae) *Agriomaroulo in Crete*

Habitat: Meadows, description: perennial herbaceous plant, toothed leaves (rosette). Flowers yellow. Flowering time: April-June. Properties: Bitter tonic, diuretic, stimulate the bile and the liver.
Active substances: Laktoupikrini (root and stem latex). Young leaves in spring can be used for detoxification.

• Muscari comosum (Liliaceae) bulbs.

Habitat: Rocky soils and farmland. Properties: very bitter (pink). Dioiskouridis used them on Gout and arthritis as a poultice. Properties: stimulate the bile. Uses: Detoxification for the liver. It is considered as an aphrodisiac when used with honey, vinegar and sesame.

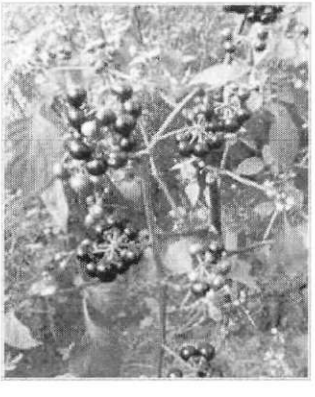
• Cynara cardunculus: (Asteraceae) *Wild artichoke or Agrioaginara in Crete.*

Habitat: Rocky soils
Uses: the edible tender shoots, the leaf stalk and leaves have invigorating properties to the liver.

• Urospermum picroides (Asteraceae). Agriozochos

Habitat: Wasteland, parts and roadside. It differs from Sonchus oleraceus. It is an herbaceous plant with stems upright, up to 50 cm, hairy. Its leaves are oblong with toothed lobes surrounding the shoot and its flowers are yellow.
Uses: The leaves and sprouts are edible with lemon juice and after boiling or makind pies (Chortopittes).

• Solanum nigrum - Solanaceae. Crabbed, *or agriontomatia in Crete*, the nightshade of Dioscorides



Habitat: Cultivated soils and slopes
Contains solanine (toxic alkaloid) in green parts (not the fruit).
Uses: It can be eaten as vegetables after boiling
Democratic therapeutic: analgesic
Homeopathy: Neuromuscular recommendations

Example of common medicinal wild Cretan bitter plants are:

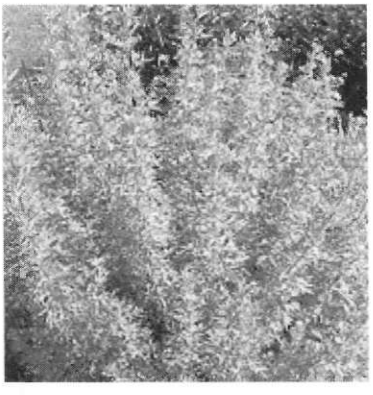
• Berberis cretica (Berberidaceae) or *Ververidou Cretan*

Related species: Berberis vulguris. Berveris common.
Description: Arborescent up to 3 m, with thorny branches, leaves ovate, serrated, flowers yellow, red fruit. Flowering from May to June.
Medicinal used: Peel roots for * Pro-drug (alkaloids)
Uses: In the Middle Ages was used, now abandoned. Homeopathy: using dry root for inflammatory and hepatic

• Centaurium erythrea (Gentianaceae). *Eritrea the cornflowers.*

Habitat: Meadows, uncultivated places, forest glades.
Description: Annual or biennial plant with a height of 50 cm, covered the ground, leaves oval base (rosette). Flowers pink. Flowering in June and August.
Active substances: gentiopikrini and erythrokentafrini
Pro-drug: Leaves and flowers injectors. Properties: tonic, antipyretic and stimulant for the bile.

• Artemisia absinthium (Compositae).

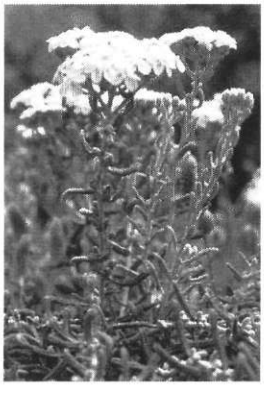


Habitat: Dry soil, roadside.
Description: Perennial herb 50 cm, with silvery foliage, yellow flowers in heads (trusses), flowering in July and August, very aromatic (essential oils).
Active substances: Bitter (absinthin, terpene lactone).
Properties: Bitter tonic stomach but today it is not used much.
Uses: Folk medicine for tonic pulmonary tuberculosis. Hippocrates used it in powder form. The goddess Artemis gave her name to this plant. Absinthe liqueur is toxic to the nervous system, so it is banned in many countries.

• Tamus cretica (Dioscoraceae) *Avronia in Crete*.

Related items: Tamus communis: Bryonia
Habitat: roadside. The fruits (berries) are toxic because they contain diosgenine.
Description: Climbing plant with stems without propellers, heart-shaped leaves, flowers small, open green in May and June.

• Achilea cretica (Compositae). *Achillios Cretan*



Related items: Achilea milefolium (thousand leaves)
Habitat: Rocky, meadows and slopes.
Description: Root perennial herb up to 60 cm, divided leaves, flowers white or pink visor. The plant and its flowers give off a characteristic odor. Flowering time: May - October.
In Greek mythology, Achilles (a pupil of Chiron the Centaur) used it as haemostatic treatment for injuries in the Trojan War (hence the name of the plant).
Pro-drug: the whole plant (excluding roots).
Active substances: bitter achilleini etc.
Properties: Bitter, tonic, appetizer, detoxifying, haemostatic and astringent. Used as injectors for anorexia and indigestion.

3. *POISONOUS CRETAN WILD PLANTS: PSAKOTARIA* *(= POISONOUS PLANTS, IN THE CRETAN DIALECT «PSAKI» MEANS POISON).

In the category of poisonous plants are all plant species that are toxic to humans and animals. They have widely variable toxicities depending on a) The growing period, b) of age, c) the density of the juice, d) part of the plant.

There are species that are toxic raw, which lose their capacity after drying, e.g. the root of the arum manulatum.

The plants are poisonous wild plants containing specific chemicals: alkaloids, glycosides, kardenolidia, bitter substances, essential oils and resins or acids (oxalic acid), toxic elements (Cd, F, Mo, Pb, etc.) with harmful action (toxic) to dangerous (fatal) for the human body.

These substances are certainly useful for protection and survival of the plant. The local populations and wild animals know poisonous plants and avoid them.Work for naturalists is the recognition and public awareness.

Poisonous wild plants are exploited and used therapeutically in homeopathy and phamacology to manufacture medicines and drugs, respectively.

Examples of important Cretan poisonous wild plants:

• Colchicum macrophyllum (Liliaceae). *Colchicums the makrofyllo.*

Habitat: grasslands and mountain areas (shadows and pine oils).
Description: perennial bulb, flowers pink or violet, flowering in August and September.
Uses: homeopathy with bulbs and seeds. In ancient healing was used for gout as a poultice. Avoid use because of toxicity
Active substances: Highly toxic venom (kochlikini - cytostatic)
Congenital type: Colchicum automnale.

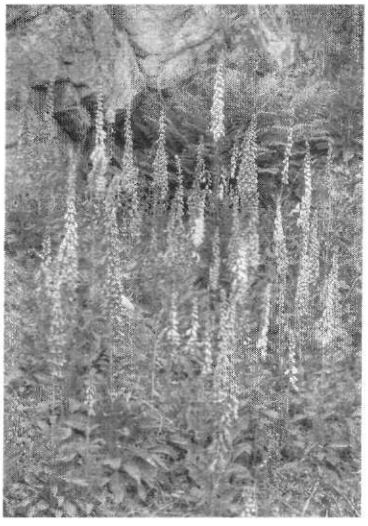
• Conium maculatum (Umbelliferae) *Hemlock spotted the mob.*

Habitat: heaths and roadside. It grows in Southern Europe.
Description: Annual plant height from 0.5 to 2 meters, turns nasty smell in the grating, flowers white (shades), flowering in June and July.
Uses: Poison «Socrates» (hemlock, drink from leaves and seeds) contains coniine (the first plant alkaloid that was composed artificially 1886). It is lethal (10 gr. leaves cause death by paralysis of the nervous system).In ancient and popular treatment used in tumors, swelling and inflammation (poultice equality).
Homeopathy: Arteriosclerosis and prostatic hypertrophy (tincture).

• Datura stramonium (Solanaceae). *Datoura the stramoneios* (Tatoulis)

Habitat: mounds and ruins of houses.
Description: robust annual plant up to 1 meter, giving off an unpleasant smell, characteristics of white flowers tube form, flowering from July to October, prickly fruit. Native of America, popularized in Asia, Europe, Africa. Very poisonous and deadly to animals.
Active substances: alkaloids (yoskiamini, atropine, scopolamine).
Properties: The seeds of the fruit are spasmolytic. The leaves were used as cigarettes for asthma attacks. Its leaves are used also as a tincture against spasmodic cough, chronic bronchitis, etc.

• Digitalis purpurea (Scrofulariaceae). *Digitalis purple.*

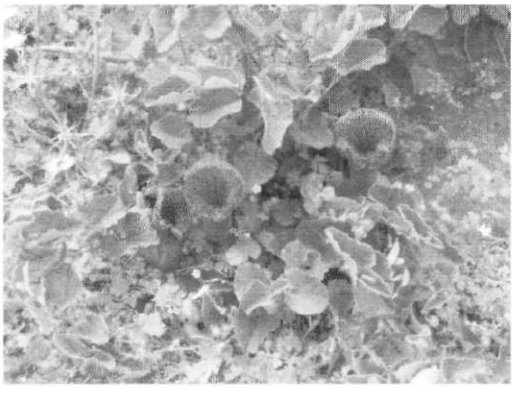


Habitat: forest clearings.
Description: Biennial or perennial herb. The flowering stem reaches a height of 1.60 m.
Leaves lanceolate, large (downy). Flowers: purple, pink, flowering: from June to September.
Uses: Medicinal and poisonous plants.
Active substances: Kardenolidia, glycosides, digitalini, digitoxin, gitoxini), medications (Digoxin) from the 1775 by William Withering.

• Arum creticum (Araceae). *Aron the Cretans.*

Related species: Arum maculatum, the spotted Aron.
Habitat: Hedges, ravines, edges of roads, forests device.
Description: Perennial herb with large lanceolate leaves with black spots, inflorescence: purple cob, surrounded by a large foil (sword).
Uses: Dioscurides used it against asthma (root). It has a bitter taste. The berries are poisonous, such as leaves and flowers.
Active Substances: Aroini (essential oil, poisonous), corrosive to the skin and the toxin CNS (Central nervous system).
The root (containing hydrocyanic acid), withered or cooked is safe, used for making bread sitodeia.
Homeopathy: Bronchitis.* Homeopathic medicines are diluted and potentiated prepared from original tinctures (Hahnemann). It is completely harmless.

• Aristolochia cretica: (Aristolochiaceae). * Cretan Aristolochia.



Aristolochia (perfect confinement).
Related species: Aristolochia clematis. Aristolochic the klimatis.
Habitat: Woods, hedges and near homes.
Description: Perennial herb, large heart-shaped leaves, smelly, flowers: pale yellow with a long tube. Flowering from June to September.
Active substances: Aristologiko Acid (rhizome and stem) and aristolochini essential oil.
Properties: Anti-inflammatory, inhibiting cancer, gynecological infections etc.

Uses: Hipppokratis uses for deliveries. The fresh plant can be used against ulcers, treatment of arthritis and rheumatism. Farmers use it against snake bites

• Mandragora autumnalis: (Solanaceae) Mandragoras the Autumnal, kalanthropos root.

Habitat: rocky barren and parts.
Active substances: alkaloids (atropine, Hyoscyamine, scopolamine)
Properties: antispasmodic, analgesic.

4. CONCLUSIONS

Bitter wild plants are natural resources of food and medications. Modern diet and formal medicine have forgotten the importance of these plants so that many species are in danger of extinction. There are many threats to medicinal and edible wild plants in general. The most alarming cause is the ignorance and lack of education. Old generations managed to keep the knowledge about the uses of the wild plants but modern life tends to cut the contact between human and nature. Spread of residential areas, clearing forests, soil erosion, overgrazing and forest fires are among the threats to the conservation of bitter wild plants. Therefore humankind may be deprived of valuable benefits from edible and medicinal wild plants if actions are not taken in due time.

We would like to thank the Cretan people without whom this survey would not reach its goal. This paper is the outcome of the collaboration between the Institute of Theology and Ecology of the Orthodox Academy of Crete and the Cretan naturalist, Dr. Nikolaos Samaridis who has done all the survey over the whole island of Crete for his own research.

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MICROPAGATION OF PHYLLANTHUS AMARUS SCHUM AND THONN: AN IMPORTANT MEDICINAL PLANT

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Abstract

Phyllanthus amarus Schum and Thonn (Euphorbiaceae) is an important medicinal plant species due to its antiviral properties, useful against hepatitis infection. The species is also used in stomach ailments like dyspepsia, colic, diarrhoea, dysentery, dropsy, urinogenital problems and also as external application for oedematous swelling and inflammation. In recent years, the demand of P. amarus has increased owing to its antiviral property. This led to indiscriminate harvesting and threatened its status in the biodiversity. Therefore, present investigation was taken up to establish a protocol for in vitro propagation of elite germplasms of this highly important medicinal plant species using nodal explant culture.

Nodal explants of P. amarus were aseptically cultured on MS medium with various combinations of indole-3-acetic acid (IAA), benzyl amino purine (BAP), napthalene acetic acid (NAA), 2-4-dichlorophenoxy acetic acid (2,4-D) and kinetin at concentrations ranging from 0.5 to 5 mg/L. High-frequency organogenesis and multiple shoot regeneration was induced on MS medium supplemented with 0.5 mg/L of IAA and 3 mg/L of BAP. Rooting was induced in MS medium with 0.5 mg/L of IBA and 2 mg/L of BAP. The rooted plantlets showed 80% field survival. The developed protocol would be useful for mass propagation and germplasm conservation of P. amarus.

Keywords: Plant biodiversity conservation, In vitro propagation, Phyllanthus amarus

PART VIII

Wild Plant
in Natural Ecosystem and Climate Change

MITIGATING THE IMPACT OF CLIMATE CHANGE ON THE RARE WILDFLOWERS OF THE GRANITE BELT IN SOUTHERN QUEENSLAND, AUSTRALIA

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Abstract

Climate change will produce long-lasting and difficult to predict changes to the abundance, composition and distribution of species and ecosystems in Australia, affecting the ability of protected areas to be truly comprehensive, representative and adequate. How these changes will occur, in what direction, and at what rate is the subject of considerable debate, particularly given the climatic events that have historically contributed to Australia's unique flora. Government and non-government organizations are attempting to determine which mechanisms, or combination of mechanisms will provide the best strategy to direct the conservation of Australia's biodiversity in the future; all agree that building the ecological resilience of landscapes will be pivotal to mitigating impacts.

Based on extensive fieldwork, the author investigates which conservation mechanisms – the protection of climate refugia, enhancing connectivity through strategically located corridors, and landholder incentives – are having an impact on the Granite Belt in Southern Queensland, Australia. This area is characterized by a unique combination of altitude, geology and landforms that give rise to a diverse flora containing:

1. A high number of listed endangered, vulnerable and rare species
2. High numbers of endemic species and species at the northern or southern limits of their distribution
3. A suite of endangered regional ecosystems
4. Topographical habitat niches that support relict species

This area also contains interesting examples of climate refugia – places that have provided refuge for plants (and animals) from past climatic changes. These include:

Evolutionary refuges – areas with concentrations of endemic species that remained when the surrounding environment become unfavourable in the past

Ecological refuges – drought refuges and other remaining areas of favourable habitat, which could become increasingly isolated and under pressure in the future

Trigger points – areas where source populations may be concentrated, i.e. species and assemblages with the potential to radiate from a localised point in response to changing climate

Recommendations are provided for preserving threatened flora and facilitating natural evolution at a bioregional level.

Keywords: Climate change, policy, conservation, Australia

REDUCTION OF CARBON EMISSION BY WISER USE OF FOREST IN THE SUB-TROPICAL REGION OF NORTH EAST OF INDIA

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Abstract

Issue: The global warming that had direct effect on the livelihood of the indigenous people of the North Eastern part of India is on their survival and the secondary concern is the carbon emission due to the destruction of the forest that has contributed to global warming, protecting the forest is one way of controlling carbon emission.

Description: The region is one of the two areas that produce oxygen in India, the other being the Western Ghats in South India. The diverse flora and fauna is systematically destroyed along with deforestation, faster cycle of jhum cultivation, supply of timber, wood for fuel to heat and cook and uncontrolled wildfire due to arson, an issue of survival of the communities in this underdeveloped region. The global and the country planning to cut emission do not spiral down to the people from whom much could be benefited; preservation of forest is a natural counter force to the modern technological pollution.

Action Plan and Recommendation: This part is dominated by Christians; the land and the forest are owned by them. A Christian perspective on environment and incorporate it in the life and teaching of the church, in their institutions and become an ongoing learning process for the teachers will have an added value to protect the changing environment of the world.

***Keywords**:* Global warming, forest, conservation, India

ECOLOGICAL CHARACTERIZATION OF TAMARIX SPP. POPULATIONS OF SOUTHERN ITALY UNDER DIFFERENT ENVIRONMENTAL CONSTRAINTS

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Abstract

Climate change is directly affecting many environmental factors, increasing the risk of desertification, soil salinization and periodic flooding in all Mediterranean countries. In these areas, fragmented populations are the most vulnerable to extreme events, which increase the risk of genetic erosion and population loss.

The Tamarix genus includes 90 species, many of which are distributed in all Mediterranean countries. Tamarix spp. are characterized by a high variability, allowing them to grow under a wide range of ecological conditions. Many species are tolerant to saline stress, thanks to the presence of salt extruding foliar glands, and are able to survive in very dry soil. On the other hand, Tamarix spp. are phreatophytes; their presence is linked to superficial (rivers) or deep water sources availability, and populations are frequently located in depressed areas, which are periodically subjected to flooding. The study of the tolerance to extreme events of these populations is a prerequisite for any in-situ conservation plan. Moreover, the wide genetic diversity of Tamarix genus is promising for the selection of plant material, which could be used for the recovery of degraded areas under present and future climate.

In this work, we present some results concerning the ecological and structural characterization of natural Italian Tamarix populations collected under contrasting water availability and salinity conditions, and the creation of an ex-situ germplasm collection with the selected plant material.

Keywords: Tamarix spp., salinity, water availability, restoration ecology, plant diversity.

WILD PLANT COMMUNITIES, AS RESERVOIR OF BENEFICIAL NATURAL ENEMIES OF PESTS, IN AGRICULTURAL ECOSYSTEMS

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Abstract

Habitat manipulation for the conservation of natural enemies involves providing and protecting vegetation in and around agricultural areas so that beneficial arthropods can use this vegetation for food, shelter, or overwintering sites. Wild plants, in association with a crop, offer floral resources (nectar and pollen) to beneficial insects. Nectar and pollen are important food sources for some parasitic wasps (Hymenoptera), syrphid fly adults (Diptera: Syrphidae) and predators. In addition, provisioned habitat can offer alternate victims for parasitoids and predators. So called "pollen and nectar plants" include plants in the family Umbelliferae, *Anethum graveolens*, *Foeniculum vulgare*, and *Petroselinum* spp.; family Labiatae, *Mentha piperata*, *Melissa officinalis*, *Nepeta cataria*, *Mentha spicata*, and *Thymus* spp.; and the family Compositae, *Echinacea* spp. and *Rudbeckia* spp., *Achilles* spp., and *Solidago* spp. Unfortunately, scientific literature based on quantified studies of tritrophic systems containing different kinds of host plants, herbivores and natural enemies, is very poor. However, in a review of research on the effect of vegetational diversity on the relative abundance of herbivores and their parasitoids and predators, it was generally determined that natural enemies cause higher levels of herbivore mortality in polycultures than in monocultures. It has been shown that certain parasitoids and predators are attracted to specific annual and perennial plants, and that these plants support greater natural enemy reproduction and longevity. In most situations, there is an inverse relationship between the number of natural enemies and herbivores, causing less plant damage due to feeding as herbivore populations decline. However, the level of benefit depends on the cropping system and geographic location.

Keywords: wild plants, natural enemies, herbivores, agro-ecosystem

1. INTRODUCTION

Plant communities that are modified to meet the special needs of humans become subject to heavy pest damage and generally the more intensely such communities are modified, the more abundant and serious the pests. The inherent self-regulation characteristics of natural communities are lost when humans modify such communities through the shattering of the fragile thread of community interactions. Agroecologists maintain that this breakdown can be repaired by restoring the shattered elements of community homeostasis through the addition

or enhancement of biodiversity (Altieri, 1999). Vegetation and fauna of extensively managed orchards are mainly determined by the site and its maintenance, the type of grassland management and its land use intensity (Deuschle *et al.*, 2002). Navrozidis et al., (2007) recorded that, the level of 4 olive tree cultivars susceptibility was affected by soil plowing and fertilization, which strongly increased the susceptibility of all cultivars tested to attacks by the olive fly (*Bactrocera oleae*) and infections by *Sphaeropsis dalmatica* and *Spilocaea oleagina*.

Until now animal communities of extensively managed orchards have not been analysed based on the direct comparison of different forms of grassland management in the same area (Deuschle and Glück, 2001). There are few investigations dealing with the influence of management systems on arthropod communities in extensively managed grassland (Southwood and van Emden, 1967). The dominance structures of communities allow a direct comparison and are independent of external influences (e.g. weather) as the activity density. Therefore it is well suitable to characterize habitats. Species with low colonizing density are argued to have a high potential to colonize new areas (Gravesen and Toft, 1987; Deuschle and Glück, 2005).The biocoenotic relationship of neighbouring area specific communities is not only influenced in quality but also in quantity. Therefore, the occurring neighbouring aspects are not only caused by the accidental presence of single exploring individuals. Rather are parts of populations obviously present on several plots and management forms within the area specific communities (Desender *et al.*, 1989; Maelfait *et al.*, 1988). Many of the modern principles of companion planting were present many centuries ago. The cottage garden is a distinct style of garden that uses an informal design, traditional materials, dense plantings, and a mixture of ornamental and edible plants.

2. COMPANION PLANTS

Companion plants apparently are very useful for both attracting and retaining beneficial arthropods. They provide abundant sources of pollen and nectar for adult parasitoids and predators at critical times during the vegetable and ornamental plant growing seasons, and can help to increase natural enemies in the landscape. So called "pollen and nectar plants" include plants in the family Umbelliferae, *Anethum graveolens*, *Foeniculum vulgare*, and *Petroselinium* spp.; family Labiatae *Mentha piperata*, *Melissa officinalis*, *Nepeta cataria*, *Mentha spicata*, and *Thymus* spp.; and the family Compositae, *Echinacea* spp. and *Rudbeckia* spp., *Achilles* spp., and *Solidago* spp.

However, in a review of research on the effect of vegetational diversity on the relative abundance of herbivores and their parasitoids and predators, it was generally determined that natural enemies cause higher levels of herbivore mortality in polycultures than in monocultures (E. P. Russell 1989) Environmental Entomology 18:590-595). It has been shown that certain parasitoids and predators are attracted to specific annual and perennial plants, and that these plants support greater natural enemy reproduction and longevity. Examples include Hymenoptera (parasitoids) and Diptera (Syrphidae) that are attracted to *Alyssum* spp *Coriandrum sativum*, *Fagopyrum* spp, *Brassica* spp, *Phacelia* spp, *Foeniculum vulgare* and *Achillea millefolium*. In most situations, there is an inverse relationship between the number of natural enemies and herbivores, causing less plant damage due to feeding as herbivore populations decline. Thus, companion plants attract and maintain natural enemies that help to manage pests on adjacent crops Vegetables, thrive on companionship and will yield up to twice as much when they are surrounded with companion plants. Companion

planting in gardening and agriculture is planting of different crops in close physical proximity, on the theory that they will help each other. It is a form of polyculture Companion planting is used by farmers and gardeners in both industrialized and developing countries.

3. INTEGRATED PEST MANAGEMENT (IPM)

For farmers, these techniques are used in IPM. In **agriculture**, integrated pest management (IPM) is a **pest** control strategy that uses a variety of complementary strategies including: mechanical devices, physical devices, genetic, biological, cultural management, and chemical management. These methods are done in three stages: prevention, observation, and intervention. It is an **ecological** approach with a main goal of significantly reducing or eliminating the use of pesticides while at the same time managing pest populations at an acceptable level, and systems can be set up to allow the farmer to have more yield and/or reduce pesticides. For gardeners, the combinations of plants also make for a more varied, attractive vegetable garden. It can also be used to mitigate the decline of biodiversity.

4. INSECTARY PLANTS

Insectary plants are a term used to describe plants that attract insects. As such, beneficial insectary plants are intentionally introduced into an **ecosystem** to increase pollen resources and nectar resources required by the natural enemies of harmful or unwanted insect pests. Beyond an effective natural control of pests, the *friendly insects* also assist in pollination. The "friendly insects" include ladybeetles, **bees**, **ground beetles**, **hoverflies**, and **parasitic wasps**.) is a good way to enhance the population of beneficial insects that control pests. Some insects in the adult form are nectar or pollen feeders, while in the larval form they are voracious predators of pest insects.

The results of two studies suggest an important role for *Dittrichia viscosa* L. (Asteraceae) in conserving and augmenting of the effective predator *Macrolophus melanotoma* (Costa) of several pests, in agro ecosystems, and in the development of natural control augmentation strategies in vegetable crops (Perdikis D., et al., 2007).

5. SYSTEMS AND METHODS

There are a number of systems and ideas using companion planting, for example, attempts to protect plants from many normal gardening problems by packing them as closely together as possible, which is facilitated by using companion plants, which can be closer together than normal.

Another system using companion planting is the forest garden, where companion plants are intermingled to create an actual ecosystem, emulating the interaction of up to seven levels of plants in a forest.

There are many weeds, which can be allowed to grow alongside plants, imparting the same kinds of benefits as mixing cultivated crops.

Recent studies on host-plant finding have shown that flying pests are far less successful if their host-plants are surrounded by any other plant or even "decoy-plants" made of green plastic, cardboard, or any other green material.

In a recent experiment, highest mean percentage of parasitism (62%) of *Chilo partellus* (Swinhoe) (a pest in maize) by *Cotesia flavipes* (Cameron) was recorded in maize plots surrounded by *Pennisetum purpureum*. Therefore, the findings revealed that, this wild host have considerable merit to be used as trap plant in the development of strategies for managing cereal stemborers in maize crops (Yewhalaw D., et al., 2008).

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THE HOLY CONVENT OF CHRYSOPIGI "THE LIFE GIVING SPRING"

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Abstract

The Holy Monastery of Chrysopigi, in the town of Chania in western Crete, is a monument of the 16th century. It is dedicated to the Mother of God, the Life-Giving Spring. Since its foundation, the monastery has been a source of spiritual life and social activity for the whole island of Crete.

After the Second World War the monastery remained in ruins until 1976, when the present sisterhood settled there. The sisters restored the building complex of the monastery, while the relics were preserved and protected with the functioning of an ecclesiastical and a folklore museum. In the Monastery of Chrysopigi the sisters are systematically occupied with iconography, book publication, bookbinding, ecclesiastical embroidery, the preservation of old books and icons, as well as with the organic cultivation of the land.

The monastery has land of approximately 175 acres, with an extended forested area, a great variety of trees and flowers, fruit and vegetable gardens, as well as many species of birds and animals. So the whole area of Chrysopigi is a biotope with exceptional archaeological, historical and environmental value, sanctified by the ascetic struggles, prayers and worship of monastics who lived there through centuries.

Keywords: Sisterhood, monastery, organic cultivation, museum, conservation

2010 DECLARATION FROM CRETE ON PLANT BIODIVERSITY

THE PARTICIPANTS OF THE INTERNATIONAL CONFERENCE ON THE CONSERVATION AND SUSTAINABLE USE OF WILD PLANT DIVERSITY (CSUWPD) ON CRETE, 4-8 MAY 2010:

Thank the Institute of Theology and Ecology at the Orthodox Academy of Crete for their invitation and hospitality;

- *Welcome* the initiative taken by the **Institute of Theology and Ecology at the Orthodox Academy of Crete** to organise this event in co-operation with **Planta Europa** and recognise it as valuable opportunity to establish collaborations among various organisations and initiatives involved in the conservation of wild plants;

- *Refer to*:

- the decision by the General Assembly of the United Nations to declare 2010 International Year of Biodiversity;
- the rate at which animal and plant species are becoming extinct and the pace at which ecosystems are being destroyed (IUCN). With each passing hour, three species are lost worldwide(WWF/IoZ/ZSL May 2008)
- the undertaking given by states that have signed the Rio Convention on Biological Diversity (1992) to halt biodiversity loss by 2010;
- the Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979);
- the European Landscape Convention:
- Directive 92/43/EEC of the Council of the European Communities on the conservation of natural habitats and wild fauna and flora, as regards the protection of habitats;
- the Decisions VI/9, VII/10 and IX/3 on the Global Strategy for Plant Conservation, adopted by the Conference of the Parties to the Conservation on Biological Diversity respectively at its Sixth meeting (The Hague, The Netherlands, 7-19 April 2002), at its Seventh meeting (Kuala Lumpur, Malaysia, 9-20 February 2004), and at its Ninth meeting (Bonn, Germany, 19-30 May 2008);
- the European Plant Conservation Strategy (2001) and the European Strategy for Plant Conservation 2008-2014, developed by the Planta Europa Network and the Council of Europe;
- Recommendation no. 87 (2001) on the European Plant Conservation Strategy, adopted by the Standing Committee of the Convention on the Conservation of the European Wildlife and Natural Habitats (Bern Convention), on 30 November 2001;
- Recommendation no. 138 (2008) on the European Strategy for Plant Conservation 2008-2014, adopted by the Standing Committee of the Convention on the

Conservation of the European Wildlife and Natural Habitats (Bern Convention), on 27 November 2008;

- *Declare that:*

1. Biodiversity loss imperils the future of planet earth and all life on it: Plants are among the basis for all life and without plant diversity, life on earth might cease;
2. Biodiversity loss can be identified as an outcome of human irresponsibility and behaviour disorder, with its symptom, Referential Integrity Deficit, occurring when environmental action, based on privately claimed moral and ethical principles, shows no corresponding public behaviour.
3. Effective communication among all stakeholders is the key factor in assuring the successful management of plant diversity conservation.
4. Active participation of all people, particularly young people, in biodiversity conservation efforts should be encouraged and actively supported through education and awareness initiatives.
5. Global networks of biodiversity reserves and important plant areas, supported by legislation, should be given top priority. They underpin the economic, social and cultural benefits of conservation, none of which should be undervalued;
6. Research and the implementation of standards for sustainable harvesting and use of wild plant resources are vital to ensure their conservation;
7. Best practices in conserving wild plant diversity must be built on to derive maximum value for money and to achieve the best return for plant diversity over the shortest period of time.

- *Undertake* to promote this declaration;

- *Decide* to transmit this declaration to the SIXTH Conference of Planta Europa in, Krakow (Poland), 23-27 May 2011.

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Kounelaki Archontissa	
Kourti Olga	
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Mavrodimitraki Evagelia	
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Partsalakis Evagelos	
Pateraki Anna	
Potamianou Panorea	(Teacher)
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Sapounaki Ermioni	
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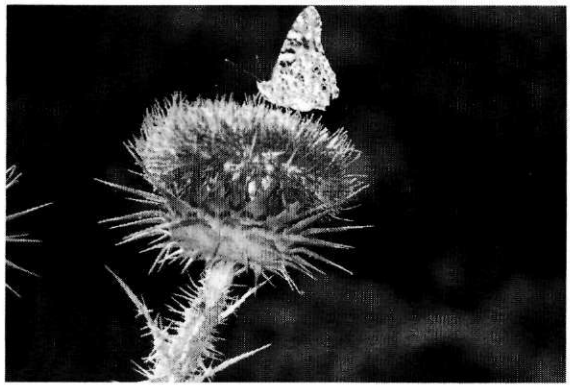
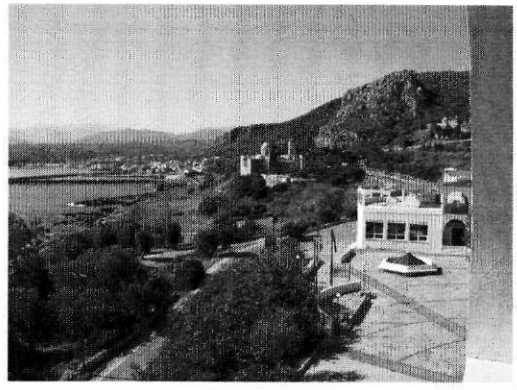
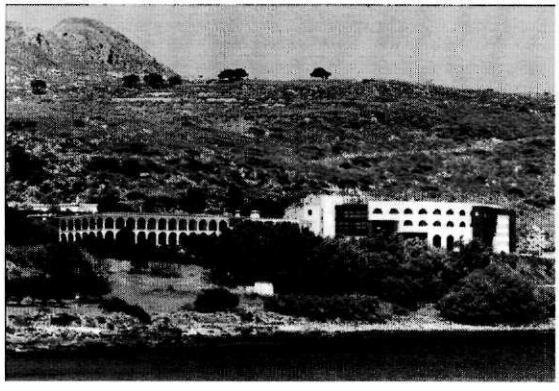
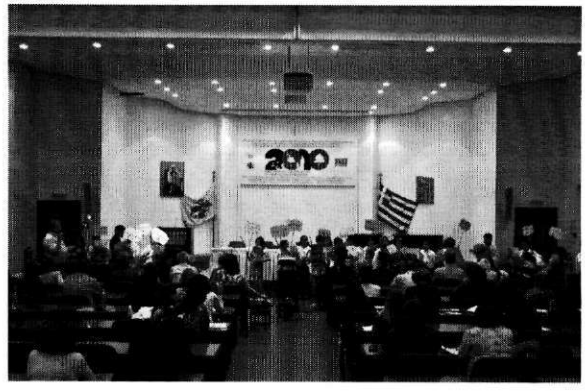
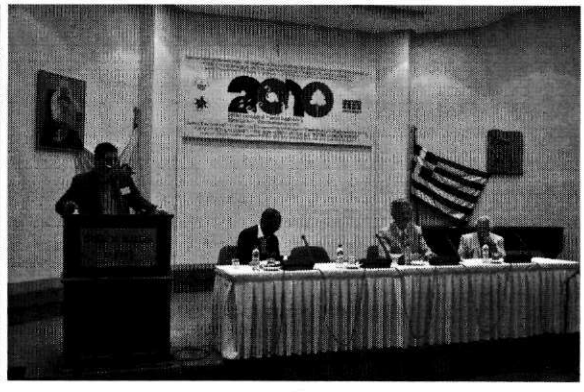
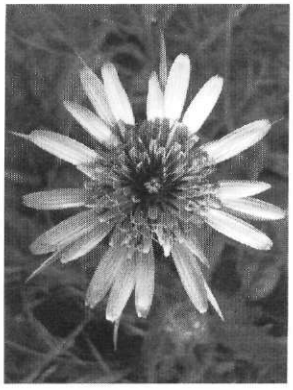


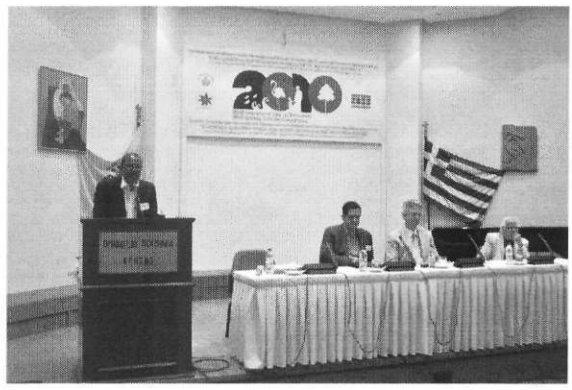




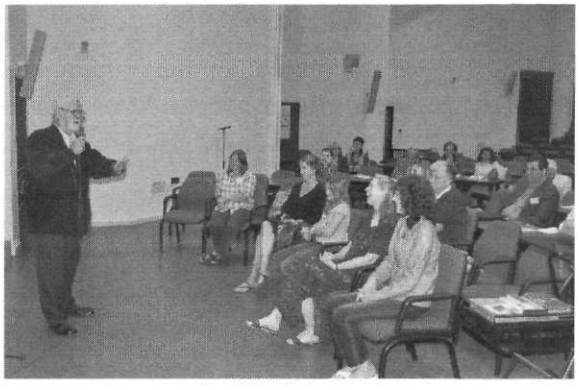


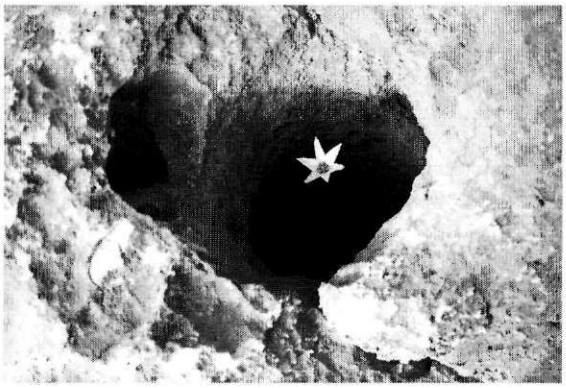
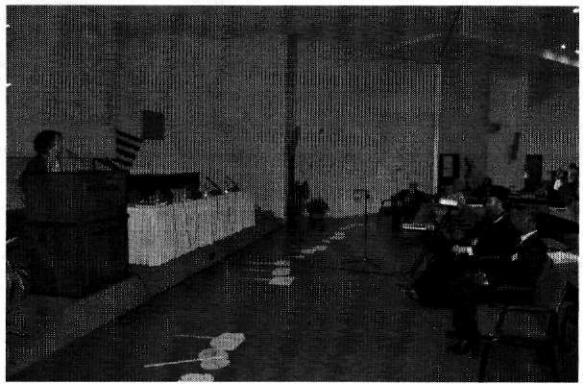


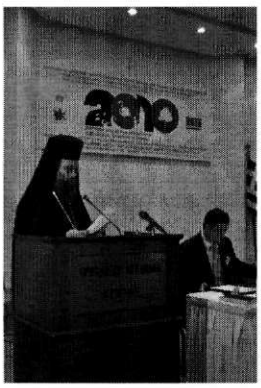
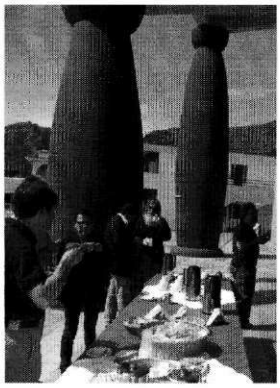




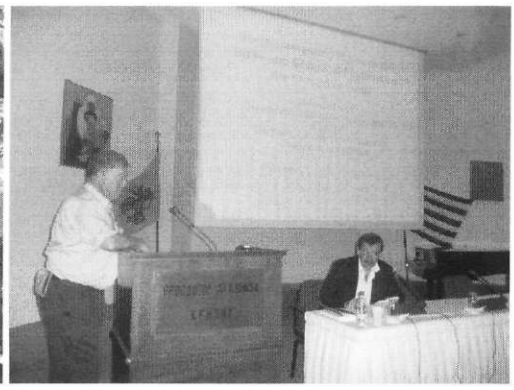


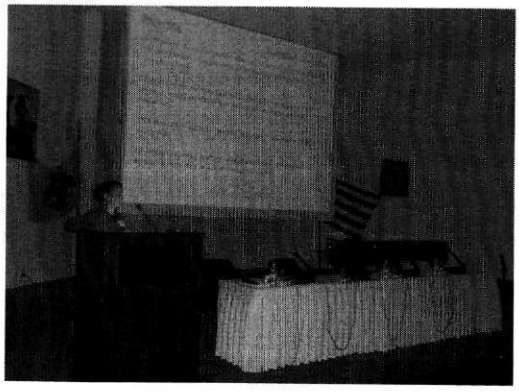
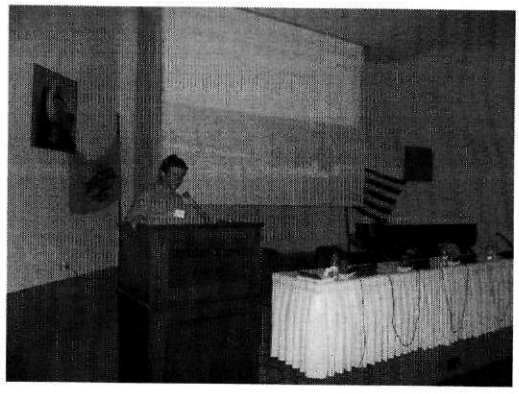


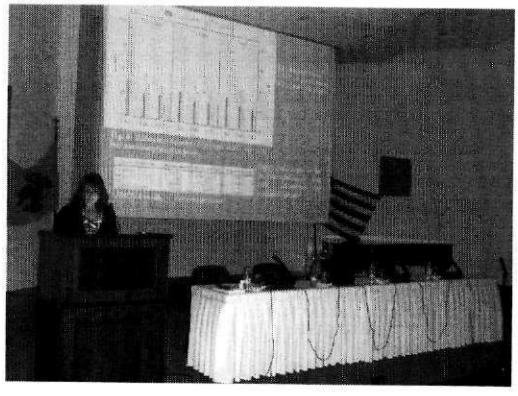




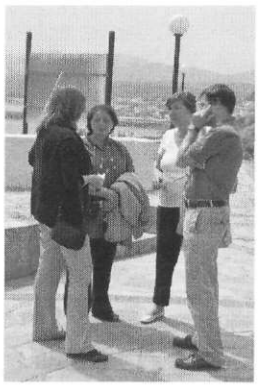







CYCLAMEN GRAECUM Link
Κυκλάμινο



L. A. ANDRIANOS SHORT BIOGRAPHY

Louk Aourelien Andrianos was born in Antananarivo Madagascar as Luc Andriantiatsaholiniaina in 1969. Since 2006, he becomes Greek citizen and now he is married with Georgia Glampedaki and live in Kolympari Crete, Greece, with their three children (Celina, Ioannis and Andriana).

After his graduation, he received a scholarship from the French government to accomplish his Master Degree in Belgium in 1995. In 2001, he got again a scholarship from the Greek government to perform doctoral studies (PhD) at the Technical University of Crete. Right after his Ph.D. degree, he went to Canada with his family and worked as postdoctoral fellow at Simon Fraser University in Vancouver, Canada.

From 2003, he worked as an Agronomist Engineer in Rethymnon Crete and since Mai 2006 he has been hired by the Foundation for Research and Technology (FORTH) as a Scientist Collaborator to help organizing scientific conferences and to be responsible for the Institute of Theology and Ecology at the Orthodox Academy of Crete in Kolympari Chania.

In addition to the creation of this international conference on the conservation and sustainable use of wild plant diversity (CSUWPD), he has been the chair and founder of the first and the second international conference on ecological theology and environmental ethics (ECOTHEE) in 2008 and 2011. Among other scientific and cultural activities, he has also helped Professor Jacques Zaffran organizing seminars on Cretan botany and gastronomy at the institute of Theology and Ecology of the Orthodox Academy of Crete. He understands six languages and loves multicultural and multidiscipline dialogue and researches. He has developed much scientific collaboration between the Orthodox Academy of Crete and other universities and institutions at local, national and international level.

As Christian by faith he seeks after perfection, meekness, humbleness, communion, wisdom, grace and the glory of the Holy Trinity: *The God Father, The Son Jesus Christ and The Holy Spirit.*

Dr. Lucas Andrianos
CSUWPD Organizer

This book collects edited and revised versions of papers and abstracts that have been scheduled to be presented at the first International Conference on the Conservation and Sustainable Use of Wild Plant Diversity (CSUWPD), held in May 4-8, 2010, at the Orthodox Academy of Crete, Kolympari, Chania.

The high number of proposals confirms the growing interest for the issues of biodiversity conservation. About forty four (44) abstracts proposal were submitted from twenty nine (29) countries, including *Algeria, Austria, Australia, Bangladesh, Bulgaria, Ethiopia, Faulkland, France, Hungary, Germany, Greece, India, Indonesia, Iraq, Iran, Ireland, Italy, New Zealand, Poland, Romania, Serbia, Sierra Leone, South Africa, Soudan, Sweden, Tanzania,* Turkey, United Kingdom and the United States of America. From these submissions, thirty nine (39) were selected for presentation and publication in this book. More than hundred participants were expected but due to the volcano ashes of Ireland and the general strike in Greece mainland, only one third of the registered participants managed to come to Crete. Therefore, this book stands as a relief for those who could not join the conference.

The CSUWPD event brings together multidisciplinary and multicultural approaches of biodiversity conservation. The themes were classified into six categories namely:

- Botanic Gardens, Reserves and Case Studies for wild plants,
- Eco-Theology and Plant Ethics,
- Wild plant in Scientific Research and Development,
- Taxonomic Investigations and Conservation Methods for Wild plants,
- Models and Issues of Sustainable Use of Wild plants,
- Wild plant in health science, cosmetics and pharmacology, and
- Wild plant in natural ecosystem and climate change.

The selected papers and abstracts present a useful perspective to evaluate the core of biodiversity management and the conference itself revealed the diversity of approaches to the issues of biodiversity conservation. However, the goal was not to collect academic papers but to raise awareness for the protection of life and to call the community to celebrate together the year of biodiversity. The outcome of the conference is summarized in the "***2010 Declaration from Crete on Plant Biodiversity***" which is stated at the end of this book.

I wish the most constructive inspirations for all readers of this book and I look forward to organizing the second CSUWPD conference in 2013 at the same place (OAC) – God Willing.

Dr. Lucas Andrianos
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www.oac.gr

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