

FHH における東アジア地域の生薬・薬用植物の国際調和の現状

(独) 医薬基盤研究所 薬用植物資源研究センター 川原 信夫

1. はじめに

近年、漢方薬あるいは生薬への関心が高まる中で、名称の類似、同名異物等の問題が表面化してきている。生薬の安全性を確保し、有効利用を考える上で、生薬の正しい認識と理解が必須であり、各国で使用されている生薬に関する情報を収集、整理し、共通認識を得ることは生薬、薬用植物の国際調和の観点からも非常に重要と考えられる。このような背景から2002年3月に北京において「生薬・薬用植物に関する国際調和のための西太平洋地区討論会 (FHH)」設立のための国際会議が開催された。本フォーラムでは、西太平洋地区の6カ国7地域（日本、中国、韓国、ベトナム、シンガポール、オーストラリア、香港）の生薬・薬用植物の規制に関する関係者が一堂に会し、生薬・薬用植物の安全性、有効性及び品質に関する技術的な記録とコンセンサスを提供することが目的に掲げられた。日本はその下部組織である Nomenclature and Standardization に関する Sub-Committee 会議を主催することを受諾し、2002年5月、FHH 東京会議が開催された。本会議において以下の5つの専門部会 (Expert working group, EWG) が設立された。

EWG1: Nomenclature

EWG2: Testing Method in Monographs

EWG3: List of Chemical Reference Standards (CRS) and Reference of Medicinal Plant Materials (RMPM)

EWG4: List of Analytically Validated Method

EWG5: Information on General Test

これらの専門部会では、それぞれの分野における各国薬局方の比較表を作成することが課題事項として議決され、EWG 2の責任者となった著者は、試験法及び規格値に関する比較表の作成につ

いて担当することとなった。本稿では、主として著者が FHH の専門部会において取り組んできた各種比較表の作成並びに比較検討により得られた知見の概要について説明する。

2. 西太平洋地区4カ国（日本、中国、韓国、ベトナム）の薬局方収載生薬の比較検討について

1) 各種試験法並びに規格値の比較¹⁾

EWG 2では将来的な国際調和を踏まえ、各国の薬局方収載生薬について共通点と相違点を認識すること目的として、日本、中国、韓国、ベトナム4カ国の薬局方に収載された生薬の試験法並びに規格値について比較表を作成し、比較検討を行った。比較表は、EWG 1 (Nomenclature) の責任者である酒井博士が作成した共通生薬 (103種) の比較表をもとに各国の確認試験、純度試験、乾燥減量、灰分、酸不溶性灰分、エキス含量及び定量法の各項目について試験法の設定の有無、試験方法、規格値について作成した。

各国の各種試験法の比較に関して作成した表の一例を表1に示す。この結果、4カ国局方すべてにおいて共通の基原植物に由来する生薬は57種であった。4カ国共通生薬57種に関して比較を行った場合、確認試験、純度試験、灰分の3項目についてはすべての局方においてほぼ設定がなされており、特に TLC 法を用いた確認試験が普及していることが明らかとなった。一方、乾燥減量、酸不溶性灰分、エキス含量等は設定されていない国が多かった。また、定量法に関してはカンゾウ、ボタンピ、ホミカにおいて共通の指標成分が各局方に設定されていたが、試験法や規格値に相違点が認められた。

本比較表より、東アジア地区4カ国の薬局方の

表1 各国薬局方における生薬関連試験法及び規格値の比較（部分抜粋）

No.	Latin name	Identification / Purification (1) Identification, (2) Not available, (3) Not available, (4) Not available	Loss on drying	Total ash	Sulfur content (5) Not available	Extract content	Assay (Amount of content)
1	<i>Adiantum species Blume</i>						
	JP RADIX ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP RADIX ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
2	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
3	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
4	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
5	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
6	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
7	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
8	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
9	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
10	<i>Albizia speciosa</i>						
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%	7.0% (Dried extract)	0

共通点、相違点が明らかとなった。特にベトナム薬局方（VP）と中華人民共和国薬典（CP）、また日本薬局方（JP）と大韓民国薬局方（KP）の間にはそれぞれ共通点が多かった。これは局方作成に当り、VPはCPをKPはJPをそれぞれ参考にして作成されているため、このような結果が得られたものと推測された。

2) 確認試験における TLC 条件及び定量法における分析条件の比較²⁾

本検討では前述の比較研究において対象とした共通生薬103種に、CP 2005年版において基原植物の変更、追加等が確認されたモクツウ、ケイガイ、ソボクの3生薬を加えた106種を対象生薬とした。これらの生薬をもとに各国の確認試験における TLC 条件（展開溶媒、検出方法、呈色、指標成分）

表2 各国薬局方の確認試験法における TLC 条件の比較（部分抜粋）

No.	Latin name	TLC condition (1) Developing solvent	(2) detection	(3) color tone on TLC	(4) marker compounds
1	<i>Adiantum species Blume</i>				
	JP RADIX ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP RADIX ADIANTUM SPECIES BLUMAE	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
2	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
3	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
4	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
5	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
6	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
7	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
8	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
9	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
10	<i>Albizia speciosa</i>				
	JP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	CP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%
	VP ALBIZIA SPECIOSA	(1) (2) (3) (4)	(1) 10.0%, Max	(1) 5.0%	(1) 5.0%

表3 各国薬局方の定量法における試験条件の比較 (部分抜粋)

No.	Latin Name	Assay (1: Not less than)	(2) method	(3) developing solvent	(4) detection
1	<i>Asarum canadense</i> Linné JP <i>ASARUM ACUTUM</i> RADIX	Total Alkaloids 5.7-7.4% (Type 1), 8.1-9.4% (Type 2), 9.4-9.8% (Type 3)	Titration		
2	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	Fluorescence / Light Scattering method
3	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
4	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	Fluorescence / Light Scattering method
5	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column), 15-40 min a 10-20 min, 5-10 min	1) acetonitrile / water (20 : 80) 2) adjust flow rate to elute Epigallocatechin at ca. 8 min	UV 254 nm
6	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column), 15-40 min a 10-20 min, 5-10 min	1) acetonitrile / water (20 : 80) 2) adjust flow rate to elute Epigallocatechin at ca. 8 min	UV 254 nm
7	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
8	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
9	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
10	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
11	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
12	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
13	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
14	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
15	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
16	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
17	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
18	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
19	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
20	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
21	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
22	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
23	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
24	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
25	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
26	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
27	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
28	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
29	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
30	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
31	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
32	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
33	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
34	<i>Asarum canadense</i> Sieber JP <i>ASARUM ACUTUM</i> RADIX	Epigallocatechin 1.0%	HPLC (2006 column)	acetonitrile / water (20 : 80)	UV 254 nm
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並びに各種試験法を用いた定量法における分析条件（試験方法、溶出溶媒、検出方法）の詳細について比較表を作成した。

確認試験の比較に関して作成した表の一例を表2に示す。この結果、TLC法を用いた確認試験が設定されている生薬は106種の共通生薬のうち89種で、これらのうち4カ国局方すべてにおいて設定されている生薬は15種であった。また、TLCの指標成分に関しては、72生薬に何らかの指標成分が設定されており、特にインヨウカク、サンシシ、シャクヤク、ボタンピの4生薬は4カ国局方すべてにおいて同一の指標成分が設定されていた。

一方、定量法の比較に関して作成した表の一例を表3に示す。定量法が設定されている生薬は106種の共通生薬のうち69種で、これらのうちマオウ、カンゾウ、ボタンピ、オウゴン、ホミカの5生薬は、4カ国すべての局方に定量法が設定されていた。確認試験におけるTLC条件に関してCP及びVPではTLC法に使用する溶媒の種類が非常に多く、かつ多成分系の条件が設定されているのが特徴であると考えられた。定量法に関し

ては、VPでは未だにHPLCによる分析法が確立されておらず、また定量法が設定されている生薬も少なかった。一方、CP 2005年版では2000年版と比較してHPLC法を設定した生薬が飛躍的に増加しており、さらにELSD法等、新たな検出機器の導入も認められた。

3) 生薬関連一般試験法の比較³⁾

我々はさらにEWG 5 (Information on General Tests) の課題事項である4カ国の薬局方に収載された生薬関連一般試験法を精査し、各国の生薬試験法（試料の採取、異物、分析用試料の作成、乾燥減量、灰分、酸不溶性灰分、エキス含量、精油含量、鏡検、重金属、ヒ素等）の各項目について試験法の設定の有無、試験方法について比較表を作成した。

生薬関連一般試験法の比較に関して作成した表の一例を表4に示す。この結果、JPとKPの試験項目、記載内容はほぼ同一であった。他方、CPとVPの試験項目、記載内容はほぼ同一であった。また、鏡検に関してJP及びKPでは装置、鏡検用プレパラートの作成及び性状の項の各要素の観察の

表4 各国薬局方における生薬関連一般試験法の比較 (部分抜粋)

JP	KP	CP	VP
Sampling Unless otherwise specified, sample should be taken by the following methods. If necessary, preserve the samples in light containers. (1) When crude drugs to be sampled are small-sized, cut or powdered, 90 to 200 g of sample should be taken after mixing thoroughly. (2) When crude drugs to be sampled are large-sized, 200 to 300 g of sample should be taken after mixing thoroughly. (3) When the mass of each single piece of the crude drug is not less than 100 g, not less than 3 pieces should be taken for a sample, or not less than 400 g of the sample should be taken after cutting to a suitable size and mixing thoroughly.	Sampling Unless otherwise specified, sample should be taken by the following methods. If necessary, preserve the samples in light containers. (1) When crude drugs to be sampled are small-sized, cut or powdered, 90 to 200 g of sample should be taken after mixing thoroughly. (2) When crude drugs to be sampled are large-sized, 200 to 300 g of sample should be taken after mixing thoroughly. (3) When the mass of each single piece of the crude drug is not less than 100 g, not less than 3 pieces should be taken for a sample, or not less than 400 g of the sample should be taken after cutting to a suitable size and mixing thoroughly.	Sampling of Crude Drugs Sampling of crude drugs refers to the method used to test the crude drugs for examination. The validity of sampling affects directly the precision and accuracy of the examination. The procedure for sampling should be followed in detail. 1. Examine the condition of the mass, source of material, specification and package form of the cargo before sampling. Examine the moisture, cleanliness of package and contamination of insects and foreign matter; make notes in detail. The abnormal packages should be examined separately. 2. The general requirements for sampling of crude drugs in a consignment are as follows: when the total number of packages less than 5, the packages are sampled one by one; 5-99 packages, 5 packages are sampled at random; 100-1000 packages, 5% are sampled; more than 1000 packages, 1% of the part in excess of 1000 packages are sampled. Precise crude drugs are sampled one by one, regardless of the number of packages. 3. If the material is in crushed or powdered form or in pieces of less than 1 cm in size, at least 3-4 portions of sample are taken by suitable means from different parts in each package. If volume of package is large, sample taken should be 10 cm in depth below the surface from different parts. The quantity of samples taken is defined as follows: Crude drugs: 100-200 g Powdered drugs: 50 g Precious drugs: 10 g As for the drugs of large size or large number, representative samples can be taken on the basis of real situation. 4. Mix the samples thoroughly. 1. 5. The total quantity of samples taken. If the total weight of samples taken is several times that required for the testing, take an average sample by quartering, and sufficient quantity of sample is obtained for testing and retention. 5. The quantity or average sample taken should be not less than 3 times of that required for the testing, using one third for analysis, another one third for verification and the remaining as retention which should be kept.	SAMPLING OF CRUDE DRUGS Sampling of crude drugs refers to the method used to test the crude drugs for examination. The representativeness of sample affects directly the precision and accuracy of the examination. Attention should be paid to the following points while sampling: (a) Verify the name, source of the material, specifications and forms of packages before sampling. Examine the moisture, cleanliness of the packages, the contamination of insects and foreign matter, make notes in detail. Abnormal packages should be examined more carefully. (b) The general requirements for sampling of crude drugs are as follows: For a number of packages: less than 5, every package is sampled; less than 100, 5 packages are sampled; from 100 to 1000, 5% of packages are sampled; over 1000, 1% packages and 1% of the number in excess of 1000 packages are sampled. For precious crude drugs every package is sampled, regardless of the number of packages. (c) If the material is in scraps or powder form or in pieces of less than 1 cm in size, at least 3-4 portions of sample are taken by suitable means from different places in each package. If the number of packages is small, the amount of sample taken should be not less than 3 times the quantity required for testing. If the number of packages is large, the amount of sample taken is as follows: Common drugs: 100-200 g Powdered drugs: 50 g Precious drugs: 10 g (unless otherwise specified) For the drugs in large size, a representative sample can be taken from the drugs in large size (at 10 cm in depth below the surface for large packages). (d) Mix the samples taken as required for the test sample. If the sample size of drug is small, take an average sample by quartering method as follows: Mix the sample thoroughly in a mortar (after mixing thoroughly) in a mortar, then divide the sample into 4 equal parts by diagonals, take two opposite parts and mix again. With the mixture obtained, repeat the quartering in the same way until a sufficient amount of sample is obtained for testing and retention. In the case of large size drugs, the average samples can be obtained with any appropriate methods. The amount of an average sample should be not less than 3 times of that required for testing, using one third for analysis, another for verification and the remaining as retained sample which should be kept at least for one year.
Foreign matter Unless otherwise specified, weigh 25 to 100 g of the sample, spread out in a thin layer, and separate the foreign matter by inspecting with the naked eye or with the use of a magnifying glass of 10 magnification. Weigh, and calculate the percentage of foreign matter.	Foreign matter Unless otherwise specified, weigh 25 to 100 g of the sample, spread out in a thin layer, and separate the foreign matter by inspecting with the naked eye or with the use of a magnifying glass of 10 magnification. Weigh, and calculate the percentage of foreign matter.	Determination of Foreign Matter Foreign matter consists of any of all of the following: 1. The foreign origin of which is the same as that specified in the monograph concerned but the appearance or botanical parts is different. 2. The botanical origin of which differs from that specified in the monograph concerned. 3. Foreign natural matters such as stones, sand, lumps of soil. (1) Weigh a quantity of the drug as specified in the monograph and spread out in a thin layer. Detect the foreign matter by inspection with naked eye or with a lens (5-15 X), or by the use of a suitable sieve, if necessary. To separate the foreign matter, use a suitable sieve, if necessary. Weigh the foreign matter and calculate the percentage content.	DETERMINATION OF FOREIGN MATTER IN CRUDE DRUGS Foreign matter in crude drugs consists of any of all of the following: Foreign natural matter such as stones, sand, lumps of soil. Other matter and other parts of the plant that are not specified as crude drugs. Methods of testing: Weigh a quantity of the crude drug as specified in the monograph and spread out in a thin layer. Detect the foreign matter by inspection with naked eye or with a lens or by use of a suitable sieve, if necessary. To separate the foreign matter, weigh the foreign matter and calculate the percentage, using the expression: $\frac{\text{Weight of foreign matter (g)}}{\text{Weight of test sample being examined (g)}} \times 100$
Preparation of the test sample for analysis Preparations are to be made by mixing the sample well. Powdered drugs should be used as they are, and in the case of uncrushed drugs, crushes otherwise specified, grind the sample into powder. If the sample cannot be ground into powder, reduce it as finely as possible, spread it out in a thin layer, and withdraw a typical surface for analysis. If necessary, preserve the test sample in a light container. Loss on drying	Preparation of the test sample for analysis Preparations are to be made by mixing the sample well. Powdered drugs should be used as they are, and in the case of uncrushed drugs, crushes otherwise specified, grind the sample into powder. If the sample cannot be ground into powder, reduce it as finely as possible, spread it out in a thin layer, and withdraw a typical surface for analysis. If necessary, preserve the test sample in a light container. Loss on drying	Preparation of the test sample for analysis Preparations are to be made by mixing the sample well. Powdered drugs should be used as they are, and in the case of uncrushed drugs, crushes otherwise specified, grind the sample into powder. If the sample cannot be ground into powder, reduce it as finely as possible, spread it out in a thin layer, and withdraw a typical surface for analysis. If necessary, preserve the test sample in a light container. Loss on drying	Preparation of the test sample for analysis Preparations are to be made by mixing the sample well. Powdered drugs should be used as they are, and in the case of uncrushed drugs, crushes otherwise specified, grind the sample into powder. If the sample cannot be ground into powder, reduce it as finely as possible, spread it out in a thin layer, and withdraw a typical surface for analysis. If necessary, preserve the test sample in a light container. Loss on drying
Loss on drying Unless otherwise specified, transfer 2 to 3 g of the test sample for analysis to a tared weighing bottle, and weigh accurately. Dry at 100°C for 3 hours, since it is used in a desiccator (unless specified), and weigh accurately. Continue the drying at 100°C, and weigh accurately at 1-hour intervals.	Loss on drying Unless otherwise specified, transfer 2 to 3 g of the test sample for analysis to a tared weighing bottle, and weigh accurately. Dry at 100°C for 3 hours, since it is used in a desiccator (unless specified), and weigh accurately. Continue the drying at 100°C, and weigh accurately at 1-hour intervals.	Loss on drying Unless otherwise specified, transfer 2 to 3 g of the test sample for analysis to a tared weighing bottle, and weigh accurately. Dry at 100°C for 3 hours, since it is used in a desiccator (unless specified), and weigh accurately. Continue the drying at 100°C, and weigh accurately at 1-hour intervals.	Loss on drying Unless otherwise specified, transfer 2 to 3 g of the test sample for analysis to a tared weighing bottle, and weigh accurately. Dry at 100°C for 3 hours, since it is used in a desiccator (unless specified), and weigh accurately. Continue the drying at 100°C, and weigh accurately at 1-hour intervals.

各小項目で比較的簡単に記載されているのに対し、CP 及び VP では崩壊した組織のスライド作成法、花粉や胞子のスライド作成法、細胞壁及び細胞内容物の観察方法等、詳細な記載が認められた。このように CP 及び VP では、鏡検による生薬の鑑別が現在においても重要視されていることが示唆された。さらに生薬の品質評価法、生薬の調製・加工等の項目も新規収載されており、興味深い。

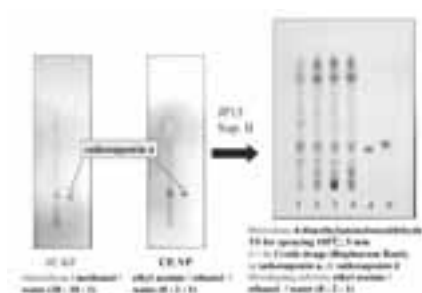
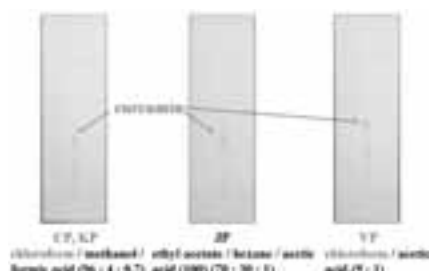
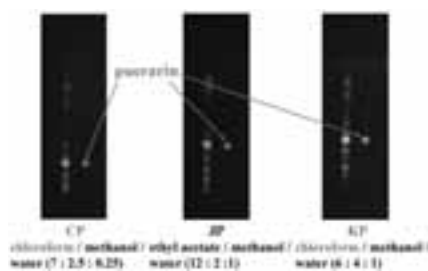
4) クリーンアナリシスと国際調和を指向した TLC 条件の比較⁴⁾

近年、環境汚染防止並びに実験者の健康保護を目的として、各種試験における有害試薬の使用を極力排除する“クリーンアナリシス”が世界的に浸透しつつある。日本においても2002年に公示された第十五改正日本薬局方原案作成要領、第一部、第十五改正日本薬局方原案の作成に関する細則において、有害な試薬の扱いと題して、人及び環境への影響を配慮した試験方法となるよう努めるとの記載がなされている⁵⁾。本項目には、ベンゼン、四塩化炭素、水銀化合物等の試薬は原則使用せず、またクロロホルム、ジクロロメタン（塩化メチレ

ン）等のハロゲン化合物は使用について慎重に検討すると記載されている。有害試薬の扱いについては、2007年に公示された第十六改正日本薬局方原案作成要領においても継承され、特にクロロホルム等のハロゲン化合物は代替溶媒がない場合についてのみその使用を認めると記載され、より厳密な表記に変更されている⁶⁾。

このような背景の下、2006年の FHH 会議において、クリーンアナリシスを指向した国際調和の観点から、TLC の展開溶媒として有害試薬を使用している国は、他国の有害試薬を使用しない試験法を参考にして自国の試験法を変更する努力を行うことが重要であるとの提案がなされ、自国内で流通する生薬を用い、有害試薬を使用しない他局の試験法について検討することが承認された。そこで我々は、FHH 諸国の局方に収載された共通生薬の TLC を用いた確認試験法について、各種試験条件の詳細な検討を行い、比較実験を行った。

各国薬局方における TLC を用いた確認試験法に使用される有害試薬の比較表を表5に示す。また、比較検討を行った TLC の写真の一例を図1

図1-1 *Bupleurum falcatum* Linné (サイコ)図1-2 *Curcuma longa* Linné (ウコン)図1-3 *Pueraria lobata* Ohwi (カッコン)

に示す。この結果、サイコ、ケイヒ、サンシュユ、ウコン、マオウ、カンゾウ、コウボク、シャクヤク、キョウニン、オウゴン、キクカ、ジャショウシ、リュウタン、カッコン及びカイカの15生薬において、いずれかの薬局方の確認試験に有害試薬が使用されていることが明らかとなった。そこでこれら15種の生薬について、各国局方の試験条件により TLC 検討を行った結果、サンシュユ、コウボク及びキクカを除く12生薬では、すべて有害試薬を使用しない方法でも同一の指標成分が確認可能であることが示された。特にサイコでは、JP 及び KP でクロロホルムを使用しているのに対し、CP 及び VP では有害溶媒を使用しておらず、CP 及び VP 法を用いても国内流通生薬の確認が可能であることが明らかとなった。そこでサイコに関して、日本薬局方生薬等委員会では、確認試験法における試験条件の再検討を行い、検出試薬の違いによる呈色の比較検討を行った。この結果、噴霧用4-ジメチルアミノベンズアルデヒド試液では、saikosaponin a 及び d の呈色が異なることが確認され、本噴霧試液を用いることにより、両化合物を同時に分別、検出することが可能となった。本検討により第15改正日本薬局方第二追補では、サイコの確認試験について、有害試薬を用いず、かつ検出の容易な試験法に変更するに至った。

第6回 FHH 会議(2008年)以降、クリーンアナリシスにおける国際調和の観点から、我が国も含め有害試薬を使用している国は、他国の有害試薬を使用しない試験法を参考として自国の試験法を変更する検討が継続的になされている。

3. おわりに

2010年に中華人民共和国薬典2010年版が刊行さ

れ、2011年4月には第16改正日本薬局方が施行されている。また韓国、ベトナムにおいても順次薬局方の改正が予定されており、引き続き FHH 会議では、各種比較表の更新、クリーンアナリシスに関する調和、副作用情報の共有等、新たな課題に積極的に取り組んでいく方針である。

一方、WHO が主催する IRCH (International Regulatory Cooperation for Herbal Medicines) の活動も進捗しており、生薬・薬用植物の規制等に関わる国際協調の潮流は、今後さらに加速していくものと考えられる。我が国がアジア諸国の代表として国際協調に貢献し、世界にその存在感を十分にアピールするためには、産官学が一体となった積極的かつ継続的な活動を展開していくことが必須である。本研究を通じて作成した各種比較表が今後の活動の一助となれば幸いである。

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表5 各国薬局方の確認試験法における TLC 溶媒条件の比較 (部分抜粋)

No.	Latin name	TLC condition (developing solvent)
1	<i>Bigelarraia filicata</i> Linné (サイコ)	
CP	RADIX BUPLEURI	ethyl acetate / ethanol / water (8 : 2 : 1)
JP	BUPLEURI RADIX	chloroform / methanol / water (30 : 10 : 1)
KP	BUPLEURI RADIX	chloroform / methanol / water (30 : 10 : 1)
VP	RADIX BUPLEURI	ethyl acetate / ethanol / water (8 : 2 : 1)
2	<i>Cinnamomum cassia</i> Blume (ケイヒ)	
CP	CORTX CINNAMOMI	petroleum ether / ethyl acetate (17 : 3)
JP	CINNAMOMI CORTX	hexane / ethyl acetate (2 : 1)
KP	CINNAMOMI CORTX	hexane / ethyl acetate (2 : 1)
VP	CORTX CINNAMOMI	n-hexane / chloroform / ethyl acetate (4 : 1 : 1)
3	<i>Cornus officinalis</i> Siebold et Zuccarini (サンシユウ)	
CP	FRUCTUS CORNI	toluene / ethyl acetate / formic acid (20 : 4 : 0.5)
JP	CORNI FRUCTUS	ethyl acetate / water / formic acid (6 : 1 : 1)
KP	CORNI FRUCTUS	ethyl acetate / water / formic acid (6 : 1 : 1)
VP	FRUCTUS CORNI OFFICINALIS	cyclohexane / chloroform / ethyl acetate (20 : 5 : 8)
4	<i>Curcuma longa</i> Linné (ウコン)	
CP	RHIZOMA CURCUMAE LONGAE	chloroform / methanol / formic acid (96 : 4 : 0.7)
JP	CURCUMAE RHIZOMA	ethyl acetate / hexane / acetic acid (100) (70 : 30 : 1)
KP	CURCUMAE LONGAE RHIZOMA	chloroform / methanol / formic acid (96 : 4 : 0.7)
VP	RHIZOMA CURCUMAE LONGAE	chloroform / acetic acid (9 : 1)
5	<i>Ephebra sinica</i> Stapf (マオウ)	
CP	HERBA EPHEDRAE	chloroform / methanol / concentrated ammonia (20 : 5 : 0.5)
JP	EPHEDRAE HERBA	1-butanol / water / acetic acid (100) (7 : 2 : 1)
KP	EPHEDRAE HERBA	n-butanol / water / acetic acid (7 : 2 : 1)
VP	HERBA EPHEDRAE	chloroform / methanol / ammonia (20 : 5 : 0.5)
6	<i>Glycyrrhiza uralensis</i> Fischer, <i>G. glabra</i> Linné (カンゾウ)	
CP	RADIX ET RHIZOMA GLYCYRRHIZAE	ethyl acetate / formic acid / glacial acetic acid / water (15 : 1 : 1 : 2)
JP	GLYCYRRHIZAE RADIX	1-butanol / water / acetic acid (100) (7 : 2 : 1)
KP	GLYCYRRHIZAE RADIX	n-butanol / water / acetic acid (7 : 2 : 1)
VP	RADIX GLYCYRRHIZAE	petroleum ether / benzene / ethyl acetate / glacial acetic acid (10 : 20 : 7 : 0.5)
7	<i>Magnolia officinalis</i> Rehd. et Wilson var. <i>biloba</i> Rehd. et Wilson (コウボク)	
CP	CORTX MAGNOLIAE OFFICINALIS	benzene / methanol (27 : 1)
JP	MAGNOLIAE CORTX	1-butanol / water / acetic acid (100) (4 : 2 : 1)
KP	MAGNOLIAE CORTX	n-butanol / water / acetic acid (4 : 2 : 1)
VP	CORTX MAGNOLIAE OFFICINALIS	benzene / methanol (27 : 1)
8	<i>Paeonia lactiflora</i> Pall. (シャクヤク)	
CP	RADIX PAEONIAE ALBA	chloroform / ethyl acetate / methanol / formic acid (40 : 5 : 10 : 0.2)
JP	PAEONIAE RADIX	acetone / ethyl acetate / acetic acid (100) (10 : 10 : 1)
KP	PAEONIAE RADIX	acetone / ethyl acetate / glacial acetic acid (26 : 14 : 5)
VP	RADIX PAEONIAE	chloroform / ethyl acetate / methanol / formic acid (40 : 5 : 10 : 0.2)
9	<i>Pinus armenica</i> Linné, <i>P. amurica</i> Linné var. <i>amurica</i> Maximowicz (キウニン)	
CP	SEMEN ARMENIACAE AMARUM	chloroform / ethyl acetate / methanol / water (15 : 40 : 22 : 10)
JP	ARMENIACAE SEMEN	ethyl acetate / methanol / water (7 : 3 : 1)
KP	ARMENIACAE SEMEN	ethyl acetate / methanol / water (7 : 3 : 1)
VP	SEMEN ARMENIACAE AMARUM	chloroform / ethyl acetate / methanol / water (15 : 40 : 22 : 10)
10	<i>Scutellaria baicalensis</i> Georgi (オウゴン)	
CP	RADIX SCUTELLARIAE	toluene / ethyl acetate / methanol / formic acid (10 : 3 : 1 : 2)
JP	SCUTELLARIAE RADIX	1-butanol / water / acetic acid (4 : 2 : 1)
KP	SCUTELLARIAE RADIX	chloroform / methanol / glacial acetic acid (20 : 10 : 3)
11	<i>Chrysanthemum indicum</i> Linné (キクカ)	
CP	FLOS CHRYSANTHEMI INDICI	ethyl acetate / butanone / chloroform / formic acid / water (15 : 15 : 6 : 4 : 1)
JP	CHRYSANTHEMI FLOS	ethyl acetate / 2-butanone / water / formic acid (25 : 3 : 1 : 1)
VP	FLOS CHRYSANTHEMI INDICI	ethyl acetate / formic acid / water (8 : 1 : 1)
12	<i>Oxidium monnieri</i> Casson (ジャシノウシ)	
CP	FRUCTUS CNIDI	toluene / ethyl acetate / n-hexane (3 : 3 : 2)
JP	CNIDI MONNIERIS FRUCTUS	hexane / ethyl acetate (2 : 1)
VP	FRUCTUS CNIDI	benzene / ethyl acetate (30 : 1)
13	<i>Gentiana scabra</i> Blume (リュウタン)	
CP	RADIX ET RHIZOMA GENTIANAE	ethyl acetate / methanol / water (20 : 2 : 1)
JP	GENTIANAE SCABRAE RADIX	ethyl acetate / ethanol (99.5) / water (8 : 2 : 1)
KP	GENTIANAE SCABRAE RADIX	chloroform / methanol / water (30 : 10 : 1)
14	<i>Pueraria lobata</i> Ohwi (カッコン)	
CP	RADIX PUERARIAE LOBATAE	chloroform / methanol / water (7 : 2.5 : 0.25)
JP	PUERARIAE RADIX	ethyl acetate / methanol / water (12 : 2 : 1)
KP	PUERARIAE RADIX	chloroform / methanol / water (6 : 4 : 1)
15	<i>Sophora japonica</i> Linné (カイカ、兜外)	
CP	FLOS SOPHORAE	ethyl acetate / formic acid / water (8 : 1 : 1)
JP	SOPHORAE FLOS	chloroform / methanol / water (6 : 4 : 1)
KP	SOPHORAE FLOS	ethyl acetate / formic acid / water (8 : 1 : 1)