薬効解析センター　Research Center for Ethnomedicines

センター長	小松　かつ子	Chief of Center	Katsuko Komatsu (Ph.D.)
助教授	小松　かつ子 （10月31日まで）	Associate Professor	Katsuko Komatsu (Ph.D.)
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研究目的　Aims of the research projects

世界各地の民族薬物に関する資料の収集及び整理，薬効の評価及び解析並びにデータベースの構築を行い，世界の伝統薬物及び薬用植物に関する共同研究を推進する。

研究概要　Research projects

Ⅰ）伝統薬物に関するデータベース（ETHMEDmmm）の構築

和漢薬・アーユルヴェーダ薬物データベースの英語版を作成する目的で，翻訳または入力済み学術情報の整理を行った。

Ⅱ）伝統薬物の薬効の評価と解析に関する研究

1）難治性の神経疾患に対する有効性の検討とそれらの薬理作用の機序に関する研究

インド生薬 Ashwagandha から単離した 3 種の化合物の経口投与により，アミロイドβのマウス脳室内投与により誘発される空間記憶障害が改善され，その際，脳内の軸索と樹状突起の萎縮，前シナプスの減少が正常状態に戻っていることを明らかにした。活性化合物のうち withanoside IVについては，経口投与後に血清中に検出される代謝物 sominone を同定し，それが活性本体であることも明らかにした。

アミロイドβのマウス脳室内投与による空間記憶障害に対し，改善作用を有する生薬エキスを探索し，有効性が示された生薬4種からなる漢方処方を作製した。その処方について，空間記憶障害に対する作用を検討し，改善作用を明らかにした。

Ⅲ）生薬の品質評価に関する研究

1）遺伝子解析による生薬の同定法開発に関する研究

これまで同定が不可能であった修治された莪朮について，*trn*K 遺伝子領域の解析法を改良し，基源または遺伝子型を明らかにした。本法は鬱金類健康食品の基源解明にも応用可能であった。

2）生薬の基源と品質に関する研究

中国産莪朮の日本市場品には，一部 *Curcuma phaeocaulis* または *C. kwangsiensis*（gl タイプ）の単一品が認められたが，多くは混合品で，遺伝子多型が認められた。これらの精油含量はばらつきが大きく，局方の限度値未満のものも存在した。鬱金類健康食品には *C. longa* 以外の基源不明のものも存在し，curcuminoids 含量で 9 倍の差が認められた。*Curcuma* 属 7 種に由来する鬱金類生薬の，アジュバント関節炎に対する作用を検討した。文朮（*C. phaeocaulis*）メタノールエキスにより，肢の腫脹と，血清中の炎症マーカータンパク質の発現が有意に抑制された。また文朮エキスは *in vitro* 実験において COX-2 活性の抑制作用を有意に示した。

Ⅳ）世界の伝統医薬学の調査研究

漢薬の資源をアジアに探る研究の一環として，モンゴル国東部で *Ephedra* 属，*Glycyrrhiza* 属，*Astragalus* 属植物などの資源調査を行った。

◇原著　Original papers

1）**Sasaki Y., Fushimi H., and Komatsu K.: Application of Single Nucleotide Polymorphisms Analysis of *trn*K Gene to the Identification of *Curcuma* Plants. Biol. Pharm. Bull., 27: 144-146, 2004.**

Abstract: We previously found that *Curcuma* plants and drugs derived from *Curcuma longa, C. phaeocaulis, C. zedoaria,* and *C. aromatica* could be identified by the nucleotide differences at two sites and the existence of a 4-base indel on *trn*K gene. In this paper, based on species-specific nucleotide sequences, the application of a new method, single-nucleotide polymorphism (SNP) analysis was investigated to identify *Curcuma* plants more conveniently. First, three types of reverse primer were synthesized in different lengths, 34 mer, 26 mer, and 30 mer, to anneal the template DNAs from each species at sites immediately upstream from substitution positions 177 and 645, and at the site including the 4-base insertion from 728 to 731, respectively. After single-base extension reaction of these primers using fluorescent-labeled ddNTPs and PCR products of the *trn*K gene region as template, the resulting products were detected using an ABI PRISM 310 Genetic Analyzer. The electrophoretogram showed three or two peaks at different positions depending on the 27 mer, 31 mer, and 35 mer product lengths. Each peak was derived from the incorporated fluorescent-labeled ddNMPs complementary to template nucleotides at positions 645, 724, and 177, respectively. *C. phaeocaulis* showed three peaks of ddCMP, ddAMP, and ddAMP. The other three species showed two peaks derived from 27 mer and 35 mer products: peaks of ddCMP and ddAMP in *C. longa,* those of ddCMP and ddTMP in *C. zedoaria,* and those of ddTMP and ddAMP in *C. aromatica.* Thus SNP analysis to identify four *Curcuma* plants was newly developed.

2）**Zhao J., Nakamura N., Hattori M., Yang X. W., Komatsu K., and Qio M. H.: New Triterpenoid Saponins from the Roots of *Sinocrassula asclepiadea. Chem. Pharm. Bull.,* 52: 230-237, 2004.**

3）**Tohda C., Matsumoto N., Zou K., Meselhy M. R., and Komatsu K.: Aβ (25-35)-induced memory impairment, axonal atrophy and synaptic loss are ameliorated by M1, a metabolite of protopanaxadiol-type saponins. *Neuropsychopharmacology,* 29: 860-868, 2004.**

Abstract: We previously screened neurite outgrowth activities of several Ginseng drugs in human neuroblastoma, and demonstrated that protopanaxadiol (ppd)-type saponins were active constituents. Since ppd-type saponins are known to be completely metabolized to 20-*O*-β-D-glucopyranosyl-20(*S*)-protopanaxadiol (M1) by intestinal bacteria when taken orally, M1 and ginsenoside Rb_1, as a representative of ppd-type saponins, were examined for cognitive disorder. In a mouse model of Alzheimer's disease (AD) by Aβ (25-35) i.c.v. injection, impaired spatial memory was recovered by p.o. administration of ginsenoside Rb_1 or M1. Although the expression levels of phosphorylated NF-H and synaptophysin were reduced in the cerebral cortex and the hippocampus of Aβ (25-35)-injected mice, their levels in ginsenoside Rb_1- and M1-treated mice were almost completely recovered up to control levels. Potencies of the effects were not different between ginsenoside Rb_1 and M1 when given orally, suggesting that most of the ginsenoside Rb_1 may be metabolized to M1, and M1 is an active principal of ppd-type saponins for the memory improvement. In cultured rat cortical neurons, M1 showed extension activity of axons, but not dendrites. The axon-specific outgrowth was seen even when neuritic atrophy had already progressed in response to administration of A β (25-35) as well as in the normal condition. These results suggest that M1 has axonal extension activity in degenerated neurons, and improve memory disorder and synaptic loss induced by Aβ (25-35). M1 was shown to be effective in vitro and in vivo, indicating that Ginseng drugs containing ppd-type saponins may reactivate neuronal function in AD by p.o. administration.

4) **Zhu S., Fushimi H., Cai S. Q., and Komatsu K.: Species Identification from Ginseng Drugs by Multiplex Amplification Refractory Mutation System (MARMS). *Planta Med.*, 70: 189-192, 2004.**

Abstract: The multiplex amplification refractory mutation system (MARMS) was applied to the identification of 5 *Panax* species (*P. ginseng, P. japonicus, P. quinquefolius, P. notoginseng* and *P. vietnamensis*). A set of specific primers, including 2-pair primers on chloroplast *trn*K gene and nuclear 18S rRNA gene regions, respectively, was designed and synthesized for each species on the basis of species-specific sequences of the 2 genes. By using 5 sets of specific primers, in turn, PCR amplifications were performed with total DNA extracted from 5 *Panax* species as template under appropriate condition, and each resulting product was detected by agarose gel electrophoresis. The results showed that two expected fragments, one from *trn*K gene and another from 18S rRNA gene regions, were observed simultaneously only when the set of species-specific primers encountered template DNA of the corresponding species. This assay could give more reliable results for identification of not only 5 *Panax* species but also corresponding Ginseng drugs by simultaneous detection of 4-site nucleotide differences on 2 completely different genes.

5) **Yang D. Y., Fushimi H., Cai S. Q., and Komatsu K.: Molecular Analysis of *Rheum* Species Used as Rhei Rhizoma Based on Chloroplast *mat*K Gene Sequence and Its Application for Identification. *Biol. Pharm. Bull.*, 27: 375-383, 2004.**

Abstract: Rhei Rhizoma (Dahuang in Chinese) is widely known as a purgative and antiinflammatory agent. In the Japanese Pharmacopoeia, Rhei Rhizoma is prescribed for four *Rheum species, Rheum palmatum, R. tanguticum, R. officinale,* and *R. coreanum,* while the first three species are prescribed for Dahuang in the Chinese Pharmacopoeia. Due to the morphologic similarity of the aerial parts and frequent occurrence of intermediate forms, the taxonomy of this genus and the correct identification of *Rheum* species and their derivative drugs are very difficult. To resolve taxonomic problems of the genus Rheum and develop an ultimate identification method for plants and drugs, molecular analysis of the chloroplast *mat*K gene and nuclear 18S ribosomal RNA gene were performed on nine species. The sequence comparison of the *mat*K gene revealed that most species had variable sequences not only inter- but also intraspecies. However, the specimens of the same species belonged to the same subclade in the phylogenetic tree constructed based on *mat*K gene sequences, except for *R. palmatum,* in which specimens belonged to three subclades related to their production areas. The nucleotide differences at positions 587, 707, and 838 distinguished official species from others, while specific nucleotides at positions 367 and 937 became identification markers for *R. palmatum, R. tanguticum,* and *R. officinale* (or *R. coreanum*). Moreover, three groups of *R. palmatum,* each belonging to three subclades, were characterized by the nucleotides at positions 619, 769, 883, and 1061. By detecting marker nucleotides, the botanical origins of Rhei Rhizoma were determined.

6) **Teerawatanasuk N., Nakamura E. S., Wangma-neerat A., Komatsu K., Saiki I: Anti-invasive and anti-angiogenic activities of *Curcuma* sp. extracts. *J. Trad. Med.*, 21: 27-33, 2004.**

7) **Yang D. Y., Fushimi H., Cai S. Q., and Komatsu K.: Polymerase Chain Reaction - Restriction Fragment Length Polymorphism (PCR-RFLP) and Amplification Refractory Mutation System (ARMS) Analyses of Medicinally Used *Rheum* Species and Their Application for Identification of Rhei Rhizoma. *Biol. Pharm. Bull.*, 27: 661-669, 2004.**

Abstract: Previously, we have determined marker nucleotides on the chloroplast *mat*K gene to identify *Rheum palmatum, R. tanguticum* and *R. officinale* used as Rhei Rhizoma officially. In the present study, we further developed a convenient and efficient identification method on the basis of marker nucleotides with Amplification Refractory Mutation System analysis. On the basis of the nucleotide substitutions at positions 367 and 937 among

the three species on the *mat*K gene, at each position two kinds of reverse primers with complementary 3'-terminal nucleotides were designed. Upon PCR amplification using three sets of primers and template DNA from each species, one or two fragments (202 bp or/and 770 bp) were detected. As the resultant three fragment profiles were species-specific, the procedure enabled us to classify the botanic origins of 22 drug samples of Rhei Rhizoma.

8) **Zhu S., Zou K., Fushimi H., Cai S. Q., and Komatsu K.: Comparative Study on Triterpene Saponins of Ginseng Drugs. *Planta Med.*, 70: 666-677, 2004.**

Abstract: A comparative study on the triterpene saponins of 47 samples of Ginseng drugs derived from 12 *Panax* taxa was conducted using a reverse-phase high-performance liquid chromatography (HPLC) method. Eleven ginsenosides, which represent 4 types of typical sapogenins, were chosen as standards for quantitative determination in order to characterize the chemical constituent pattern of each Ginseng drug and investigate the relationship between genetic varieties and chemical constituent pattern. The results showed that the ginsenoside compositions in Ginseng drugs of different origins were of considerable variability. Total saponin contents varied by 10-fold from the highest drug to the lowest one. Chikusetsu-ninjin derived from *P. japonicus* (Japan) was found to have the highest content (192.80 - 296.18 mg/g) and Ginseng from *P. ginseng* to be the lowest (5.78 - 15.63 mg/g).Two main groups (I and II) suggested by phytochemical data were clearly observed; group I mainly containing dammarane saponins consisted of *P. ginseng, P. quinquefolius, P. notoginseng, P. vietnamensis* and *P. vietnamensis* var. *fuscidiscus*; and group II containing a large amount of oleanolic acid saponins was composed of *P. japonicus* (Japan), *P. zingiberensis, P. japonicus* (China), *P. japonicus* var. *angustifolius, P. japonicus* var. *major, P. japonicus* var. *bipinnatifidus* and *P. stipuleanatus.* The ratios of the subtotal of dammarane saponins to that of oleanolic acid saponins (D/O) were found to be > 1.9 and < 0.25 for groups I and II, respectively. The drug samples derived from the same botanical origin revealed similar constituent patterns, in other words, each *Panax* taxon showed its own characteristic chromatographic profile,which appeared in the specific shape of an 11-direction radar graph constructed on the basis of the result of quantitative analysis. Similarities of chemical constitution were seen among the closely phylogenetically-related taxa, including *P. ginseng* and *P. quinquefolius, P. vietnamensis* and *P. vietnamensis* var. *fuscidiscus, P. japonicus* (China) and its varieties were demonstrated, except *P. japonicus* (Japan) and *P. zingiberensis.*

9) **Zhu S., Zou K., Cai S. Q., Meselhy M. R., and Komatsu K.: Simultaneous Determination of Triterpene Saponins in Ginseng Drugs by High Performance Liquid Chromatography. *Chem. Pharm. Bull.*, 52: 995-998, 2004.**

Abstract: A HPLC method for the simultaneous determination of 11 triterpene saponins with four-type aglycones (protopanaxadiol, protopanaxatriol, ocotillol and oleanolic acid types) in Ginseng drugs was developed and validated. Using a gradient of acetonitrile and 10 mM K-phosphate buffer (pH 5.80) as the mobile phase and UV detection at 196 nm, more than 18 ginsenosides with different aglycones were separated satisfactorily within 60 min. The detection limits (signal/noise> or =3) were 0.1 g for ginsenosides Rb_1, Rc, Rd, Re and Rg_1, chikusetsusaponin III, and notoginsenoside R_2, 0.2 microg for gisenoside Ro and chikusetsusaponin IVa, 0.3 μg for chikusetsusaponin IV, and 3 μg for majonoside R_2. The calibration curve of each saponin had a correlation coefficient close to 1. Intra- and interday precisions were less than 2.1% (n = 5) and 3.3% (n = 15), respectively. The recovery rates of extraction were in the range of 96.4-102.7% for all ginsenosides. By adopting this method, the determinations of 11 ginsenosides in three Ginseng drugs derived from *Panax ginseng, Panax vietnamensis* var. *fuscidiscus* and *Panax japonicus* (Japan) were achieved.

10) **Ahn E. M., Akao T., Nakamura N., Komatsu K., Nishihara T., and Hattori M.: Screening of Medicinal Plant Extracts for Estrogenic Activity in Combination with a Glycosidase Treatment. *J. Trad. Med.*, 21: 81-86, 2004.**

11) **Long C. F., Kakiuchi N., Takahashi A., Komatsu K., Cai S. Q., and Mikage M.: Phylogenetic Analysis of the DNA Sequence of the Non-Coding Region of Nuclear Ribosomal DNA and Chloroplast of *Ephedra* Plants in China. *Planta Med.*, 70: 1080-1084, 2004.**

Abstract: Twenty-four *Ephedra* plants belonging to 8 species grown in the northern and western parts of China were phylogenetically analyzed for their non-coding DNA sequences, internal transcribed spacers (ITSs) of nuclear ribosomal DNA as well as *trn*L intron and intergenic spacers between *trn*L and *trn*F (*trn*L/ *trn*F) of the chloroplast. Based on the ITS sequences, the 8 species could be divided into 3 groups: Group 1 (*Ephedra intermedia, E. sinica, E. przewalskii*), Group 2 (*E. equisetina, E. monosperma, E. gerardiana*), and Group 3 (*E. likiangensis, E. minuta*). The species classified into Group 1 grow mainly in the north, Group 3 in the south and Group 2 in the center, suggesting their genetic and geographic relationships. A specific primer set was designed to classify the 3 groups by routine PCR. Combined analysis of ITS and *trn*L/ *trn*F differentiated the 8 *Ephedra* species.

12) **Ahn E. M., Nakamura N., Fushimi H., Komatsu K., Batkhuu J., and Hattori M.: Constituents of the seeds of *Glycyrrhiza uralensis*. *Nat. Med.*, 58: 311, 2004.**

◇総　説　Review papers

1) Komatsu K., Zhu S., and Sasaki Y.: Systematic Pharmacognostical Study on *Panax* Drugs and *Curcuma* Drugs - Phylogenetic Analysis, Molecular Authentication and Quality Evaluation -. *J. Trad. Med.*, 21: 251-270, 2004.

◇学会報告　Scientific presentation（*: 招待講演）

1) 田村隆幸，東田千尋，鄒 坤，小松かつ子： 黄耆によるAβ25-35誘発性の神経突起萎縮に対する抑制作用—基源植物の差異および修治が及ぼす影響—．日本薬学会第124年会，2004，3. 29-31，大阪.
2) 小松かつ子：フィールドワークの2つの視点—比較民族薬物学と生薬資源学，ミニシンポジウム「天然薬物のフィールドワークを考える」．日本薬学会第124年会，2004，3. 29-31，大阪.
3) Zhu S., Fushimi H., Cai S. Q., and Komatsu K.: Phylogenetic Relationship in the Genus *Panax*: inferred from Chloroplast *trn*K Gene and Nuclear 18S rRNA Gene Sequences. International Symposium on Asian Plant Diversity and Systematics, The Japanese Society for Plant Systematics, International Association of Plant Taxonomists, 2004, 7. 29-8.1, Chiba, Japan.
4) Cai S. Q., Wang X., Ma F. Y., Li J., and Komatsu K.: Studies on HPLC-Fingerprinting of Notoginseng. JSP-KSP-CCTNM Joint Seminar 2004 -International Symposium on Natural Medicines-, The Japanese Society of Pharmacognosy, 2004, 8.9-11, Kaga, Japan.
5) 橋本斎，東田千尋，小松かつ子：Aβ25-35誘発性の神経突起萎縮に対するprotopanaxadiol系サポニンの腸内細菌代謝物M1による軸索伸展作用とそのメカニズム．第21回和漢医薬学会大会，2004，8. 21-22，富山.
6) 東田千尋，畠中史幸，中山なつき，小松かつ子：NO産生系を指標とした鬱金類生薬の駆瘀血作用．第21回和漢医薬学会大会，2004，8. 21-22，富山.
7) 高橋京子，松田秀康，松永和憲，隅田昭彦，木下香葉子，小松かつ子，服部征雄，高橋幸一，東純一：動物性生薬由来成分の肝薬物代謝酵素に及ぼす影響．第21回和漢医薬学会大会，2004，8. 21-22，富山.
8) 西田裕子，高橋京子，上島悦子，小松かつ子，佐々木陽平，畠中史幸，高橋幸一，荒川行生，黒川信夫，東純一：ウコン属生薬の基源と品質：ヒト肝CYP代謝活性への影響．第21回和漢医薬学会大会，2004，8. 21-22，富山.
9) 久保山友晴，東田千尋，小松かつ子：Withanolide A, withanoside IV, withanoside VIによる神

経突起再伸展とシナプス再形成作用．日本生薬学会第51年会，2004，9. 9-10，神戸.

10) Zhu S., Zou K., Fushimi H., Cai S. Q., and Komatsu K.: Comparative study on triterpene saponins of Ginseng drugs. 日本生薬学会第51年会，2004，9. 9-10，神戸.

11) 佐々木聡子，佐々木陽平，伏見裕利，南雲清二，合田幸広，小松かつ子：日本市場に流通するガジュツの基原— *trn*K 遺伝子の塩基配列—．日本生薬学会第51年会，2004，9. 9-10，神戸.

12) 佐々木陽平，佐々木聡子，伏見裕利，南雲清二，合田幸広，小松かつ子：ガジュツ及びウコンの試験法に関する研究．日本生薬学会第51年会，2004，9.9-10，神戸.

13) 久保山友晴，東田千尋，小松かつ子：神経突起伸展及びシナプス形成を機序とする withanolide 類の空間記憶障害改善作用．第27回日本神経科学大会・第47回日本神経化学大会合同大会 Neuro 2004，2004，9. 21-23，大阪.

＊14) Komatsu K.: Recent Research on Genus *Curcuma*: Molecular Analysis, Identification and Quality Evaluation on Vasomotion Effect. The First International Conference presented by Western Pacific Regional Forum for the Harmoni- zation of Herbal Medicines, WHO/WPRO, 2004, 9.21-22, Shanghai, China.

◇その他　Others

1）東田千尋：富山県で栽培可能な生薬に関する総合的研究－新しい作用機序で抗痴呆活性を示す生薬および漢方方剤の研究．平成15年度受託研究「和漢薬・バイオテクノロジー研究」研究成果報告書，pp. 55-61, 2004.

2）服部征雄，東田千尋，小松かつ子，土屋真澄，中村憲夫：コーヒー豆のトリゴネリンと脳神経細胞．第7回「くすりと食物」シンポジウムーシーズ と ニーズー，2004，11. 19，東京.

◇共同研究　Co-operative researches

学内

1）柴原直利：富山医科薬科大学和漢薬研究所，「富山県で栽培可能な生薬に関する総合的研究」，2002～2004

海外

1）Javzan Batkhuu：国立モンゴル大学生物学部，蔡　少青：北京大学薬学院，Sitthithaworn Worapan：Srinakarinwirot 大学薬学部「漢薬の資源をアジアに探る：モンゴル及びタイ産薬用植物の調査研究」，2002～2004

◇研究費取得状況　Acquisition of research funds

1）文部省科学研究費，基盤研究(B)(2)（第3年度）（代表：小松かつ子，分担：東田千尋）「漢薬の資源をアジアに探る：モンゴル及びタイ産薬用植物の調査研究」，220万

2）(財) 田村科学技術振興財団（代表：小松かつ子，分担：東田千尋）「各種ウコン属生薬の生活習慣病予防・治療薬としての有効性評価」，30万

3）富山医科薬科大学特別経費「戦略的経費」（代表：東田千尋）「漢方処方を進化させる科学的アプローチ－痴呆を治療する処方の開発－」，35万

4）富山県受託研究「和漢薬・バイオテクノロジー研究」（分担：東田千尋）「富山県で栽培可能な生薬に関する総合的研究：新しい作用機序で抗痴呆活性を示す生薬および漢方方剤の研究」，50万

5）富山県受託研究（代表：小松かつ子，分担：東田千尋）「富山産ヤマブシタケの抗痴呆作用の検討」，40万

◇研究室在籍者　Research members（一部10月31日まで）

学部4年生：中山なつき，松山修二

大学院前期1年：市村真帆子，表　貴之，橋本　斎，劉　洪宇

大学院前期2年：佐々木聡子，杉山玲子
大学院後期3年：久保山友晴
研究機関研究員：朱　姝
技術補佐員（研究支援推進員）：幸　雅子，出口鳴美
技術補佐員：林　和子
受託研究員：石塚　修 (富山北部高校, 2004, 09.01－11.26)
外国人客員研究員：Nijsiri Ruangrungsi (Chulalongkorn University, 2004, 3. 13-3.25)
Rith Watthanachaiyingcharoen (Srinakarinwirot University, 2004, 5. 19-7.18)
Wichet Leelamanit (Mahidol University, 2004, 6. 22-7.31)
Worapan Sitthithaworn (Srinakarinwirot University, 2004, 6. 28-7.31)
Preecha Boonchoong (Ubonrachatanee University, 2004, 7. 10-8.9)
Surapong Kengtong (Chulalongkorn University, 2004, 9. 1-10. 25, 拠点大学方式学術交流事業)
Suchada Sukrong (Chulalongkorn University, 2004, 9. 28-11.11)

◇民族薬物資料館記録　Archive of Museum of Materia Medica

1）一般公開：平成16年10月30日に第7回の民族薬物資料館一般公開を実施した．予約制とし，10時，11時，14時，15時，16時からの5回に分けて各1時間，生薬の解説を加えながら館内を案内した．13:00～13:50に大阪大学大学院薬学研究科・助手の高橋京子先生による講演会「漢方薬の効き方を科学する：クスリとリスク」を行った．来館者は48名，講演会参加者は40名．

2）見学者記録（2004年4月1日 ～ 2005年3月31日）
来館者総数：874名（日本人　805名，外国人　69名）
案内総回数：124回（日本人　99回，外国人　25回）
外国人の国名（人数）：中国(20)，韓国(23)，タイ(8)，アメリカ(8)，ベトナム(5)，スリランカ(3)，不明(2)

◇民族薬物データベース記録　Record of The Data Base of Ethno-medicines in the World (ETHMEDmmm)（2004年4月1日～2005年3月31日）

アクセス数：8730件
専門検索登録者数：110名（全796名），専門検索アクセス数：2069件