

Pflanzenprodukte

Wie gut qualitätsgesichert sind die einzelnen Produktkategorien?

Michael Heinrich

Research Cluster 'Biodiversity and Medicines', UCL School of Pharmacy

London, UK

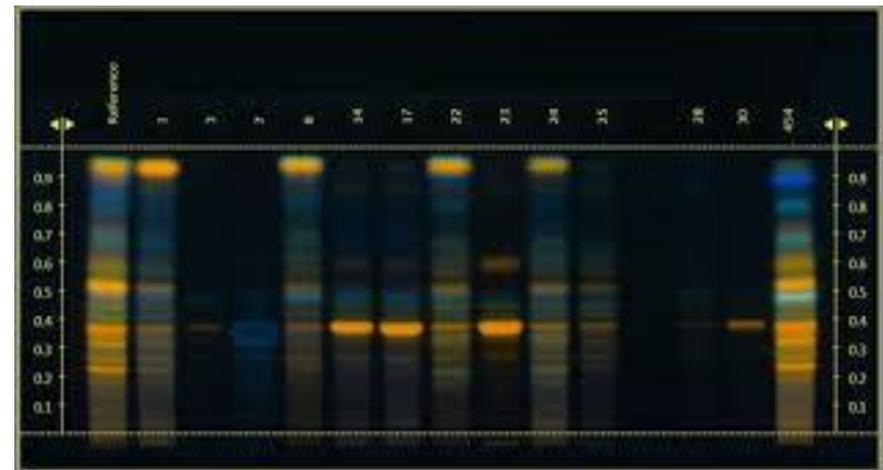
Trust me – I am a doctor (BBC 2) July 2015



In our study 40% of all unregulated products (from the internet and high-street) do not contain what they claim to contain

The BBC & regulatory bodies.

- MHRA: Food supplements are not under their jurisdiction
- FSA responded that they would investigate any individual complaint from a consumer. No action so far.



Main groups of 'botanicals' (UK)

- Very few licensed products (Cannabis, some Echinacea preparations, Senna, some valerian preparations)
- Registered traditional herbal medicines (Traditional Use Directive)
- Food supplements (generally not covered by any licensing)



Main groups of 'botanicals' (Germany)

- Mostly licensed medical products
- Registered traditional herbal medicines (Traditional Use Directive)
- Food supplements (generally not covered by any licensing)



Food or Medicine? The regulatory perspective

	UK	Australia	Russia	USA	Germany
Ginkgo	Food Suppl. (Trad. Med.)	Listed med.*	Food Suppl.	Food Suppl.	Medicine
Echinacea	Medicine/ trad med / Food Suppl.	Listed med.*	Medicine	Food Suppl.	Medicine
Cimicifuga	Traditional Medicine	Listed med.*	Medicine/ Food Suppl.	Food Suppl.	Medicine
Siberian ginseng	Food Suppl.	Listed med.*	Medicine	Food Suppl.	Medicine
Mangosteen	Food	Food	Food	Food/ Food Suppl.	Food

The challenges in globalising markets

Booker et al. (2014) Chemical variability along the value chains of turmeric. *Journal of Ethnopharmacology* 152: 292-301.

From Local to Global: Commodification of local resources



The Welfare Effects of Trade in Phytomedicines: A Multi-Disciplinary Analysis of Turmeric Production

ANTHONY BOOKER ^{a,b}, DEBORAH JOHNSTON ^{a,c} and MICHAEL HEINRICH ^{a,b,*}

World Development 77, 221-230, 2016

When production is for the organic northern market, we found evidence of a “captive” value chain, where the lead firm requires strict adherence to conditions of production and processing. Prices for farmers were relatively stable, at a reasonably high level. In contrast, where farmers were producing for local markets, including the major auction at Erode, prices were volatile and farmers bore considerable risk. We found that competition and volatility in the market-based chain can lead to turmeric adulteration and contamination, both intentional and unintentional. Our case study suggests that many small turmeric farmers would find it difficult to meet both public and private health standards, in contrast to some academic literature that argues that public health standards do not discriminate against small farmers. More than this, our study adds to the discussion of the impact of standards, suggesting clear consumer benefits in northern markets.

Rhodiola crenulata collection
(China 2015, T, Booker

**Phytomedicine 2015,
doi:10.1016/j.phymed.2015.10.006**

Rhodiola rosea

= *Sedum roseum* (L.) Scop.,

First introduced as an
'adaptogen'

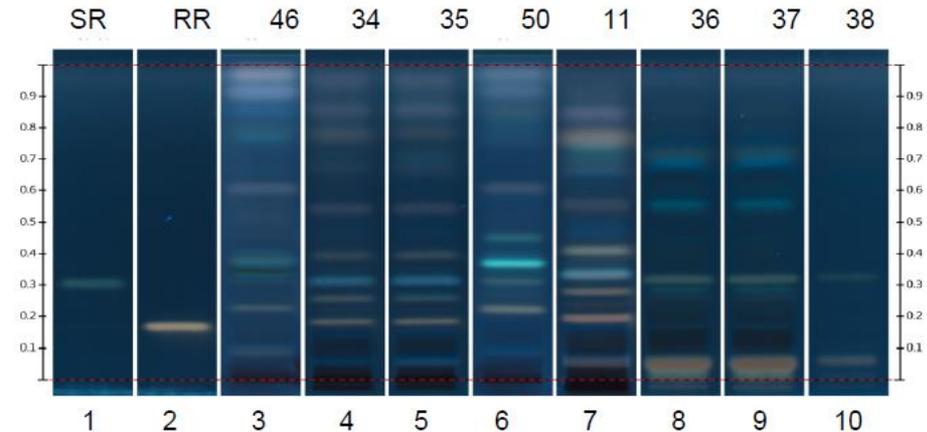
A high-value herbal medicinal product, registered in the UK for the treatment of stress-induced fatigue, exhaustion and anxiety and widely used in many countries also as a sports supplement.



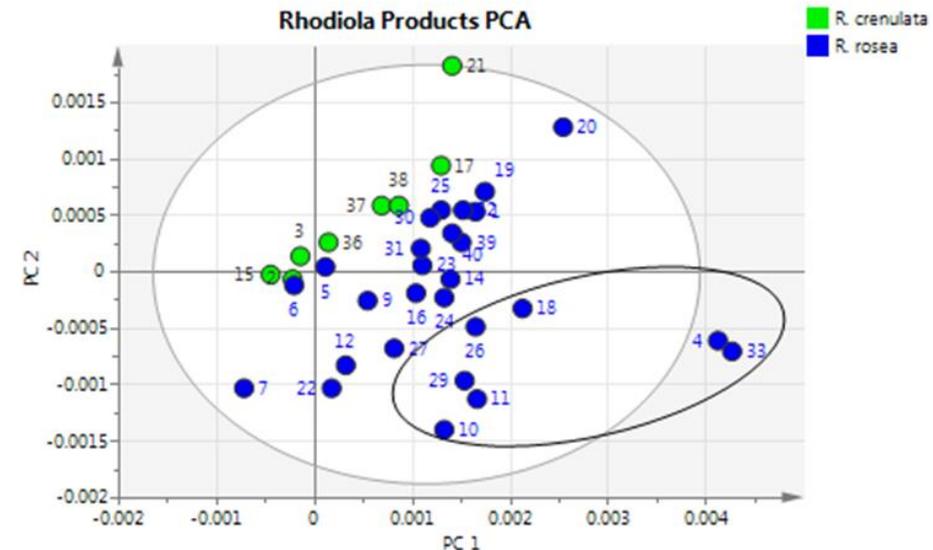
Mostly collected from the wild

Approximately 45 products were sourced on the internet or bought from retail outlets

Our analysis of Rhodiola products showed that a quarter of products were adulterated with the wrong species.



Sample no.	Claim	Findings
2	Rhodiola rosea sourced in China	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
3	Whole dried root of <i>Rhodiola rosea</i>	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
8	<i>Rhodiola rosea</i> extract 2000 mg, wild-sourced from Siberia	Not <i>R. rosea</i> or any other <i>R.</i> species. Determined as 5-HTP and excipients
13	<i>Rhodiola rosea</i> root 1000 mg	Probably not <i>Rhodiola</i> species, appears adulterated
15	<i>Rhodiola rosea</i> plus multivitamins standardised to contain 3% rosavins and 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
17	<i>Rhodiola rosea</i> standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
21	<i>Rhodiola rosea</i> standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i> . Probable high sugar content



BOOKER, A., JALIL, B., FROMMENWILER, D., REICH, E., ZHAI, L., KULIC, Z. & HEINRICH, M. The authenticity and quality of *Rhodiola rosea* products. *Phytomedicine*.

Sample no.	Claim	Findings
2	Rhodiola rosea sourced in China	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
3	Whole dried root of <i>Rhodiola rosea</i>	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
8	<i>Rhodiola rosea</i> extract 2000 mg, wild-sourced from Siberia	Not <i>R. rosea</i> or any other <i>R. species</i> . Determined as 5-HTP and excipients
13	<i>Rhodiola rosea</i> root 1000 mg	Probably not <i>Rhodiola species</i> , appears adulterated
15	<i>Rhodiola rosea</i> plus multivitamins standardised to contain 3% rosavins and 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
17	<i>Rhodiola rosea</i> standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
21	<i>Rhodiola rosea</i> standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i> . Probable high sugar content

Sample no.	Claim	Findings
------------	-------	----------

Products registered under the THR were all shown to be of good and consistent quality

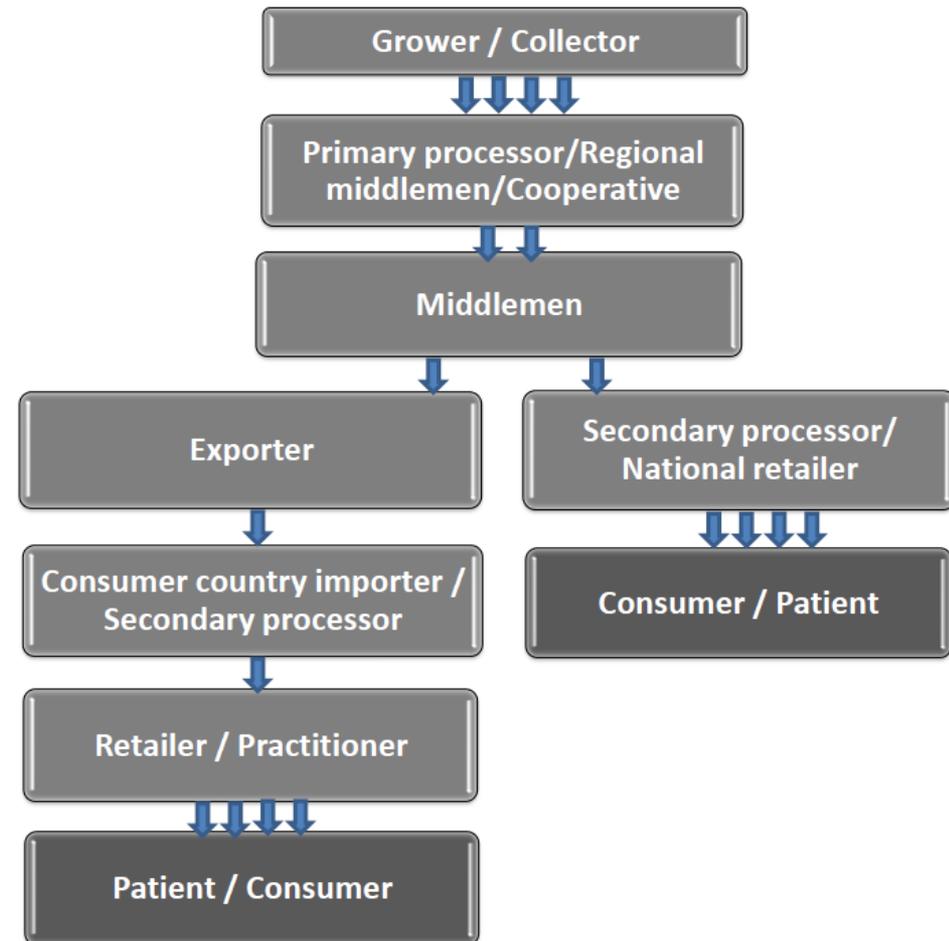
17	Rhodiola rosea standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i>
21	Rhodiola rosea standardised to contain 1% salidroside	Not <i>R. rosea</i> , probably <i>R. crenulata</i> . Probable high sugar content

**A KEY CHALLENGE:
UNDERSTANDING DIFFERENT
VALUE CHAINS OF HERBAL
MEDICAL PRODUCTS /
SUPPLEMENTS**

An industrial value chain

- Generally many producers, diverse levels of middlemen and producers.
- Driven by external demand
- Limited control by the producer(s)
- Strong addition of value is possible

D. THE INDUSTRY CHAIN I



- 24% of unregistered products did not meet product label specifications and were likely to be adulterated by unknown plant species. Indiscriminant collection from the wild is likely to be a contributory factor.
- 75% of products contained less rosavins than contained in a product registered under the THMPD.
- Products with a traditional use registration were found to be of the correct species
- This project highlights the dangers of obtaining herbal medicines that are unlicensed or have not been registered.

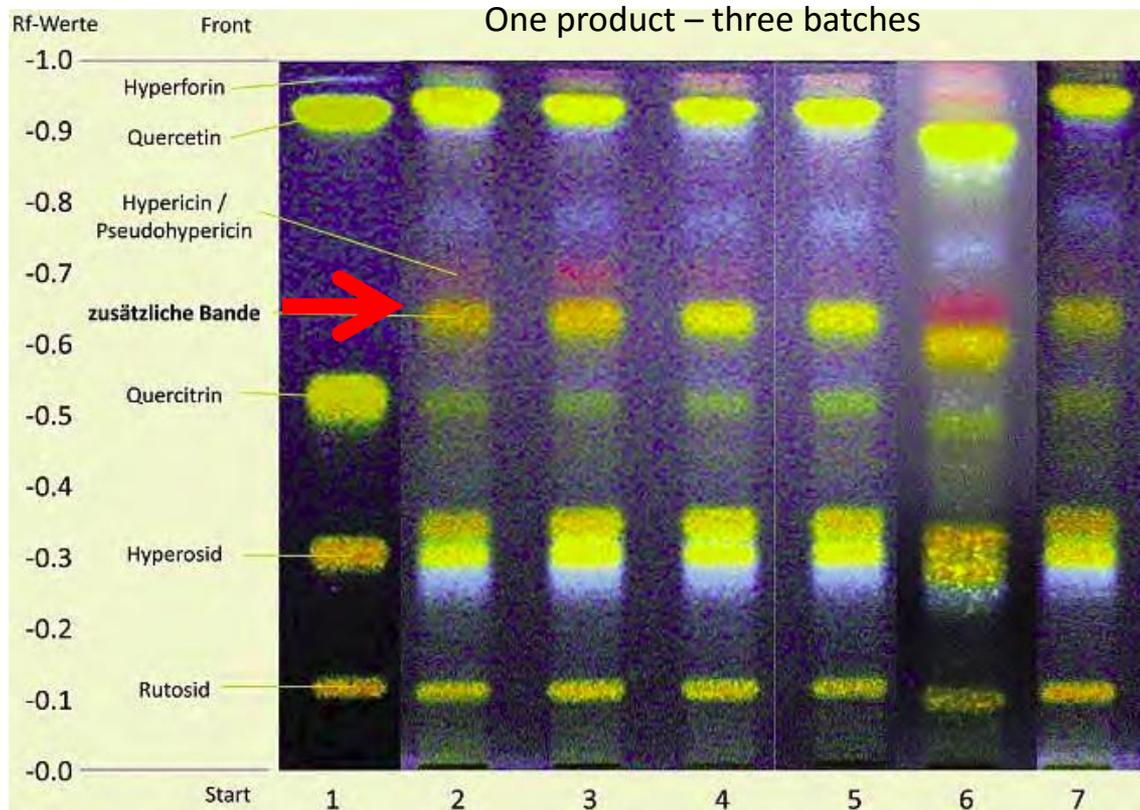


USA

Three leading non-profit organizations—the American Botanical Council (ABC), the American Herbal Pharmacopoeia (AHP), and the University of Mississippi's National Center for Natural Products Research (NCNPR)—have initiated a large-scale program to educate members of the herbal and dietary supplement industry about ingredient and product adulteration.

<http://cms.herbalgram.org/BAP/BotanicalAdulterantsIndex.html#AbouttheProgram>

Is this only a problem ‘abroad’?



And there are the challenges we have not (yet) looked at:

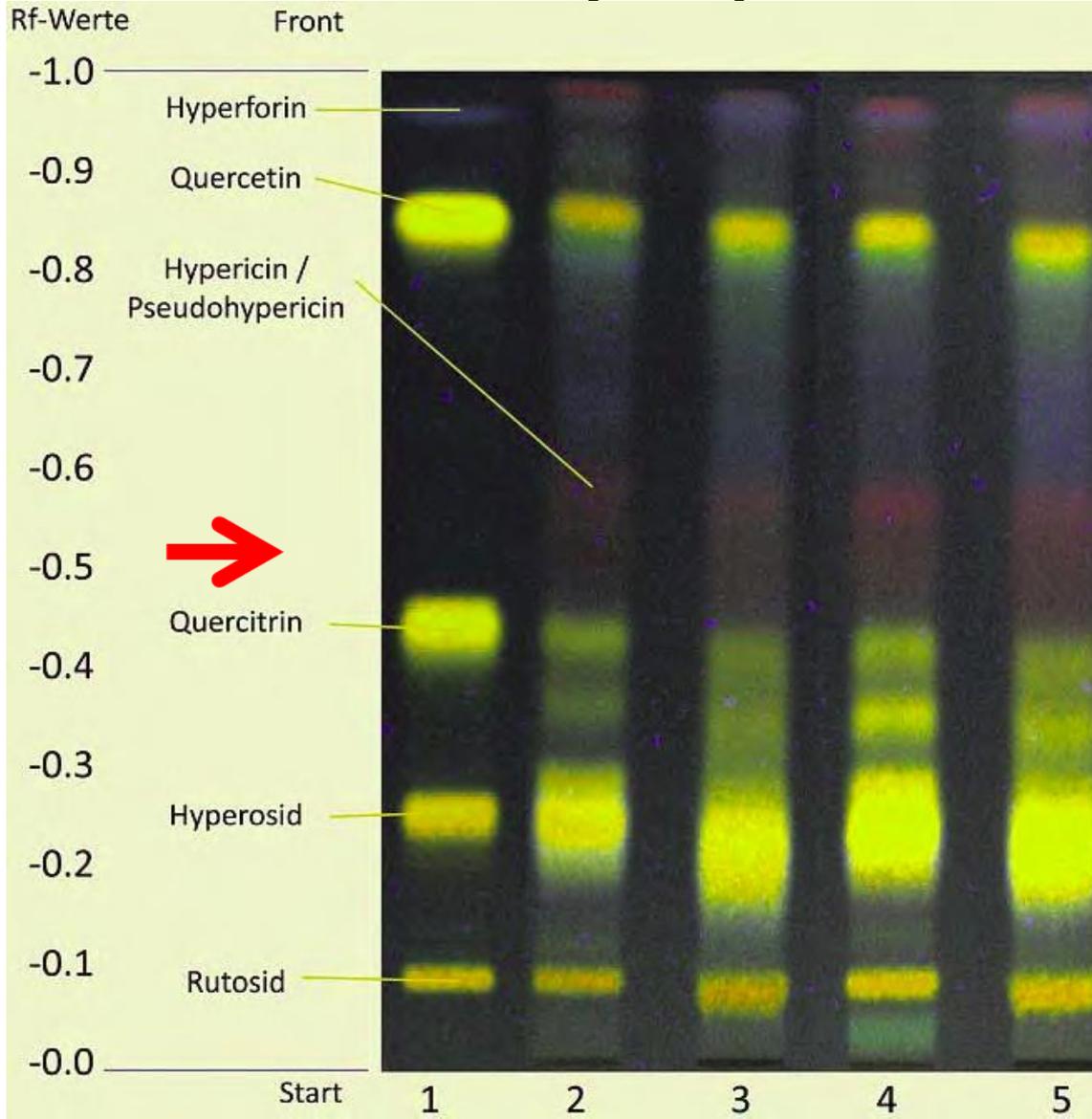
- Pesticides
- Herbicides
- Heavy metals
- Stability,
- Microbiological contamination
-

Poor quality St. John's Wort preparations in German supermarket products ('freiverkaufliche Arzneimittel')

KFN-Presskonferenz 2.12.2015

Abdel-Tawab, et al. 2011, Pharmazeutische Zeitung 156, 46

Is this only a problem 'abroad'?



Pharmacy only, fully regulated products (Apothekenpflichtige Präparate) are of consistent and good quality and show no extra bands

Abdel-Tawab, et al. 2011, Pharmazeutische Zeitung 156, 46

Example Pelargonium products Germany

- Different phytochemical composition of

– P. sidoides



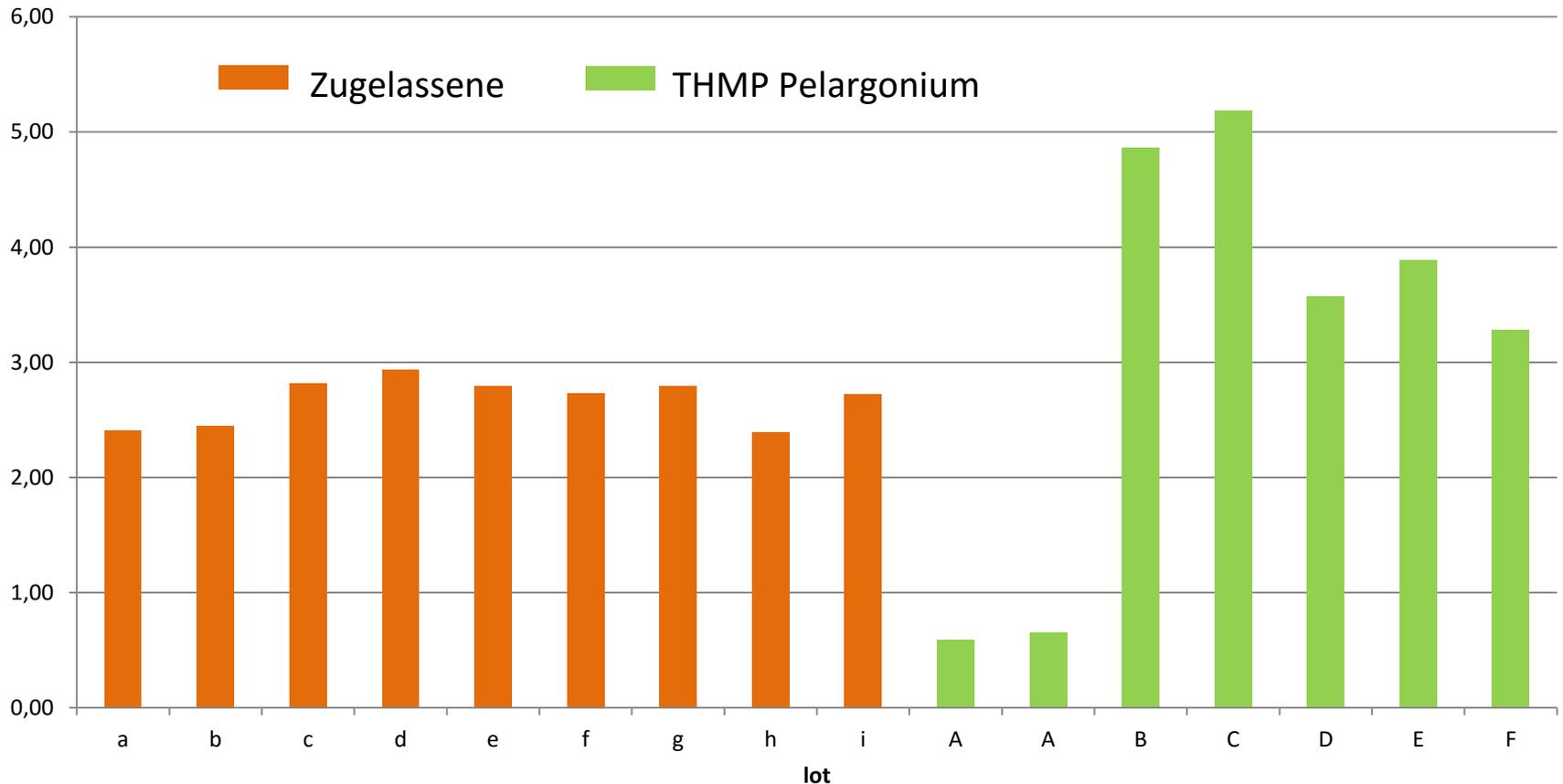
– P. reniforme



Inhaltsstoff	P. reniforme	P. sidoides
Phenolic acids, phenylpropanoids and derivatives		
Galic acid	+	+
Galic acid methyl ester	+	+
p-Hydroxybenzoic acid	+	
Protocatechuic acid	+	
Vanillic acid	+	
Caffeic acid	+	
Ferulic acid	+	
p-Coumaric acid	+	
p-Coumaraldehyde	+	
Shikimic acid		
Shikimic acid 3-O-gallate	+	+
Coumarins		
6,7-Dioxygenation		
7-Hydroxy-6-methoxycoumarin (Scopoletin)	+	+
5,6,7-Trioxxygenation		
7-Hydroxy-5,6-dimethoxycoumarin (Umckalin)		+
7-Acetoxy-5,6-dimethoxycoumarin		+
5,6,7-Trimethoxycoumarin		+
6-Hydroxy-5,7-dimethoxycoumarin (Fraxinol)	+	
5,6-Dihydroxy-7-methoxycoumarin (Isofraxetin)	+	
6,7,8-Trioxxygenation		
6,7,8-Trihydroxycoumarin	+	+
6,8-Dihydroxy-7-methoxycoumarin		+
8-Hydroxy-6,7-dimethoxycoumarin (Fraxidin)	+	
7,8-Dihydroxy-6-methoxycoumarin (Fraxetin)		+
5,6,7,8-Tetraoxxygenation		
6,8-Dihydroxy-5,7-dimethoxycoumarin		+
5,6,7,8-Tetramethoxycoumarin (Artelin)	+	+
8-Hydroxy-5,6,7-trimethoxycoumarin	+	+
Coumarin glycosides		
Magnolioside		+
Isofraxoside		+
Umckalin-7-b- glucoside		+
Coumarin sulfates		
5,6-Dimethoxycoumarin-7-sulfate		+
6,7-Dihydroxycoumarin-8-sulfate		+
6-Hydroxy-5,7-dimethoxycoumarin-8-sulfate		+
8-Hydroxy-5,7-dimethoxycoumarin-6-sulfate		+
Flavonoids		
Kaempferol-3-O-b- glucoside	+	
Kaempferol-3-O-b- galactoside	+	
Quercetin-3-O-b- glucoside	+	
Myricetin-3-O-b- glucoside	+	
Flavan-3-ols/Proanthocyanidins		
Afzelechin	+	
Catechin	+	+
Gallocatechin	+	+
Proanthocyanidins	+	+
Miscellaneous		
Reniformin	+	
b-Sitosterol	+	+
b-Sitosterol-3-O-b- glucoside	+	

Licensed vs. THMP Pelargoniumproducts

Polyphenol-content Ph. Eur. [mg / ml]



➤ Fully licensed and THMP product differ in quality and composition

Value chains: Where can things go wrong?



High confidence in quality of the starting material from beginning stages of manufacture

Batch integrity is maintained throughout processing. In-house quality control

Tightly controlled processing leads to consistently high quality products.

High confidence in product integrity during specified shelf-life

Consumer is able to have confidence that the product is safe and of high quality

* Lack of botanical knowledge can result in misidentification of species

* Poor controls, including poor container packaging and storage can lead to development of spoilage organisms

* Lack of standard procedures results in poor quality finished products

* Prolonged shelf life can lead to deterioration of product due to spoilage organisms

* Variable quality and safety. Consumers are less informed about product

There are numerous bottlenecks along the complex value chains of HMPs, which may result in poor quality products.

Registered / Licensed products have to comply with the regulatory requirements providing better patient safety

Regulation and enforcement – The key challenges

- Regulation offers better protection of consumers / patients
- Licensed medical and THR products simply are under rigorous quality assurance and management
- For poorly or unregulated products, there is a need to ascertain adequate enforcement of existing standards. In this regard, the situation in Germany is certainly much more beneficial for consumers.