

Closing the gap between modern science and traditional medicine: Saffron (*Crocus sativus*) and Hoodia sp. in the context of adulterations, GACP and clinical research

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Dr. Mathias Schmidt
Herbresearch Germany



Current market situation

- Most plants are traded via middle-men
- The producing company has no way to know the origin of the herbal material
- Herbal material is mostly of rather low quality, as payment is per mass and not per class
- Frequent adulterations, especially with expensive raw materials
 - The potential of high performance cultivars can hardly be used!
 - Little interest in the development of better than average standards



New legislation in the EU

- New EU directives claim full transparency of the origin of food ingredients (178/2002/EC)!
- Legislation already in force!
- Directive based on new WHO GACP guideline



The WHO GACP Guideline

Good Agricultural and Collection Practice:

- How to bring transparency to trading channels
- How to protect the natural resources
- How to improve quality and avoid adulterations
 - How to improve the consumer's safety!



Traceability

Traceability of the origin of herbal raw material will

- Help to avoid accidental and fraudulent adulterations
- Create new market chances through competition in the countries of origin
- Have a positive impact on reliability of research results in phytotherapy



The example of saffron

Crocus sativus:

- National heritage of Mediterranean and Middle East countries
- Highly interesting medicinal virtues
- Very expensive
- Obscured origin: „Spanish saffron“
- Frequently adulterated



Saffron: Exclusively from cultivation



1 kg of saffron corresponds to 150.000 flowers!
World market price approx. 1.000-1.500 US\$/kg

Producing countries

Production in all Mediterranean and Middle East countries

- Indication of origin often doubtful!
- Spain is thought to be the major producer, but:
- There is 100 times more Spanish saffron on the market than cultivated in Spain!
- In fact, Iran produces 85% of the world market of saffron!



Saffron in phytotherapy

Traditional medicine and pharmacological research:

- Tonic, Concentration enhancing
- Antidepressant
- Gastrointestinal
- Tumour-preventive
- Aphrodisiac
- Anti-stress and immunomodulating
- Antioxidative
- Cardiovascular



Phytochemistry

Three interesting fractions:

- Terpenes: Safranal
- Crocin/Crocetin (Tumour-protective, memory-enhancing, cardiovascular)
- Xanthones: Mangiferin (anxiolytic, anti-stress)



Quality issues of saffron

Frequent fraudulent adulterations, e.g.

- Tiny red-coloured paper strips
- Meat fibres
- Anilin dyes
- Strips of flowers of Calendula or other red species
- Pre-extracted and dried stigmates



Adulterations

Current study of the „Direction générale pour le repression des fraudes“ (France):

102 samples of commercial saffron examined
85 samples adulterated!!!



Toxicological consequences

Toxicological observations partly due to adulterated material!

→ Similarity of names of *Crocus sativus* (left) and „Meadow Crocus“ = *Colchicum autumnalis* (right) origin of various cases of toxicity



Developmental project

- Controlled cultivation of saffron with full traceability in the Middle East
- Screening project for chemovars
- Screening in pharmacological models
- Phytochemical examinations
- Development of galenical application forms



Controlled cultivation

Medicinal&Aromatic Plants R&D + HerbResearch:

- Experience with controlled cultivation with full traceability
- Agricultural research programs on quality of saffron by optimization of *Crocus* propagation and harvesting techniques



Galenical formulations

Studies in progress:

- Development of a standardized liquid extract
- Development of methods for the transformation into dry extracts
- Stability testing



The example of Hoodia

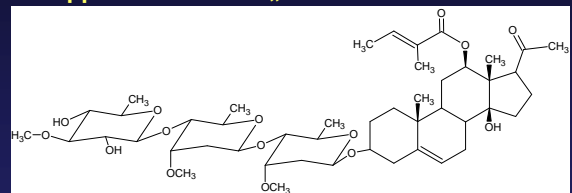
Hoodia gordonii:

- Native to Southern Africa
- Cactus-like Asclepiadacea
- Weight-loss activity
- Antidiabetic and cardioprotective
- Rapid rarification due to overharvesting
- Frequently adulterated



Phytochemistry

Triterpene-Steroid-Fraction with appetite suppressive action: „P57“



3-O-(β -D-Thevetopyranosyl-(1 \rightarrow 4)- β -D-cymaropyranosyl-(1 \rightarrow 4)- β -D-cymaropyranosyl)-12- β -O-tigloyloxy-14-hydroxy-14- β -pregn-5-en-20-one

Wild crafting

Problem:

- Uncontrolled wild crafting leads to dramatic reduction of natural resources
- Products increasingly adulterated!
- Fraction „P57“ not detectable in many Hoodia products

Adulterations

Possible sources of adulterants or inferior quality:

- Mexican Asclepiadaceae devoid of P57
- Possibly powders of Opuntia (Prickly pear) sold as Hoodia
- Chinese and Eastern Europe plant powders of unknown origin



Traceability

Solution: Controlled cultivation

But: Slow growth rate requires good planning!



Cultivation of Hoodia gordonii in South Africa

Research projects

- Phytochemical screening of Hoodia species (running)
- Clinical research with traceable and well-characterized plant material (planned)



Summary

Goals already achieved:

- Implementation of a controlled cultivation of saffron and Hoodia with full traceability according to WHO GACP standards
- Development of galenical forms of saffron extracts

Projects still running:

- Botanical and phytochemical screening of saffron and Hoodia species
- Stability testing of saffron extracts

Projects in preparation:

- Pharmacological testing of traceable Saffron and Hoodia samples

Summary

Thank you for your attention!

