

**NEW INSIGHTS ABOUT  
MEDICINAL USES AND  
HEALTH-BENEFICIAL PROPERTIES  
OF CACTUS PRODUCTS**



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*Códice Florentino, 1575*

## ***TRADITIONAL USES***

The origin and history of cacti are closely related to the ancient Mesoamerican civilizations.

For over 12,000 years, fresh nopal cactus has been consumed by the natives for its nutritional qualities and healing properties.



# MEDICINAL PROPERTIES OF CACTUS PRODUCTS

- Traditional and popular uses
- Latest advances in scientific studies concerning medicinal properties
- Functional foods and nutraceutical products available in the market

# TRADITIONAL USES

Plants and herbs have been used by ancient civilizations to cure diseases and heal wounds for thousands of years.



## ***TRADITIONAL USES***

Although, cacti are native to America, they are now, wild or cultivated, widely spread in Africa, Asia, Europe and Oceania.

Cactus cladodes, fruits, seeds and flowers have been used as folk medicines in several countries for centuries.





## ***TRADITIONAL USES***

# **FLOWERS**

The use of cactus flower petals to treat urological problems is well-known in Sicily.

Kidney colic treatment with *Opuntia ficus-indica* flowers was already mentioned by Pitrè (1896).

Pitrè, G., 1896. Medicina Popolare Siciliana. In: Barbèra, G. (Ed.), Biblioteca delle Tradizioni Popolari Siciliane, seconda edizione. Firenze, 1949.



## ***TRADITIONAL USES***

# **FLOWERS**

They are also recognized the properties of the infusions of dried flowers to prevent prostate cancer.



- **Depurative and diuretic effects**
- **Renal calculus expulsion**



## *TRADITIONAL USES*

# CLADODES



Cladodes are used in folk medicine for the treatment of **gastric ulcer** and for their **healing activity** as therapeutic agent.

- **Emollient and Moisturizing effects**
- **Cicatrizant properties**
- **Hypoglycemic action**
- **Gastritis relief**



## ***FOLK MEDICINAL USES***

# **FRUITS AND JUICES**

- **Diuretic effect**
- **Hypoglycemic agent**
- **Hypocholesterolemic factor**
- **Anti-allergic activity**
- **Analgesic and anti-inflammatory actions**
- **Used to treat indigestion**
- **Used to alleviate alcohol Hangover symptoms**

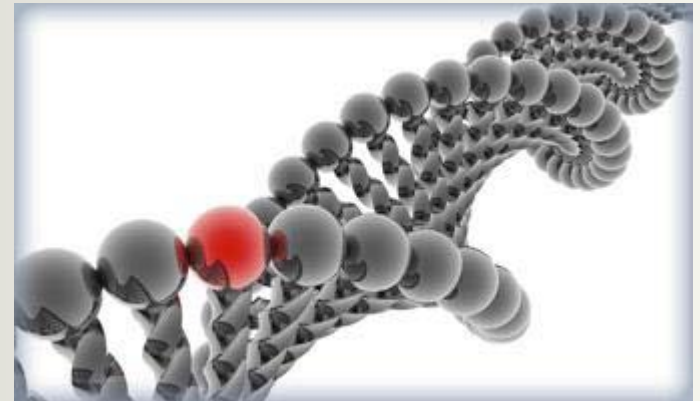
These popular uses, whose safety and effectiveness have been tested and verified over centuries only with the empirical evidence, need to be validated with scientific studies.

This will allow to find new applications and discover more effective formulations.

# SCIENTIFIC INVESTIGATIONS

BIOACTIVE CONSTITUENTS

*IN VITRO* AND *IN VIVO* ACTIVITIES

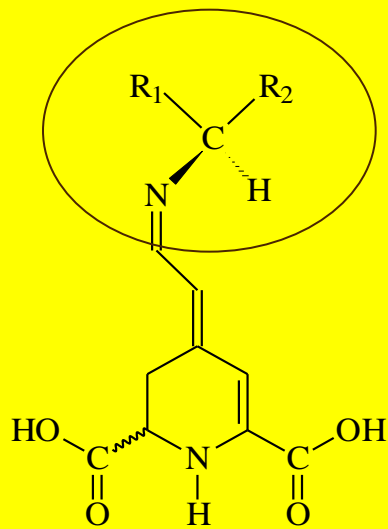


# CACTUS FRUITS

- BETALAINS
- POLYPHENOLS
- VITAMIN C

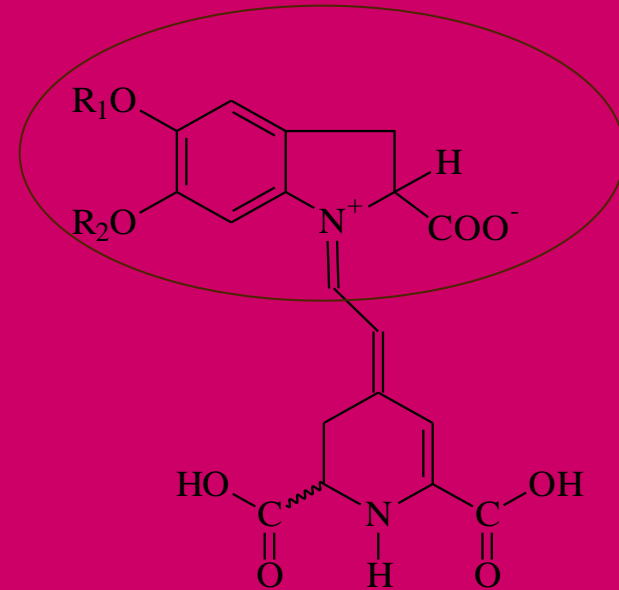


# CACTUS FRUITS PIGMENTS



BETAXANTHINS

Indicaxanthin



BETACYANINS

Betanin, isobetanin

# PADS OR CLADODES

- DIETARY FIBRE (43 % d.w.)
- MUCILAGE (18 % d.w.)
- PECTINS
- MINERALS :  $\text{Ca}^{2+}$ ,  $\text{K}^{+}$



# FRUIT SEED OIL

## ● RICH IN POLYUNSATURATED LIPIDS

PUFA 70% (Linoleic acid 60%)

## ● OTHER CONSTITUENTS AS PHYTOSTEROLS

- Columnar cactus seed oil

LA: 50 %

OA: 36 %

- Pitayas (*Hylocereus* spp.)

Tocopherols and polyphenols

Seed endosperm consists of  
arabinan-rich polysaccharides





# FLOWERS

## ● FLAVONOIDS

Quercetin, isorhamnetin  
and kaempferol glycosides

## ● BETALAINS

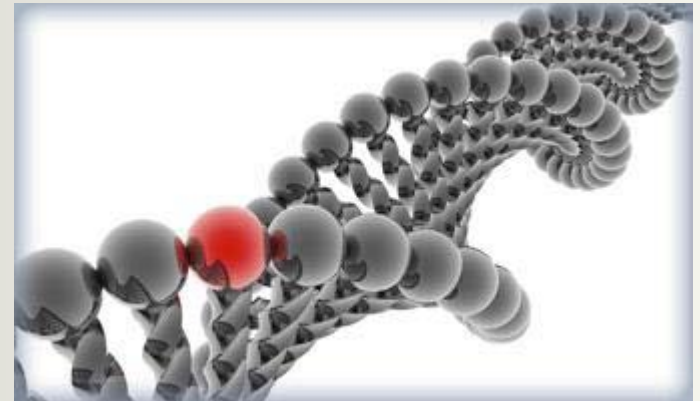
betanin, phyllocactin  
(6'-*O*-malonylbetanin )

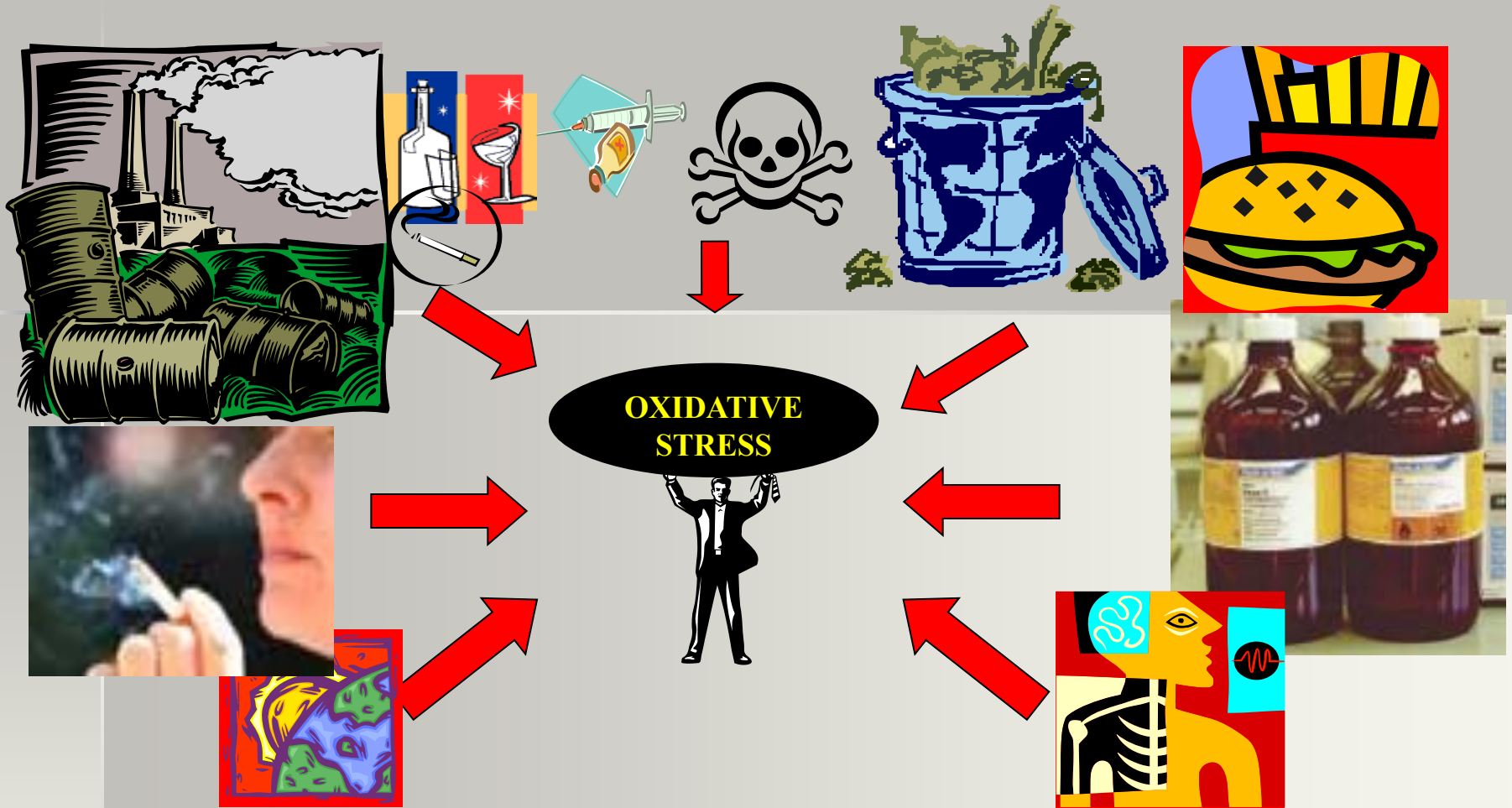


# SCIENTIFIC INVESTIGATIONS

BIOACTIVE CONSTITUENTS

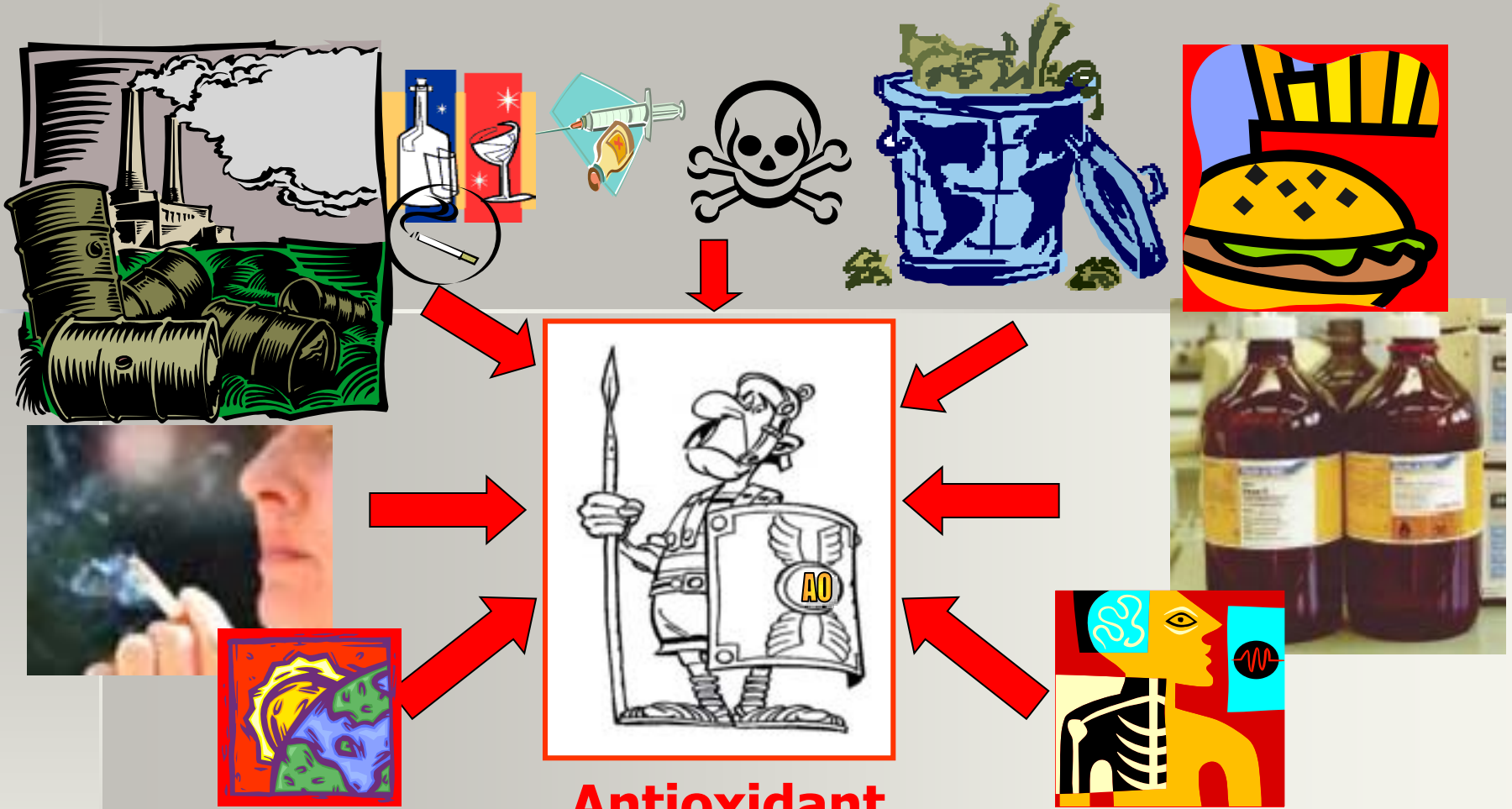
*✓* *IN VITRO* AND *IN VIVO* ACTIVITIES





Free Radicals have been related to serious diseases

- Cancer
- Alzheimer's and Parkinson's Diseases
- Heart Conditions
- Cataracts
- Atherosclerosis



## Antioxidant

FREE RADICAL SCAVENGING  
OXYGEN REACTIVE SPECIES DEACTIVATION  
PROOXIDANT ENZYMES INHIBITION

# ANTIOXIDANTS

**DELAY, INHIBIT, OR PREVENT OXIDATIVE DAMAGE**

BETALAINS

CAROTENOIDS

VITAMIN C

POLYPHENOLS

CARMINIC ACID



# ANTIOXIDANT ACTIVITY

## *In vitro* assays

**The extracts of fruits and cladodes of different cactus species have been assayed *in vitro* by numerous research groups during last 15 years.**

- Antiradical activities against DPPH• and ABTS•+ radicals
- Oxygen Radical Absorbance Capacity (ORAC)
- Protective ability towards lipid oxidation thermically induced in oils and emulsion models

## ANTIOXIDANT ACTIVITY

### ***In vivo* assays**

The effectiveness *in vivo* of an antioxidant depends on diverse factors as its bioavailability, the action site, the type of reactive species with which it will react and the possible synergistic effects with other compounds present in the food matrix.

# Effect on the oxidative stress in humans

## Betalains

↓oxidative stress markers

↓LDL oxidation

↓oxidative hemolysis red blood cells (ex vivo)

-Livrea and coworkers

Supplementation with cactus pear (*Opuntia ficus-indica*) fruit decreases oxidative stress in healthy humans: a comparative study with vitamin C1–3. *Am. J. Clin. Nutr.* 2004, 80, 391–395.

Absorption, excretion and distribution of dietary antioxidant betalains in LDLs: potential health effects of betalains in humans. *Am. J. Clin. Nutr.* 2004, 80, 941-945.

Distribution of betalain pigments in red blood cells after consumption of cactus pear fruits and increased resistance of the cells to ex vivo induced oxidative hemolysis in humans. *J. Agric. Food Chem.* 2005, 53, 1266-1270.

Increased resistance to oxidation of betalain-enriched human low density lipoproteins. *Free Radic. Res.* 2003, 37, 689-696.

-Budinsky, A.; Wolfram, R. Oguogho, A.; Elthimiou, Y.; Stamatopoulos, Y.; Sinzinger, H. Regular ingestion of *Opuntia robusta* lowers oxidation injury. *Prostaglandins, leucotrienes and essential fatty acids.* 2001, 55, 45-50.



# PROTECTIVE EFFECT against Ni-induced toxicity

*Opuntia ficus indica* cladode juice prevents oxidative stress and decreased the related parameters in rats.  
Hfaiedh et al. (2008)

# NEUROPROTECTIVE ACTION against neuronal oxidative injuries

*O.ficus indica* flavonoids and extracts were found to be effective in cultured mouse cortical cells and against global ischemia in gerbils.  
Kim et al. (2006)

# CANCER PREVENTIVE PROPERTIES

Zou and co. tested the ability of cactus pear fruit extract in suppressing carcinogenesis in cultured human cancer cell lines in vitro and an animal model in vivo.

Their results showed that the cactus extract inhibited the growth in vitro of ovarian, bladder, and cervical cancer cells and suppressed tumor growth in animal inoculated with ovarian cancer cells.

Cactus pear extracts could be a candidate in cancer prevention for both normal and high-risk populations and prevention of recurrence in patients with previous cancers.

Zou D.M., M. Brewer, F. Garcia, J.M. Feugang, J., Wang, R. Zang, H. Liu & C.P. Zou, (2005). Cactus Pear - a Natural Product in Cancer Chemoprevention. Nutr J, 4.

# ANTIVIRAL ACTION

A cladode extract from *Opuntia streptacantha* was reported to exhibit antiviral properties towards DNA viruses, such as herpes, and RNA viruses, such as influenza type A and human immunodeficiency virus HIV- 1.

The active principle was located in the outer noncuticular tissue and ascribed to a protein with unknown mechanisms of action (Ahmad *et al.*, 1996). Replication of both DNA and RNA viruses was inhibited.

International Patent (1993) Skinner and Ezra (GB, Israel)  
Nopal cactus effect on herpes simplex and influenza A viruses.  
Chlorophyll derivative are the active compounds.

# **OTHER MEDICINAL PROPERTIES CONFIRMED BY SCIENTIFIC RESEARCH**

- Anti-inflammatory and analgesic properties**
- Antiulcerogenic effects and healing properties**
- Anti-hyperlipidemic effect and cholesterol reducing levels**
- Diuretic effect**

# INDUSTRIAL DEVELOPMENTS

PERSPECTIVES?



# HIGH VALUE-ADDED PRODUCTS

- NUTRACEUTICAL PRODUCTS,
- FUNCTIONAL FOODS
- COSMETICS



CURRENTLY AVAILABLE IN THE MARKET



Dehydrated Nopal



Nopal powder

# Nopal pills and capsules





# FUNCTIONAL FOODS



## Nopaltilla(TM) The Healthy Green Cactus Tortilla



# FUNCTIONAL FOODS



Syrup

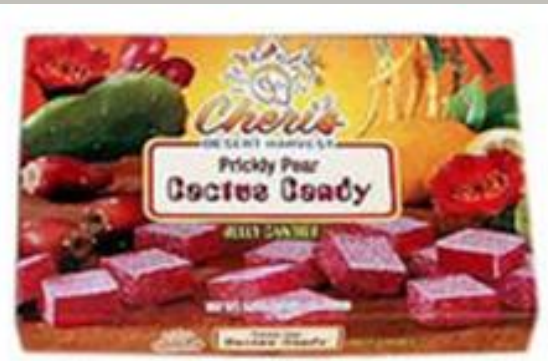


## Hangover Terminator



JAM & JELLYS

## Prickly Pear Cactus Candy



Prickly Pear Fruit Spread

# FUNCTIONAL FOODS

## Cactus pear juice



**Cahill Prickly Pear Thirst Quencher**  
Rich in Vitamin C, Flavonoids & Antioxidants  
100% Natural



- Protect against premature aging
- Reduce inflammation
- Promote optimal cellular health
- Detoxify the body

**Sonoran Bloom - The Power of Nopal Cactus**

# COSMETICS

## SEED OIL



Cactus seed oil 100 % organic from morocco



anti-wrinkle cactus seeds oil





# CACTUSNET NEWSLETTER

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

INTERNATIONAL CENTER FOR AGRICULTURAL RESEARCH IN THE DRY AREAS

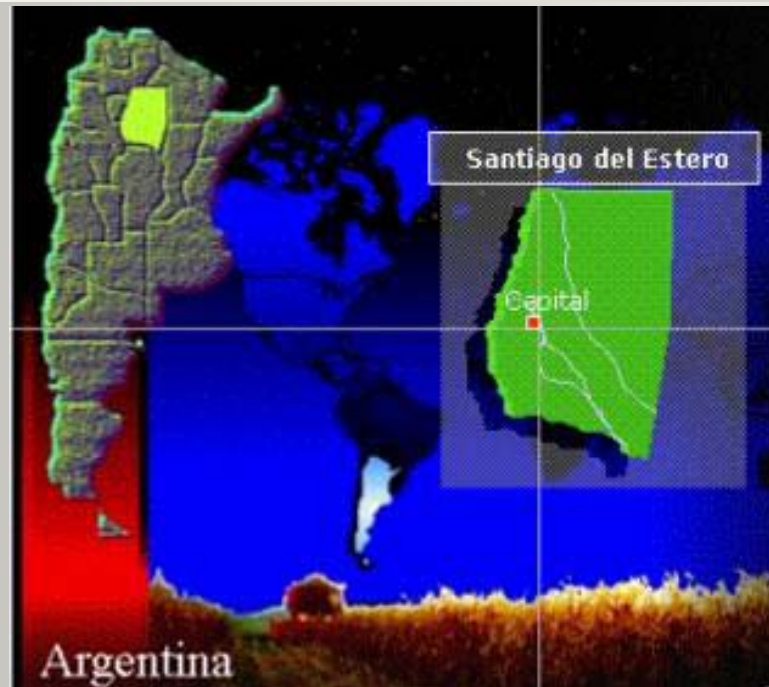
IAC-IARCA INTERNATIONAL TECHNICAL COOPERATION NETWORK ON CACTUS

UNIVERSIDAD NACIONAL DE SANTIAGO DEL ESTERO ARGENTINA

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**Thank you for your kind attention.**