

Medicinal Plant Conservation



MEDICINAL
PLANT
SPECIALIST
GROUP

Volume 12

IUCN
The World Conservation Union

Newsletter of the Medicinal Plant Specialist Group
of the IUCN Species Survival Commission

Chaired by Danna J. Leaman



SPECIES SURVIVAL COMMISSION

Chair's note 2

Resolución de la reunión satélite del Grupo de Especialistas de Plantas Medicinales (MPSG) de la Unión Mundial para la Naturaleza (UICN) 3

Resolución de la mesa redonda sobre directrices mundiales de conservación y uso sostenible de plantas medicinales 3

Botanic Gardens: Using biodiversity to improve human well-being – *Kerry Waylen*. 4

Progress on the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) – *Susanne Honnef, Danna Leaman, Britta Pätzold & Uwe Schippmann* 8

Supplier audit in MAP collection and cultivation: Buyer perspective in Germany – *Ernst Schneider* 12

Towards a sustainable management of medicinal and aromatic plants: The case of the Agro-artesanal Association of Producers of Dried Medicinal Plants of Ecuador – AAPPSME – *María Argüello & Zornitza Aguilar* 17

Regional File

The status of exudate species in Iran and existing challenges in their sustainable utilization – *F. Nadjafi, A. Koocheki & A. Ghasemi Arian*. . . 22

Alleviating poverty in Afghanistan through sustainable resource management and marketing

of medicinal and aromatic plants – *Bert-Jan Ottens, Klaus Dürbeck & Geertje Otten* 28

Prioritisation of medicinal plants for conservation through threat assessment in Madhya Pradesh, India. A paradigm shift from prescription to practice – *G. A. Kinhal, D.K. Ved & B.M.S. Rathore* 31

Medicinal plants of the Canary Islands – *David Bramwell* 36

Taxon File

Conservation strategies for *Commiphora wightii*. An important medicinal plant species – *Vineet Soni & P.L. Swarnkar* 40

Podophyllum hexandrum and its conservation status in India – *Niranjan Chandra Shah* 42

Nepeta binaludensis, a highly endangered medicinal plant of Iran – *Farsad Nadjafi* 47

Conferences and Meetings

Coming up – *Natalie Hofbauer*. 48

CITES News – *Uwe Schippmann* 49

Lista de especies, nomenclatura y distribución en el género *Guaiaicum* – *Patricia Davila Aranda & Uwe Schippmann* 50

Notices of Publication 51

List of Members. 53

Chair's Note

Danna Leaman

Two years into the current IUCN Quadrennium (2005-2008), this 12th volume of *Medicinal Plant Conservation* provides an opportunity to revisit the ambitious workplan proposed for the Medicinal Plant Specialist Group for this period (see Chair's Note MPC 11: 2-3), to consider our successes and continuing challenges, and to review our group's priorities for the two years remaining before the IUCN Members, Commissions, and staff reconvene at the next World Conservation Congress.

Workplan objective 1: Establishment of regional sub-groups and programmes of work for the MPSG in the Pacific, Europe, North America, Southeast Asia, North Asia, and Africa (regional sub-groups have already been established in South Asia and Latin America). The IUCN Species Survival Commission, to which all MPSG members belong, is initiating an on-line membership registration. Building this system created some delays in the process of inviting and registering new specialist group members. However, the larger part of the responsibility for the delay in moving forward on this objective is mine as Chair. Particularly in Africa, the middle East, Europe, and North America many potential new members have been identified. However, much remains to be done to complete the invitation process and formally establish new regional sub-groups.

On a more optimistic note, the regional Latin American sub-group of MPSG met in June 2006 in a satellite meeting of the IX Latin American Botanical Congress in Santo Domingo, the Dominican Republic. The group identified priorities for action, mechanisms to support interaction among the regional members, and nominated national focal points for those countries represented at the meeting. The resolution from this meeting, in Spanish, appears in this volume of MPC (see p. 3).

Workplan objective 2: Expansion of global conservation assessment of medicinal plants through regional Red List training and assessment projects, identification of regional Red List Authorities for medicinal plants in collaboration with other SSC Specialist Groups, and support for regional medicinal plant conservation data management capacity. We have begun work with TRAFFIC and WWF to develop a joint programme with IUCN on conservation and sustainable use of medicinal plants that will support preliminary and Red List assessments, market assessments, and implementation of models for sustainable use of medicinal plants, linking regional projects to a global strategy. I am hopeful that MPSG will be able to provide funds for regional MPSG initiatives through this programme.

Workplan objective 3: Ongoing contributions to the

development of a practical and widely relevant international standard for sustainable wild collection of medicinal plants (ISSC-MAP). This has clearly been a major focus of our work. Our substantial progress on this objective is summarized in this issue of MPC (see p. 8 f.).

Workplan objective 4: Ongoing partnership through IUCN with WHO, WWF, and TRAFFIC enabling the publication, distribution, and implementation of the revised "Guidelines for the Conservation of Medicinal Plants". The third draft of the revised "Guidelines" has been completed and is currently being circulated to the members of the steering committee. We continue our efforts to raise the funds required to support a final consultation with the author institutions, and print/web publication and distribution of the final guidelines. We remain committed to making the "Guidelines" accessible in French, Spanish, Chinese, Arabic, and other languages in addition to English, to facilitate their implementation world-wide.

We are very grateful to the Species Survival Commission, the Wildlife Conservation Society, and Swann International for funding to support completion of the third draft of the revised "Guidelines". These funds also supported a Round Table on implementation of the Guidelines in Latin America, coordinated by the MPSG regional sub-group for Latin America during the IX Latin American Botanical Congress, 19-25 June 2006, in the Dominican Republic. The Congress resolution resulting from this Round Table is included in this volume of MPC (p. 3 f.).

Workplan objective 5: Continued publication of "Medicinal Plant Conservation" and enhanced use of the MPSG website to effectively communicate current issues and actions relevant to the overall aim of the MPSG. Uwe Schippmann and Natalie Hofbauer have worked diligently to bring you this issue of MPC, and we are grateful to BfN for their continued generous support for the production and mailing of this newsletter. Work to update the main MPSG website has been slower than I'd hoped, owing to lack of time. I'm grateful to MPSG member Reza Azmi and WildAsia, based in Kuala Lumpur, for their efforts to move forward on improving design and content, and to BfN for financial support to include the ISSC-MAP project on their website. The Latin American sub-group of MPSG has designed a regional website that will be hosted by the Grupo Etnobotánico Latinoamericana (GELA), and accessible via the main MPSG website early in 2007.

Other Project Updates

Revision of CITES #-annotations for medicinal and aromatic plants: Work on this project, a consultancy undertaken by the MPSG to the CITES Secretariat to identify problems that may arise because of unclear annotations regarding medicinal plant species included in the Appendices of CITES, is nearly completed (see also p. 48).

**Resolución de la reunión satélite del Grupo de Especialistas de Plantas Medicinales (MPSG)
de la Unión Mundial para la Naturaleza (UICN)**

**IX Congreso Latinoamericano de Botánica
19 de junio de 2006**

Santo Domingo, República Dominicana

Reconociendo la contribución de los miembros latinoamericanos del Grupo de Especialistas de Plantas Medicinales (MPSG) a los objetivos globales de la Comisión de Supervivencia de Especies de la Unión Mundial para la Naturaleza

Concientes de la importancia del fortalecimiento del Subgrupo regional para trabajar conjuntamente en las prioridades regionales, relacionadas con la conservación y el uso sostenible de las plantas medicinales.

Los participantes de la Reunión Satélite acordaron:

Prioridades

- Intercambio de conocimientos, información y experiencias
- Reconocimiento del valor de los sistemas de medicina tradicional
- Valoración del conocimiento tradicional en uso sostenible de especies
- Integración de equipos multidisciplinarios
- Abordar los aspectos de conocimiento tradicional, acceso a recursos genéticos y distribución de beneficios
- Fortalecer los procesos de educación

Mecanismos de interacción

- Crear un subdominio en el sitio web del GELA para difundir y compartir información sobre actividades relacionadas al MPSG.
- Considerar el beneficio de establecer subgrupos subregionales de los miembros, así como redes de trabajo en áreas o temas particulares
- Impulsar el rol del grupo como órgano consultivo en aspectos relevantes a las plantas medicinales
- Informar adecuadamente a los donantes sobre la importancia de la conservación y uso sostenible de plantas medicinales y buscar fuentes de financiamiento.

Responsable de la Región Latinoamericana: Sonia Lagos-Witte; **Responsables por países:** *Argentina:* Nilda Dora Vignale, Ana Maria Planchuelo; *Brasil:* Luci Valle, Viviane Fonseca, Claudio Urbano Pinheiro; *Colombia:* Adriana Rivera Brusatin, María Andrea Orjuela Restrepo; *Cuba:* Maria Fernandez; *Chile:* Jose San Martin; *Ecuador:* Ximena Buitrón Cisneros; *Honduras:* Paul House, Maritza Martinez; *México:* Jose Salvador Flores; *Perú:* Joaquina Alban.

Los participantes del Subgrupo Latinoamericano del Grupo de Especialistas de Plantas Medicinales de la UICN, hacen un llamado a los miembros de la ALB, RLB, GELA, Jardines Botánicos, Herbarios, Museos, Universidades, Centros de Investigación y otras instancias representadas en el IX CLB a contribuir con las prioridades y mecanismos sugeridos y apoyar al desempeño de las acciones del Subgrupo.

**Resolución de la mesa redonda sobre directrices mundiales de
conservación y uso sostenible de plantas medicinales**

**IX Congreso Latinoamericano De Botánica
21 de junio de 2006**

Santo Domingo, República Dominicana

Reconociendo la importancia de la conservación, incluyendo el uso sostenible e investigación de las plantas medicinales;

Tomando en cuenta la Resolución de la mesa redonda sobre Conservación y uso sostenible de plantas medicinales del VIII Congreso Latinoamericano de Botánica – CLB, llevado a cabo en Cartagena de Indias en el 2002, la cual resaltó la importancia de continuar apoyando los esfuerzos de conservación de plantas medicinales y promover acciones con relación a especies amenazadas en áreas geográficas estratégicas con participación de comunidades locales, incorporando mecanismos de protección al conocimiento tradicional;

Tomando en cuenta la Resolución 3073 sobre Conservación de las plantas medicinales adoptada en el Congreso Mundial de la Naturaleza, celebrado en Bangkok, Tailandia en el 2004, la cual respalda la revisión de las Directrices para la Conservación de Plantas Medicinales de la OMS/UICN/WWF/TRAFFIC e insta a la comunidad internacional a respaldar y poner en práctica las directrices en su nueva versión;

Tomando en cuenta las metas de conservación establecidas en la Estrategia Mundial de Conservación de las Plantas – GSPC y como mecanismo de contribución al logro de las mismas;

Resaltando la necesidad de desarrollar herramientas y guías específicas para la implementación de procesos adecuados de recolección silvestre, manejo in situ y ex situ, transformación y comercio de las plantas medicinales en aras de mantener a largo plazo los recursos de plantas medicinales con un enfoque regional;

Tomando en cuenta los aportes de la Reunión Satélite del Grupo Especialista de Plantas Medicinales de la UICN, realizada en el marco del IX CLB;

Tomando en cuenta los aportes y las oportunidades de interacción sugeridas durante la mesa redonda para el desarrollo de una estrategia latinoamericana para la implementación de las Directrices de Conservación de Plantas Medicinales de la OMS, UICN, WWF y TRAFFIC, entre ellos, los ejemplos presentados durante la mesa redonda, con relación a agroforestería comunitaria, integración entre conocimientos científico y local, un estándar práctico para verificar el uso sostenible, políticas relacionadas con mercados verdes y políticas de salud que apoyan sistemas de medicina tradicional;

Reconociendo y acogiendo con beneplácito los progresos llevados a cabo en torno a la revisión amplia y concertada de las Directrices sobre la Conservación de las Plantas Medicinales de OMS/UICN/WWF/TRAFFIC, el IX Congreso Latinoamericano de Botánica, celebrado en Santo Domingo, República Dominicana, del 18 al 25 de junio del 2006:

1. Respalda el desarrollo y promoción de una estrategia latinoamericana para la difusión e implementación de las Directrices de Conservación de Plantas Medicinales de OMS/UICN/WWF/TRAFFIC, e
2. Insta a brindar asistencia técnica y científica, así como apoyo institucional de los sectores relevantes, a este proceso.

Botanic Gardens: Using biodiversity to improve human well-being

Kerry Waylen

Introduction

It is well recognised that the problems of conservation and development are linked, and so attempts to tackle them should be integrated (ADAMS et al. 2004). Accordingly, contemporary policies for conservation, such as the Convention on Biological Diversity (CBD) and the Global Strategy for Plant Conservation (GSPC) make it clear that conservation must take human needs into account (GLOWKA et al. 1994, SECRETARIAT OF THE CBD 2003).

The need to link conservation with human needs is reflected by the missions of many organisations for conservation. The world's largest network for plant conservation is Botanic Gardens Conservation International (BGCI) which represents over 800 botanic gardens. Its members receive specific guidance by the International Agenda for Botanic Gardens in Conservation (IABGC), which interprets the many relevant policies (including the CBD and GSPC), and this document also emphasises the need to link human needs with conservation (WYSE JACKSON & SUTHERLAND 2000). For example, its executive summary states “a fundamental requirement for sustainable living is to integrate conservation and development”.

Unfortunately, although botanic gardens are well known for their role in the conservation of plant diversity, relatively few know of the role they can play in linking this

diversity with practical improvements to people's lives. As making practical links between conservation and development is often a challenge (e.g. HOUGH 1994), it is important that examples of gardens' work are better known. For this reason, BGCI recently released the report “Botanic gardens: using biodiversity to improve human well-being”. This marks the start of a new core work theme: “Botanic gardens linking biodiversity with improvements to human well-being”. BGCI aims to challenge

What is meant by “Human Well-being”?

Although the term poverty is often associated with financial deprivation, it has many aspects beyond a lack of money. These include the provision of food, healthcare, basic services and human rights. Some aspects of poverty, such as gender inequality, or restriction of civil or political rights, are not exclusive to low income groups or societies.

BGCI has therefore used the term “human well-being” to encompass these many aspects of human welfare that must be fulfilled in order to reduce poverty and improve lives. This term is used in a similar way by many organisations, conventions, policies and programmes related to both conservation and development, such as the Millennium Ecosystem Assessment (MA) Programme. Some other policies use related phrases to refer to a similar concept: for example, the Millennium Development Goals (MDGs) refer to “reducing poverty and improving lives”.

the popular notion that botanic gardens are only “pretty places”, and to promote the involvement of botanic gardens in initiatives that use plants for human well-being.

The report was based on a multilingual survey of BGCI's botanic garden members, and an extensive literature review that lasted several months. This process revealed that botanic gardens have contributed to many aspects of well-being, including improvements to healthcare, improvements to nutrition, financial poverty alleviation and providing social benefits. Case studies selected for the report illustrate the diverse activities that botanic gardens are involved in, and also reveal that the use of plants for healthcare is an aspect in which botanic gardens have great involvement, and perhaps the greatest potential for future contributions. This article briefly presents some of the themes highlighted by this report.

Missions for well-being: from medieval to modern

It is important to understand the past roles of botanic gardens, which have always served useful functions, because these underpin their current ability to use plants for human well-being. The very first were created to support the use of medicinal plants by Europe's medieval physicians. For example, the Botanical Garden of Padua was founded 1545 by the Vatican Republic for the cultivation of medicinal herbs, and enabled students to learn how to distinguish and use true medicinal herbs, greatly improving the reliability of local healthcare (CAPPELLETTI 1994). Similarly, the Chelsea Physic Garden was founded in England in 1673 by the Worshipful Society of Apothecaries, to train apprentices in plant identification and to help cultivate exotic plants for medicine (MINTER 2000).

Gardens founded later served a wider range of purposes, though healthcare remained important. For example, the Centre of Economic Botany at Royal Botanic Gardens Kew was founded in 1847 by the first official director, to “render great service, not only to the scientific botanist, but also to the merchant, the manufacturer, the physician, the chemist, the druggist, the dyer, the carpenter and the cabinet maker and artisans of every description” (DESMOND 1998). Botanic gardens created during the era of colonialism played a role in distributing plants around the world, establishing new cash crop economies but also introducing vital new medicinal plants such as *Cinchona* (ROCCO 2003).

Many new botanic gardens are explicitly designed to meet the needs of local communities. For example, Earth Ethnobotanic Garden (at Earth University, Costa Rica) focuses on the conservation of medicinal plants, investigates the potential use of plants, and communicates this information to local communities (EARTH UNIVERSITY FOUNDATION 2001; J. PORTUGUEZ, pers. comm.). Medi-

cinal plants are a particularly important theme for botanic gardens in regions such as India. In 2003 participants at the first conference of Indian botanic gardens issued a statement emphasising the importance of medicinal plants for primary healthcare, and their commitment to supporting sustainable livelihoods (NBRI 2003).

Research for well-being

Botanic gardens today have extensive resources and expertise that underpin their ability to contribute to human well-being. Their long history of plant collecting, taxonomy research and seed banking represent stores of knowledge with the potential to develop useful plants and plant products, such as novel medicines, and research into properties and new uses of accessions. For example, the Botanical and Experimental Garden of Radboud University, in the Netherlands, has been investigating the properties of its African *Solanum* accessions (including taxonomy, morphology, nutritional qualities and alkaloid properties) to provide an unambiguous and comprehensive guide to ‘safe to eat’ nightshades for African consumers (G. VAN DER WEERDEN, survey response). In the Democratic Republic of Congo, Kisantu Botanic Garden conducted trials on the popular fruit mangosteen with the aim of enabling local farmers to extend the shelf life of harvested fruit, to reach a larger market (KIBUNGU KEMELO 2004). Other gardens have focused on developing plants to be locally cultivated for use in the ornamentals market.

Botanic gardens are also actively engaged in adding to their store of useful knowledge. For example, in Senegal the Garden for Useful Plant Experimentation (JEPU) has inventoried, cultivated and evaluated traditional medicinal plants and their management systems, in order to establish a system of medicine that is sustainable and meets local needs (M. LO, survey response).

Education

Botanic gardens' expertise in environmental education is important (WILLISON 2006), because it is essential for any project that wishes to inform and enable people to improve their lives. For example, in Uganda, Makerere University Botanic Garden used lectures and demonstrations to educate women and children's groups in the usefulness and cultivation of certain medicinal plant species (C. KIWUKA, survey response). Most projects described in the report use more than one method of communication to transfer knowledge and skills, often emphasising less formal approaches such as workshops and ‘hands-on’ training.

The importance of partnerships

Partnerships are widely acknowledged to be an important factor for successful conservation and development pro-

jects (e.g. MULWAFU & MSOSA 2005). This is a particular strength of botanic gardens, which have many strong networks and collaborations. For example, Garden Route Botanical Garden in South Africa responded to a request by the over-stretched Kynsna Municipal Healthcare clinic, and now works with local people to facilitate their use and access to medicinal plants.

Some projects illustrate how many partners can be involved in the design and implementation of a multi-faceted project: for example, Natal National Botanic Garden (part of SANBI, the South African National Biodiversity Institute) is involved in “CINDI” (“Children in Distress Network”; a consortium of charities, NGOs government departments and individuals), to provide free healthcare support to AIDS sufferers and children (J. ROFF, survey response). As part of this project the garden supplies a local primary healthcare centre with a free supply of medicinal plants (including *Bulbine* and *Carpobrotus*) that local residents can take to plant in their own gardens, and use to self-treat some of the symptoms of HIV/AIDS.

Partnerships also support local livelihoods. For example, the Kirstenbosch Botanic Garden in South Africa was one of several institutions that contributed research on the smoke germination and propagation of *Cyclopia* spp., whose leaves and flowers are used to make the popular drink ‘Honey bush tea’. The results of this research have allowed the bush to be cultivated with ease, so material that was traditionally wild collected is now cultivated by over 40 poor communities where there was previously no agriculture (DE LANGE 1997, VAN WYK 2002).

Some partnerships span the world, providing excellent examples of how developed countries’ resources can be shared to improve well-being in distant communities. For example, the Centre for Conservation and Sustainable Development (CSSD) at Missouri Botanical Garden has been working with the Yanesha, a people indigenous to the Selva central of Peru (O. MONTIEL, survey response). The Yanesha suffer from extreme poverty, and their efforts to meet their needs are degrading their forest, but the CSSD works with three Yanesha communities to improve their understanding and management of their surrounding natural resources. One of the benefits has been an improvement in nutrition, by promoting the inclusion of more vegetables in their diets, and establishing gardens that trial vegetables not known locally. There is also an experimental fruit tree nursery, and when trees are large enough to transplant they are planted in small parcels of land adjacent to family houses.

Home gardens

Many botanic gardens promote improvements in both health and nutrition through support of home gardening.

Their horticultural skills and ability to propagate plant materials often prove invaluable in this respect. For example, Aburi Botanical Garden in Ghana has been improving local access to medicinal plants that are increasingly difficult to source from the wild by enabling local communities to set up medicinal gardens (G. OWUSU-AFRIYIE, survey response; AMPONSAH et al. 2002, GILLET 2002, DAMANKA & OFOSUHENE-DJAN 2001). A 50 acre model Medicinal Plant Garden was created based on community ethno-botanical surveys, and it now supports a wide range of lectures, seminars, workshops and demonstrations on medicinal plant cultivation. Aburi also distributes manuals and has provided over 2 million seedlings to enable communities to set up their own nurseries and first aid gardens.

Partnership is also helpful for the development of home gardens. For example, a two year project by the Bogotá Botanic Garden “José Celestino Mutis” involved collaboration with local authorities to teach deprived urban communities how to grow plants for food (BGCI 2005). Constructive partnerships may even cross continents: for example, the Conservatory and Botanic Gardens of Geneva, Switzerland, collaborated with Ascunción Botanic Garden and the Red Cross in Paraguay, to improve local knowledge, use and access to medicinal plants, resulting in the creation of community home gardens for healthcare (GAONA 2002, PINAZZO 2002).

Communicating plant uses

Introducing communities to new uses of plants can contribute significant assistance to local healthcare and nutrition, or developing new livelihoods. Calicut Botanic Garden in the south Indian state of Kerala, helped the healthcare and livelihoods of local people as part of a project to conserve Zingiberaceae (M. SABU, survey response). This project informed local housewives from low-income groups about the potential of home gardens, how to develop nurseries for useful plants, and provided these women with saplings of medicinal plants. In addition, they were shown how to extract a starch from *Curcuma aeruginosa*. As this plant is locally abundant and its products are very popular as a ‘rasayana’ herb in Ayurvedic medicine, women who extract the starch have the opportunity to significantly improve their incomes (figure 1).

Other projects have focused on improving livelihoods through selling handicrafts and other plant products. In Poland, Przelewiec Arboretum runs a training programme “Frauenhände bringen Geld” to teach unemployed women how to produce natural soaps and products for healthcare (K. MISIAK, survey response). Other gardens, such as Malabar Botanic Garden in India (R. ANSARI, survey response), have introduced farmers to new crops, to improve livelihood security through crop diversification.

Global relevance

Some case studies demonstrate the ability of botanic gardens in relatively affluent countries to assist communities in poorer countries. However, botanic gardens in the developed world can also play an important role in assisting their own local communities. For example, they can help tackle diseases of affluence by educating communities about the importance of a healthy diet incorporating lots of vegetables. Mental health problems are universally widespread (WHO 2001) and botanic gardens have also played a key role in developing and hosting the techniques of horticultural therapy, which is a widely accepted treatment for these problems (FRAZEL 1991).

In many developed countries urban areas have poor environmental quality, which is often associated with significant social problems. Many botanic gardens have responded by running 'greening' projects, which not only improve the appearance of neighbourhoods, but have been shown to significantly improve community relations and reduce crime (KUO & SULLIVAN 2001). For example, the New York Botanical Garden has worked with individuals and community groups in the Bronx, transforming derelict lots into safe places, and creating a sense of community empowerment (KELLER 1996). In Russia, several gardens have concentrated on developing strains of plants for greening that are able to withstand the harsh climate! The value of urban botanic gardens as recreation is also important, and they can also provide a huge range of other social benefits, from conserving and promoting traditional plant knowledge, to providing peace zones in areas of conflict.

Conclusion

Botanic gardens can make significant contributions to human well-being, particularly through promoting the sustainable use of medicinal plants for healthcare. A particular strength is in educating and empowering communities in novel plant uses and in the creation of home gardens. However, botanic gardens also make many other diverse contributions to human well-being, across the world, and are clearly much more than just "pretty places". Given the scale of the crisis facing our efforts for both conservation and development, BGCI believes that it is an ethical and practical imperative that botanic gardens are mobilised to link biodiversity with improvements to human well-being.

Acknowledgements

The author would like to thank her colleagues at BGCI, and all of BGCI's botanic garden members who contributed information and assistance with the report.

Further information

WAYLEN, K. (2006), Botanic Gardens: using biodiversi-

ty to improve human well-being. Botanic Gardens Conservation International, Richmond, UK. ISBN: 1-905164-08-4

The report, further references, case studies and information on BGCI's planned work on this subject can be found online at www.bgci.org/wellbeing. Copies of the report can be requested from BGCI in writing, or by emailing wellbeing@bgci.org.

References

All references noted as "survey response" are questionnaire responses received as part of BGCI's survey of its members between the period November 2005 and March 2006.

AMPONSAH, K., CRENTSIL, O., ODAMTTEN, G.T. & OFOSUHENE-DJAN, W. (2002): Manual for the Propagation and Cultivation of Medicinal Plants in Ghana. – 32 pp., Aburi Botanic Garden.

DAMANKA, L.A. & OFOSUHENE-DJAN, W. (2001): Handbook for the Harvesting, Preparation & Storage of Medicinal Plants. – 24 pp., Aburi Botanic Gardens and BGCI, Ghana.

BGCI (2005): Botanic Gardens lead fight against urban poverty in Colombia. – Cuttings 2 (4): 7.

CAPPELLETTI, E.M. (1994): The Botanic Garden of The University of Padua 1545-1995. – Botanic Gardens Conservation News 2 (4): 23-26.

DESMOND, R. (1998): Kew: The history of the Royal Botanic Gardens. – 466 pp., Harvill Press, London and Royal Botanic Gardens, Kew.

DE LANGE, J.H. (1997): Propagation of honeybush tea, ARC Bulletin. – 6 pp., ARC Infruitec-Nietvoorbij, South Africa.

EARTH UNIVERSITY FOUNDATION (2001): EARTH Inaugurates Ethnobotanical Garden. Retrieved from: www.earth-usa.org/news/news2.html.

FRAZEL, M. (1991): Horticultural Therapy. – Hospital & Community Psychiatry 42 (11): 1192.

GAONA, J.P. (2002): Processus de coopération très bénéfique entre la suisse et le Paraguay. – La Feuille Verte 32: 4-5.

GILLET, H.J. (2002): Conservation and sustainable use of medicinal plants in Ghana 1999-2002. – Cambridge, UNEP-WCMC. CD-ROM and Online resource, www.unep-wcmc.org/species/plants/ghana/.

GLOWKA, L., BURHENNE-GUILMIN, B., SYNGE, H., MCNEELY, J. & GUNDLING, L. (1994): A Guide to the Convention on Biological Diversity. – Environmental Policy and Law Paper No. 3, IUCN, Gland, Switzerland and Cambridge, UK.

KELLER, T. (1996): Botanic Gardens Educational Involvement in the Local Community. – In: HOBSON, C. (ed.), Third International Botanic Gardens Conservation Congress 1992, pp. 187-189, BGCI, London.

KIBUNGU KEMELO, A.O. (2004): Trials on Conserving Mangosteen fruit in wet sawdust. – African Botanic Gardens Network Bulletin, 8. Retrieved from: www.bgci.org/africa/bulletin_8/.

NBRI (2003): The Lucknow Statement on Botanic Gardens of India. Retrieved from www.ibgn.org/ibgnnetwork3.htm.

MILLENNIUM ECOSYSTEM ASSESSMENT (2005): Ecosystems and Human Well-Being: Current State and Trends: Findings of the Condition and Trends Working Group. – 815 pp., Island Press, Washington, D.C.

MINTER, S. (2000): The Apothecaries' Garden: A History of the Chelsea Physic Garden. – 221 pp., Sutton Publishing, Stroud, UK.

MULWAFU, W.O. & MSOSA, H.K. (2005): IWRM and poverty reduction in Malawi: A socio-economic analysis. – *Physics and Chemistry of the Earth* 30 (11-16): 961-967.

PINAZZO, J. (2002): *Projet Ethnobotanique du Paraguay (EPY)*. – *La Feuille Verte: Journal des conservatoire et Jardin Botaniques* 32: 5.

ROCCO, F. (2003): The miraculous fever tree : malaria, medicine and the cure that changed the world. – 348 pp., Harper Collins, London, UK.

SECRETARIAT OF THE CBD (2003): Global strategy for plant conservation. – 13 pp., Secretariat of the Convention for Biological Diversity, Montreal, Canada.

UN (2005): The Millennium Development Goals Report. – 43 pp., United Nations Department of Public Information, New York, USA.

VAN WYK, B.E. (2002): A review of ethnobotanical research in South Africa. – *South African Journal of Botany* 68 (1): 1-13.

WHO (2001): Mental and neurological disorders factsheet. – Geneva, WHO. Retrieved from www.who.int/mediacentre/factsheets/fs265/en/.

WILLISON, J. (2006): Education for Sustainable Development: Guidelines for Action in Botanic Gardens. – 25 pp., BGCI, London, UK.

WYSE JACKSON, P. & SUTHERLAND, L.A. (2000): International Agenda for Botanic Gardens in Conservation. – 56 pp., BGCI, London, UK.

All internet resources mentioned in this paper have been viewed on 4.5.2006.

Kerry Waylen • Research Assistant • Botanic Gardens Conservation International • Descanso House • 199 Kew Road • Richmond, Surrey, TW9 3BW • United Kingdom • Tel. ++44/20/8332-5953 • Fax: ++44/20/8332-5956 • E-mail: kerry.waylen@bgci.org.

Progress on the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP)

Susanne Honnef, Danna Leaman,
Britta Pätzold & Uwe Schippmann

There has been substantial progress on the development of the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP), an undertaking initiated in 2004 by MPSG through IUCN Canada, in partnership with WWF, TRAFFIC, and the

German Federal Agency for Nature Conservation / Bundesamt für Naturschutz (BfN). The previous volume of *Medicinal Plant Conservation* (MPC) reported the definition of the standard's goal and objectives, and development of the main principles of the ISSC-MAP based on two preliminary drafts and their review and revision by a broad-based advisory group (MPC 11: 4-5). We can now report further progress in the following areas: field consultations, completion of an implementation study, stakeholder consultations, and refinement of the text of the standard in the first public working draft. Most recently, we have taken initial steps with key partners to establish a governance and management structure that will move the ISSC-MAP from development to implementation, and to select and initiate implementation models.

Field consultations

The relevance and practicality of the second draft standard was tested August - October 2005 in five existing MAP field projects. The projects were selected from different geographical regions, offering a range of socio-economic and resource management circumstances:

- A private company, *Andelic d.o.o.* in Bosnia-Herzegovina (financed by BfN/INA, and SIPPO),
- A non-profit initiative, *Iracambi Medicinal Plants Project* in Brazil (financed by Manfred-Hermesen-Stiftung),
- A state-owned and managed protected area of *Wanglang National Nature Reserve & Baima State Forest* in China (financed by WWF Germany),
- A community-based *agro-artesanal producers' association (AAPPSME)* in Ecuador (financed by UNCTAD, with additional support from Manfred-Hermesen-Stiftung) (p. 17),
- A non-profit *Sustainably Harvested Devil's Claw* project in Namibia (financed by Salus Haus, Germany).

A final field consultation, focusing on community-managed collection areas for medicinal plants in India is being carried out in November-December of 2006 by the Foundation for Revitalization of Local Health Traditions (FRLHT), in India, with funding from Plant Life International.

Implementation study

Results from the field consultations were evaluated during a second expert workshop on the Isle of Vilm in December 2005, providing many practical recommendations concerning the structure and content of the standard (SALVADOR 2005).

Eight scenarios in which the ISSC-MAP might be implemented effectively (figure 1) were identified during field consultations and by participants in the second Vilm

workshop (SALVADOR & PÄTZOLD 2005), including: voluntary, self-regulating efforts (first-party claims); codes of practice adopted by trade associations or through industry policy (second-party claims); and independent certification or labelling schemes backed by government regulations, NGOs, or certification bodies (third-party claims).

Stakeholder consultation

Opportunities for implementation of the ISSC-MAP in partnership with organic certification, were presented to the First IFOAM (International Federation of Organic Agricultural Movements) Conference on Organic Wild

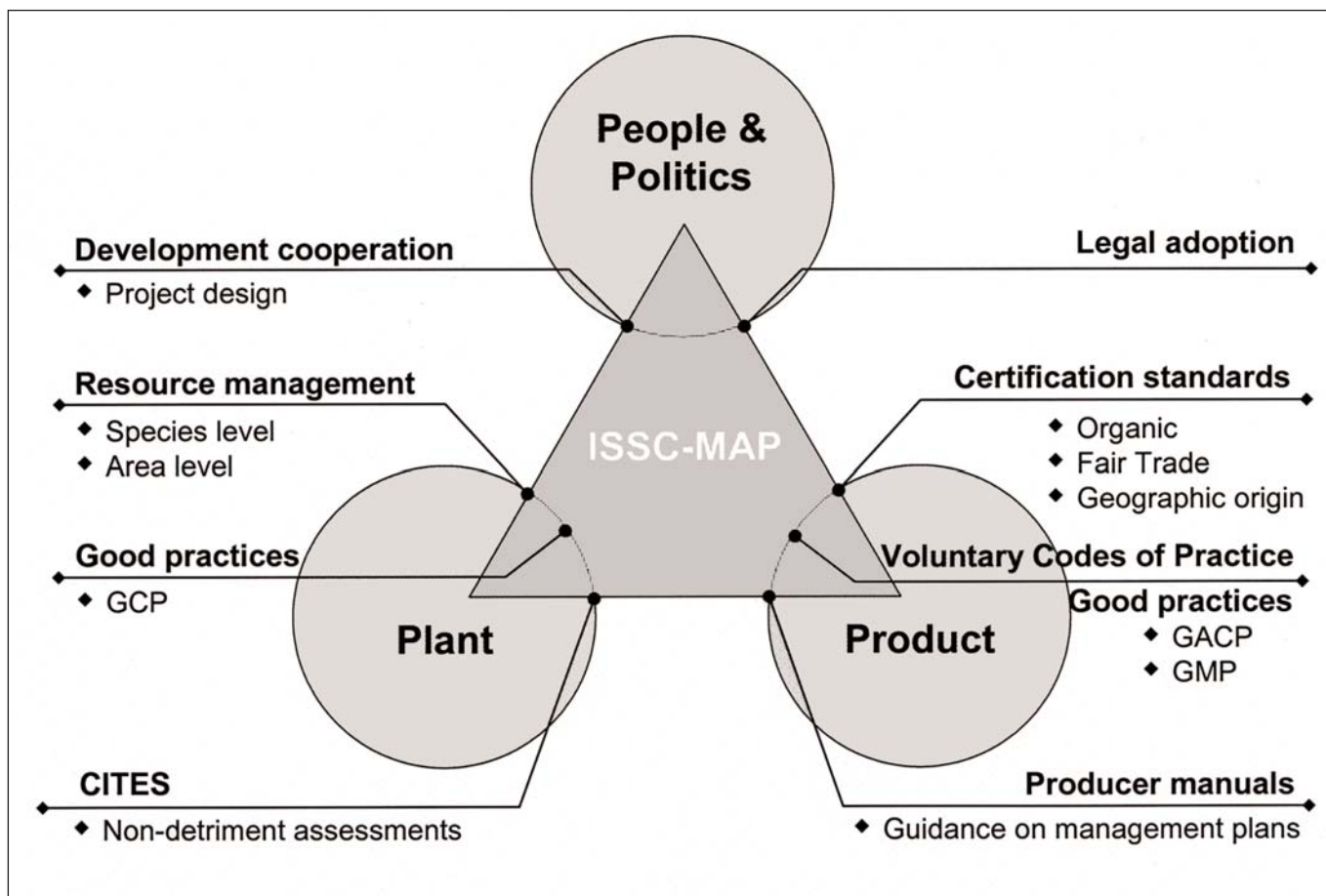


Figure 1. Implementation scenarios for ISSC-MAP identified by the Steering Group and the Advisory Group (Source: SALVADOR & PÄTZOLD 2005).

From January - April of 2006, an implementation study was carried out to assess how the standard might be used by different stakeholder groups and under different implementation scenarios (KATHE & GALLIA 2006). Principal strategies examined include:

- Integration with existing standards and mechanisms (e.g., CITES non-detriment findings for species listed on Appendix II).
- Partnership / harmonization with existing or developing standards and mechanisms (e.g., organic and fair-trade certification schemes, BioTrade principles and criteria).
- Stand-alone mechanism (e.g., verification / certification by one or more members of the ISSC-MAP steering group).

Production, convened in Bosnia and Herzegovina in May 2006 (LEAMAN et al. 2006). A side event convened by MPSG together with WWF and TRAFFIC, and BfN, with support from Manfred-Hermesen-Stiftung, focused particularly on the challenges and opportunities for implementing the ISSC-MAP with organic certification in East and South-eastern Europe (PÄTZOLD et al. 2006). This event provided a discussion forum for more than 50 participants, including representatives from government conservation agencies, natural (organic) herbal product traders, manufacturers and retailers, herbalists, organic certification bodies, and conservation organizations.

The ISSC-MAP has been presented and discussed in a variety of other venues, including: Biofach (Nuremberg, Germany, February 2006), the Latin American Botanical Congress (Santo Domingo, Dominican Republic, June 2006), the inaugural meeting of the Global Partnership for Plant Conservation (Dublin, Ireland, October 2005), the

National Conference of the Canadian Herb, Spice, and Natural Health Product Coalition (St John, Newfoundland, Canada, November 2005), the NIMH (National Institute of Medicinal Herbalists) Conference (Durham, UK, April 2006), the Supply Side East (New Jersey, USA, May 2006), the 16th meeting of the CITES Plants Committee (Lima, Peru, July 2006), Workshop “Discussion on

the verification and impact monitoring assessment system for BioTrade activities” (Lima, Peru, July 2006), German Tropentag (Bonn, Germany, October 2006), and the 12th International Conference and Exhibition of the Egyptian Society for Producers, Manufacturers & Exporters of MAP (Cairo, Egypt, November 2006).

Table 1. ISSC-MAP Principles and Criteria (Working Draft, June 2006)

SECTION 1: WILD COLLECTION AND CONSERVATION REQUIREMENTS

Principle 1. Maintaining Wild MAP Resources

Wild collection of MAP resources shall be conducted at a scale and rate and in a manner that maintains populations and species over the long term.

1.1 Conservation status of target MAP species

The conservation status of target MAP species and populations is assessed and regularly reviewed.

1.2 Knowledge-based collection practices

MAP collection and management practices are based on adequate identification, inventory, assessment, and monitoring of the target species and collection impacts.

1.3 Collection intensity and species regeneration

The rate (intensity and frequency) of MAP collection does not exceed the target species' ability to regenerate over the long term.

Principle 2. Preventing Negative Environmental Impacts

Negative impacts caused by MAP collection activities on other wild species, the collection area, and neighbouring areas shall be prevented.

2.1 Sensitive taxa and habitats

Rare, threatened, and endangered species and habitats that are likely to be affected by MAP collection and management are identified and protected.

2.2 Habitat (landscape level) management

Management activities supporting wild MAP collection do not adversely affect ecosystem diversity, processes, and functions.

SECTION II: LEGAL AND ETHICAL REQUIREMENTS

Principle 3. Complying with Laws, Regulations, and Agreements

MAP collection and management activities shall be carried out under legitimate tenure arrangements, and comply with relevant laws, regulations, and agreements.

3.1 Tenure, management authority, and use rights

Collectors and managers have a clear and recognized right and authority to use and manage the target MAP resources.

3.2 Laws, regulations, and administrative requirements

Collection and management of MAP resources complies with all international agreements and with national, and local laws, regulations, and administrative requirements, including those related to protected species and areas.

Principle 4. Respecting Customary Rights

Local communities' and indigenous peoples' customary rights to use and manage collection areas and wild collected MAP resources shall be recognized and respected.

4.1 Traditional use, access rights, and cultural heritage

Local communities and indigenous people with legal or customary tenure or use rights maintain control, to the extent necessary to protect their rights or resources, over MAP collection operations.

4.2 Benefit sharing

Agreements with local communities and indigenous people are based on appropriate and adequate knowledge of MAP resource tenure, management requirements, and resource value.

SECTION III: MANAGEMENT AND BUSINESS REQUIREMENTS

Principle 5. Applying Responsible Management Practices

Wild collection of MAP species shall be based on adaptive, practical, participatory, and transparent management practices.

5.1 Species / area management plan

A species / area management plan defines adaptive, practical management processes and Good Collection Practices.

5.2 Inventory, assessment, and monitoring

Management of MAP wild collection is supported by adequate and practical resource inventory, assessment, and monitoring of collection impacts.

5.3 Transparency and participation

MAP collection activities are carried out in a transparent manner with respect to management planning and implementation, recording and sharing information, and involving stakeholders.

5.4 Documentation

Procedures for collecting, managing, and sharing information required for effective collection management are established and carried out.

Principle 6. Applying Responsible Business Practices

Wild collection of wild MAP resources shall be undertaken to support quality, financial, and labour requirements of the market without sacrificing sustainability of the resource.

6.1 Market / buyer specifications

The sustainable collection and handling of MAP resources is managed and planned according to market requirements in order to prevent or minimise the collection of products unlikely to be sold.

6.2 Traceability

Storage and handling of MAP resources is managed to support traceability to collection area.

6.3 Financial viability

Mechanisms are encouraged to ensure the financial viability of systems of sustainable wild collection of MAP resources.

6.4 Training and capacity building

Resource managers and collectors have adequate skills (training, supervision, experience) to implement the provisions of the management plan, and to comply with the requirements of this standard.

6.5 Worker safety and compensation

MAP collection management provides adequate work-related health, safety, and financial compensation to collectors and other workers.

Content of the standard

A first public working draft of the ISSC-MAP (MPSG 2006) incorporates comments from the Advisory Group, results of the field consultation phase, and discussions during the 2nd Vilm workshop. The current working draft of the ISSC-MAP has six principles and 18 criteria, addressing ecological, social, and economic requirements for sustainable wild collection of MAP. These are summarized in table 1. Each criterion is supported by a set of proposed indicators and forms of control, or verification.

Some elements of the ISSC-MAP will require additional definition and guidance. For example, tools and processes for assessing sustainable yield are essential to the effective implementation of the ISSC-MAP. In September 2006, a workshop hosted by BfN and the University of Koblenz-Landau on the Isle of Vilm, brought together approximately 40 individuals working on field assess-

ment of sustainable yield of medicinal and aromatic plants, or of other wild-harvested non-timber resources, to discuss tools and processes available, and their relevance to medicinal and aromatic plants. Results from this workshop will be incorporated in guidance for applying the ISSC-MAP.

Governance and management of the ISSC-MAP

As we move now from the development to the implementation phase of the ISSC-MAP, we and our advisory group colleagues recognize that new structures are required for governance and management of both the standard and the process of its implementation. The Steering Group and several of the most actively involved members of the advisory group met on 18-19 September 2006 to plan this transition. This workshop was hosted by Manfred-Hermesen-Stiftung in Bremen, Germany.

The original Steering Group and Advisory Group will be expanded and differentiated into four new structures:

- a secretariat, housed within WWF Germany and TRAFFIC Europe;
- a decision board, adding to the original steering group certification and industry expertise, and expanding regional expertise;
- a technical board, which will advise the decision board on specific issues related to implementation and further development of the standard; and
- ad hoc task groups to provide expertise on specific issues, such as those related to particular species of MAP.

Implementation models

Over the next few years, we are looking forward to the challenge of working with partners to implement the ISSC-MAP. We have identified four priority strategies that will provide a broad range of models and practical experience in applying the ISSC-MAP: certification, resource management, legal adoption and policy, and voluntary codes of practice. We are currently developing implementation projects in several regions.

Information on the status and activities of this project is available via the project website (www.floraweb.de/map-pro, viewed 16.11.2006).

References

KATHE, W. & GALLIA, E. (2006): International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP): Study on Implementation Strategies and Opportunities for Pilot Implementation (Excerpt). – www.floraweb.de/map-pro.

LEAMAN, D.J., SCHIPPMANN, U., KLINGENSTEIN, F., HONNEF, S. & PÄTZOLD, B. (2006): ISSC-MAP: International Standard For the Sustainable Wild Collection Of Medicinal And Aromatic Plants. Proceedings of the 1st IFOAM International Conference on Organic Wild Production: Teslic, Bosnia and Herzegovina, May 2006. – pp. 209-217, International Federation of Organic Agricultural Movements (IFOAM).

MEDICINAL PLANT SPECIALIST GROUP (MPSG) (2006): International standard for sustainable wild collection of medicinal and aromatic plants (ISSC-MAP). Working Draft (June 2006). Steering Group for the Development of an International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants. – www.floraweb.de/map-pro.

PÄTZOLD, B., LEAMAN, D. & HONNEF, S. (2006): Sustainable Wild Collection of Medicinal and Aromatic Plants: The Need for an International Standard. – TRAFFIC Bulletin vol. 21 (1): 41-45.

SALVADOR, S. (2005): Compilation of Results from Field Consultations on the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plan (ISSC-MAP). Draft 2. – www.floraweb.de/map-pro.

SALVADOR, S. & PÄTZOLD, B. (2006): International Standard for Sustainable Wild Collection of Medicinal and Aromatic

Plants (ISSC-MAP). Minutes of the 2nd Expert Workshop on the Isle of Vilm, December 02 - 06, 2005. – www.floraweb.de/map-pro.

Supplier audit in MAP collection and cultivation: Buyer perspective in Germany

Ernst Schneider

Medicinal and aromatic plants (MAP) are used as starting material either as active ingredients of herbal medicinal products (e.g. “traditional” and “well-established”), as minor, non-active components of food supplement products (e.g. combined with vitamins), as foodstuffs and spices or food additives, as herbal and fruit beverage teas and juices, or as ingredients in cosmetic products. From the perspective of industry the focus lies on the quality of plant raw material. The need for supplier audits along the supply chain is part of the companies’ overall quality management system and no distinction is made between cultivated and wild collected plant material. However, from the legal point of view there are distinct differences between herbs used for medicinal and for food purposes. For example, culinary herbs and spices, regulated under the Foodstuffs and Commodities Act (LFGB), can be of food-grade quality (e.g. ASTA-, DIN- or ISO- standards) and are subject to Good Manufacturing Practices (GMP) for foods. Herbs for use in medicinal products, regulated under the German Medicines Law (AMG), must be of pharmacopoeial-quality (e.g. DAB- or PhEur- standards) and are subject to pharmaceutical GMPs.

What is an audit?

The term is derived from the Latin word “audire”, to hear. It is basically a question and answer process. Audits are generally carried out by the buyer’s Quality Control Unit, responsible for vendor approval, or by a 3rd party auditing organization, during site visit inspections at the supplier’s farm or wild collection area. The auditor is interviewing the supplier according to a Standard Operation Procedure (SOP) and is deriving conclusions about conformity from the answers. In addition to an inspection and interview, the supplier may also be asked to complete an audit questionnaire document. It is important to note that auditing is the attempt to control a production system through a selective and short-termed questioning process. Therefore, the auditor can only check the systematic principles involved in the process not the entire process itself.

Who is the buyer for herbal raw materials?

MAPs are used as starting material in the pharmaceutical industry for the production of medicinal products and in the food industry mostly to enhance taste or as physiologically active ingredients. It is very important to realize that the two types of buyers (pharmaceutical and

food industry) are acting in totally different legal spheres. National drug law and all regulations on medicinal products are a so-called “negative law”: Everything is forbidden unless allowed by drug law or responsible authorities. On the other hand the food law is a “positive law”, based on Roman law, which says “everything is allowed if not explicitly forbidden”, for example certain non-European herbs presently considered to be so-called “novel food ingredients”. It is extremely important to keep this in mind to understand the differing points of view of industry stakeholders.

Quality Management Systems (QMS)

The aim of audits is to check the system for traceability from the final product used by the consumer back to the source following the complete line of herb production. In addition to standard QMS auditing, depending on the company philosophy and the targeted end-use for the herbal raw material, the aim of the auditor in the process of checking traceability could also include questions within the framework of various certifications and/or regulations. For example, the traceability requirements for ISO certification may vary somewhat from the traceability requirements for additional ecological certifications (e.g. biodynamic or organic), and/or from the traceability requirements of religious certifications (e.g. Halal or Kosher) or from social certifications (e.g. Fair Trade). In addition to quality control, these certification systems also take into consideration ecological and economic sustainability as well as quality and traceability requirements of religious reason.

Medicinal products: For medicinal products, Quality Management is clearly regulated by law as well as by regulations for Good Manufacturing Practices (**GMP**). In addition API-GMP, the GMP for active pharmaceutical ingredients (**API**) and starting material, is implemented while the Good Agricultural and Collection Practice (**GACP**) is applied for primary production (growing and wild-crafting) of starting materials of herbal origin.

Food: As comparable regulations for food are still not existing or only partly implemented by law, QMS in the food industry is organized privately. Most prominent is the International Food Standard (**IFS**), now also adopted by the International Standard Organization (ISO) as ISO 22000. ISO 9001-2000, the QMS generally used in all types of industry, is also part of IFS although not well-suited for food. As an auditing system for Good Agricultural Practice (GAP) for fruits, vegetables and flowers, **EUREP-GAP** is used by most of the well-known retail trade chains. For the food industry the only mandatory system is **HACCP** originating from the World Health Organization (WHO) Codex Alimentarius, which has become part of food hygienic regulation in the EU and the national food law of the member countries.

Perspective of the buyer in the pharmaceutical industry

For pharmaceutical production there is a very complex regulation system based on European directives (e.g. EU Directive on Traditional Herbal Medicinal Products [THMPD]) and the national drug law, and which is quite difficult for people outside of the pharmaceutical industry to comprehend.

The starting point of the supply chain in the pharmaceutical industry is the specification and corresponding documentation requirement elaborated by the Quality control (QC)/QMS manager. The raw material specification sheet requires conformance to the qualitative and quantitative standards of the corresponding pharmacopoeial monograph. When handed over to the purchasing department, this requirement, together with the purchase order or future delivery contract, is going down the supply chain via wholesaler and drug agent to the local producers, collectors and growers. After purchase, representative pre-ship samples of the raw material together with the documentation required by the purchasing department are sent to the company's QC Unit for evaluation. The quality of the material is then tested according to the pharmacopoeial monograph standards and official methods, often in addition to other company- or product-specific specification requirements (e.g. bulk density, particle size, water activity, water-soluble extractive). When the tested batch of herbal material meets the specification it is released from quarantine for use through the signature of the QC manager. This is the point where an end-use determination is made that the material is definitely suitable for medicinal products and that the quality of the tested batch of herbal material is approved and released for use in pharmaceutical production.

In the pharmaceutical production process, there are three steps from plant raw material to final product related to the terms Good Agriculture and Collection Practice (GACP), API-GMP and GMP already defined above.

API-GMP

In the EU, quality assurance of starting material (API-GMP) is part of the pharmaceutical production rules (GMP) and also includes regulations on API consisting of comminuted (grinded) or powdered herbs (EUDRALEX 2005). Realizing that there are two different spheres (agriculture and drug law) touched by herbs, the initial first stages of plant production are separated from the subsequent physical processing.

In the production process from plant raw material to the final product there are increasing GMP requirements, as noted in the official document (EMA 2006). The collection of plants, cultivation and harvesting as well as post-harvest drying, cleaning, cutting and comminuting have the lowest level of control requirements. These

activities are part of agriculture and collection and therefore part of the GACP regulation.

After these first two steps of the process there is a “purposive decision line” concerning the target end-use because most of the herbs will be used for non-medicinal purposes, for example, as foodstuffs and spices, beverage teas, plant dyes or for other non-food industrial uses. This decision line is marked by the testing and release-for-use procedure already explained. API-GMP in fact is regulating only further physical processing and packaging whereas the subsequent steps to the final medicinal product are covered by the rules of GMP.

an appropriate quality assurance system. Audits are part of this system and audit reports have to be kept for at least 10 years.

A very similar GACP document was published by the WHO as a guideline for UN member countries to implement appropriate regulations (WHO 2003).

GMP

GMP is the highest ranking document and is based on European regulations and subsequently on the National Drug Law including chapters on registration and production. In pharmaceutical production, supplier inspec-

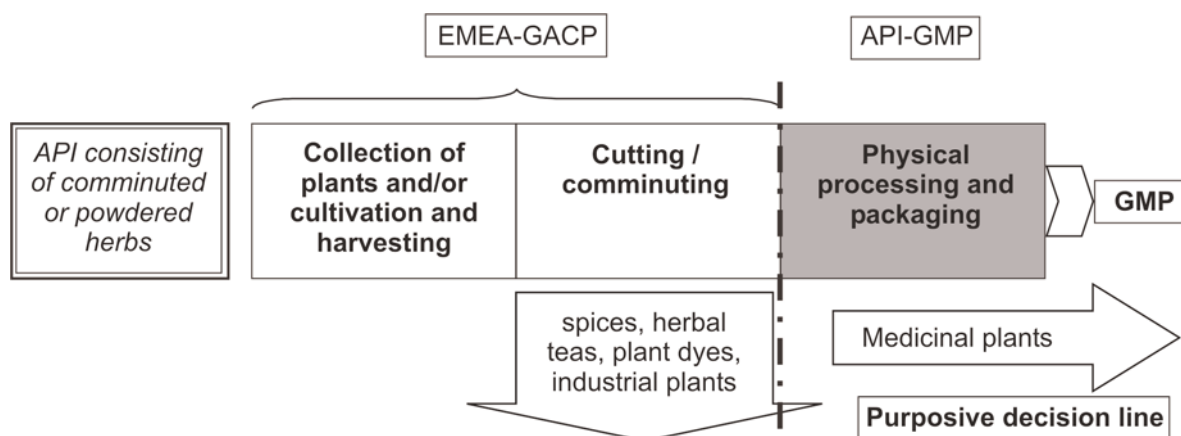


Figure 1. Relationship between EMEA-GACP, API-GMP and GMP in the production of herbal medicinal products. The decision line between Good Agricultural Practice and GMP is located very late in the supply chain because most herbs are used for other purposes than medicine.

EMEA-GACP

EMA, the European Medicines Agency, published a GACP document in 2002 as “Points to Consider” for drug application purposes only. In 2005, the same document was edited as “Public Statement” of the Committee on Herbal Medicinal Products (HMPC) with an enhanced legal status (EMA 2005). Since the end of 2005, it is obligatory for pharmaceutical companies in the EU to implement this GACP-System according to Regulation 2001/83/EG. In early 2006, HMPC published the “Guidelines on GACP for Starting Materials of Herbal Origin”, which came into effect on 1 August 2006 (EMA 2006).

In the introduction chapter of the EMA document it is stated that the concept of GMP for the manufacturing, processing, packaging and storing of APIs should also be applied to medicinal plants/herbal substances. A reproducible quality of herbal starting materials requires an adequate quality assurance system for the collection and/or cultivation, for harvesting and primary processing. Although GACP does not fall directly under GMP guidelines in the traditional sense, these considerations should be used as a basis for the establishment of such

tion is part of obligatory self-inspection according to GMP and even for the registration procedure of medicinal products details of suppliers have to be stated.

According to the legal framework for Herbal Medicinal Product Registration together with the quality documentation required to get marketing authorisation (Common Technical Document, CTD) the following details of the manufacturer have to be stated: name, address and responsibility of each supplier including contractors, each proposed site or facility involved in production/collection, the geographical source, harvesting, drying, storage conditions of plant production and plant collection (EUDRALEX 2004).

According to EU Principles and Guidelines of Good Manufacturing Practice (GMP), the appropriate system of quality assurance for the manufacturer of medicinal products should ensure that arrangements are made for the supply of the correct starting material. Specifications for starting material should include the approved suppliers of the products. In general the method to ensure GMP rules is the Standard Operation Procedure (SOP).

Inspection of MAP supplier

For inspecting cultivated and wildcrafted medicinal plants a suitable SOP was published after public discussions with the stakeholders by the Forschungsvereinigung der Arzneimittel-Hersteller e.V. (FAH) = German Medicinal Product Manufacturers' Research Association (FAH 2003a and b). At the moment this SOP is already in the process of implementation for the auditing of suppliers inspected under responsibility of pharmaceutical managers of the companies.

bility of the pharmaceutical company. Supplier audits may be conducted by trained employees of the company or may be assigned to 3rd-party auditing organizations. API-GMP and GMP are under control of the official national pharmaceutical inspection bodies and are only audited by government officials according to drug law (table 1).

To emphasize this again: Because of the negative law system of drug law all regulations mentioned are obligatory and deviations will be prosecuted.

Table 1. Quality Management Systems for MAP used in medicinal products & supplier audit	
QM-System	Certification Body
GMP	Pharmaceutical inspection by government officials
API-GMP	Pharmaceutical inspection by government officials
EMA-GACP	In responsibility of the pharmaceutical company (own staff members or 3rd-party auditing organization)

Another good tool to establish a more elaborated SOP and auditing protocol for wild collection of threatened medicinal plants is the recently discussed International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) with its principles, criteria and indicators prepared by IUCN (LEAMAN & SALVADOR 2005). The ISSC-MAP represents only an explanatory note in the QMS of herbal medicinal products and a supplement of Good Collection Practice according to EMA-GACP. In the EMA-GACP it is stated that collection must be carried out in compliance with existing species conservation legislation and that the methods must not damage the growth environment ensuring optimum conditions for regeneration of the medicinal plant harvested. This is where the ISSC-MAP will fit in.

Perspective of the buyer in the food industry

Food regulation is part of positive law. At present QMS for food in fact is legally not clearly regulated. To fill the gap, an initiative of 40 retail companies from Europe, North-America und Australia founded the Global Food Safety Initiative in 2000 in order to elaborate a scheme for uniform inspection of suppliers for their own brands. This scheme for auditing called International Food Standard (IFS) has been implemented since January 2003. IFS includes standards for a general quality management system (ISO 9001:2000), the obligatory control system Hazard Analysis and Critical Control Point (HACCP), and Good Manufacturing Practice (GMP-Food) and Good Transportation Practice (GTP). The aim is a global

Table 2. Quality Management Systems for MAP used in food & supplier audit	
QM-System	Certification Body
IFS	Accredited certification bodies
ISO 22 000	Accredited certification bodies
ISO 9001-2000	Accredited certification bodies
HACCP	Official food inspection
FDA Human Food GMP	FDA
FDA Dietary Supplement GMP	FDA
EUREP-GAP	FOODPLUS + coopted certification bodies
QS Deutscher Bauernverband (German farmers association)	QS GmbH, Bonn, Germany

Who is responsible for auditing?

As already stated, GACP does not fall directly under the GMP guidelines but is a basis for the establishment of an appropriate quality assurance system. Production of plant material is not inspected by officials but is in the responsi-

quality management system including official hygienic regulation (HACCP). IFS is audited exclusively by accredited certification bodies.

To extend their GMP-Food to primary production of plant products the Euro-Retail Produce Working

Group (EUREP) also started to elaborate Good Agricultural Practices (GAP) for fruits and vegetables and published EUREP-GAP as a normative document for International Certification in 1997. FOODPLUS GmbH in Cologne, Germany – an independent daughter company of EHI-EuroHandelsinstitut e.V., a non-profit, private research and education institute – acts as global certification body to audit partners from the entire food chain for fruit and vegetables according to EUREP-GAP. In parallel, the farmers association of Germany also installed their own auditing system (table 2).

As a result of the positive food law (in Germany) there are a wide variety of quality management systems with a number of competitive certification bodies. Auditing of wild collected plant material is not yet included in these systems but the auditing bodies for GAP will be able to adopt also the principles of ISSC-MAP.

In general, the difference between GMP and HACCP is that GMP is describing equipment and production processes whereas HACCP is evaluating risks in these processes and is defining critical points, which have to be controlled. In principle, both are similar for medicinal plants and food plants, but are regulated differently.

Conclusion

As a summary it must be understood that for future auditing of MAP suppliers the dividing line between pharmaceutical and food industry will remain. For MAP as starting material of herbal medicinal products the supplier audit is already well regulated by drug law, and the pharmaceutical industry therefore is afraid of over-regulation. In contrary, the herb suppliers for food business and their customers actively ask for certification and are looking for an independent 3rd-party control because of a lack of consistency.

Presently, there are two trends in the auditing of MAP (EHGA 2005). In the past and also at present a partnership between the pharmaceutical industry and their supplying herb growers has been established on the basis of contracts and specifications. This is typically audited by a supplier inspection and GAP audit, combined with recommendations and know-how transfer to a further enhancement of quality of plant raw material. For the future, especially the food industry will probably prefer to give order for audits to an accredited 3rd-party-auditing organization. These bodies only will do a very formal auditing for performance or non-performance with the standards and as a result will establish a list of non-conformity. If necessary, additional advice on recommendations, training and support will be offered by a cooperating consulting company of the auditing organization.

GAP already is widely accepted at the herb growers and in process of implementation with herb cultivation.

At the moment the ISSC principles and indicators are being discussed intensively for wild collection of MAP. Because of interaction with collectors and suppliers in foreign countries all stakeholders have a strong responsibility to establish realistic principles, criteria and indicators, easily to be fulfilled on all levels. Otherwise there is a danger of meaningless batch documents. Of course, additional costs must be avoided by including the collection standards in already existing quality management systems.

The situation in the United States of America for comparison

In the USA the responsible authority for agricultural and wild collection practices is the United States Department of Agriculture (USDA), which has, for example, published guidance on collection practices for wild herbal crops in the National Organic Program (NOP) regulations (USDA 2000). The responsible GMP authority for the manufacture of herbal products, whether classified as a dietary supplement-, drug- or food-product, is the Food and Drug Administration (FDA). FDA has already implemented Human Food GMPs and has published a draft for Dietary Supplement GMPs (FDA 2003 a,b). The latter includes most medicinal plant products and the intention was to enhance quality of these products and to ensure that the products really contain what is stated on the label. Many botanical raw materials, intermediates and finished products are, however, subject to FDA Drug GMPs (FDA 2006a). For example, some of the top-selling medicinal herbal products in the USA are classified as over-the-counter (OTC) laxative drug products made from either psyllium husk or seed (*Plantago ovata* Forssk.) or senna leaf or pod (*Cassia senna* L. or *C. angustifolia* Vahl) (FDA 2006b). Additionally, there are medicinal herbs in the USA permitted only for use in prescription drug products (e.g. belladonna leaf extract (*Atropa belladonna* L.), digitalis leaf (*Digitalis purpurea* L.) or rauwolfia root (*Rauvolfia serpentina* (L.) Benth. ex Kurz.), among others). The manufacture of these medicinal herbs is subject to drug GMP.

References

- EHGA (2005): Workshop “The auditing of herb farmers and growers to certify GAP and GCP”. BfArM Bonn, Dec, 2nd 2005.
- EMEA (2005): Committee on Herbal Medicinal Products (HMPC). Public statement on good agricultural and collection practice for starting materials of herbal origin. Doc. Ref. EMEA/HMPC/246816/2005. London, 29 July 2005.
- EMEA (2006): Committee on Herbal Medicinal Products (HMPC). Guideline on good agricultural and collection practice (GACP) for starting materials of herbal origin. Doc. Ref. EMEA/HMPC/246816/2005. London, 20 February 2006. Retrieved 30 July 2006 from: www.emea.eu.int/pdfs/human/hmpc/24681605en.pdf.
- EUDRALEX (2004): Vol 1 Directive 2001/83/EC Annex I. Documentation to be submitted for marketing authorisation (CTD),

Module 3: Quality, Herbal Medicinal Product Registration.

EUDRALEX (2005): Vol 4 Good Manufacturing Practice (GMP), Part II. Basic Requirements for Active Substances and Starting Material "API-GMP" (3 Oct 2005).

FDA (2003a): Food and Drug Administration, Department of Health and Human Services. Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food. Code of Federal Regulations, Title 21, Volume 2. Revised as of April 1, 2003. Retrieved 28 March 2006 from www.cfsan.fda.gov/~lrd/cfr110.html.

FDA (2003b): Food and Drug Administration, Department of Health and Human Services. Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Dietary Ingredients and Dietary Supplements. Federal Register, Volume 68, Number 49, March 13, 2003. Retrieved 28 March 2006 from www.cfsan.fda.gov/~lrd/fr030313.html.

FDA (2006a): Food and Drug Administration, Department of Health and Human Services. Current Good Manufacturing Practice in Manufacturing, Packing, or Holding of Drugs. Code of Federal Regulations, Title 21, Volume 4, Revised as of April 1, 2006. Retrieved 30 July 2006 from www.access.gpo.gov/nara/cfr/waisidx_06/21cfrv4_06.html.

FDA (2006b) Center for Drug Evaluation and Research (CDER) Rulemaking History for OTC Laxative Drug Products. Retrieved 30 July 2006 from www.fda.gov/cder/otc-monographs/Laxative/new_laxative.htm.

FAH (2003a): Forschungsvereinigung der Arzneimittel-Hersteller e.V., Standardverfahrensanweisung zur Auditierung bei Anbau und Wildsammlung von Arzneipflanzen. ZAG 8(2): 83-88.

FAH (2003b): Forschungsvereinigung der Arzneimittel-Hersteller e.V., Standard Operation Procedure for inspecting cultivated and wild crafted medicinal plants. Herb, Spices & Medicinal Plants 10 (3): 109-124.

LEAMAN, D.J. & S. SALVADOR (2005): An international standard for the sustainable wild collection of medicinal and aromatic plants (ISSC-MAP): principles, criteria, indicators, and means of verification. Draft 2, April 2005. Steering Group for the Development of Practice Standards and Performance Criteria for the Sustainable Wild Collection of Medicinal and Aromatic Plants.

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) AGRICULTURAL MARKETING SERVICE (AMS). (2000): §205.207 Wild-crop harvesting practice standard. In: Code of Federal Regulations. Part 205 National Organic Program. Subpart C: Organic Production and Handling Requirements.

WHO (2003): WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants. Retrieved 30 July 2006 from whqlibdoc.who.int/publications/2003/9241546271.pdf

Most of the documents cited are available as internet resources: IFS, CIES – The Food Business Forum, Paris. Retrieved 28 March 2006 from www.ciesnet.com.

EUREPGAP. Retrieved 28 March 2006 from www.eurep.org.

EMEA, European Medicines Agency, Committee on Herbal

Medicinal Products (HMPC), Guidance Documents on Quality. Retrieved 28 March 2006 from www.emea.eu.int/hums/human/hmpc/hmpcguide.htm.

EudraLex, The Rules Governing Medicinal Products in the European Union. Retrieved 28 March 2006 from <http://pharmacos.eudra.org/F2/eudralex/index.htm>.

Europam EHGA, European Herb Growers Association. Retrieved 28 March 2006 from www.europam.net.

ISSC-MAP, International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants. Retrieved 28 March 2006 from www.floraweb.de/map-pro.

List of abbreviations	
API	Active pharmaceutical ingredients
EMEA-GACP	Good Agricultural and Collection Practice of the European Medicines Agency (EMEA, former European Agency for the Evaluation of Medicinal Products)
EUREP-GAP	Good Agricultural Practice of the Euro-Retailer Produce Working Group (EUREP)
GMP	Good Manufacturing Practices
HACCP	Hazard analysis and critical control point, official hygienic regulation for food
IFS	International Food Standard
LFGB	Foodstuffs and Commodities Act (= Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch)
MAP	Medicinal and aromatic plants
QMS	Quality Management Systems
SOP	Standard Operation Procedure

Dr. Ernst Schneider • PhytoConsulting • Seeblick 11 Freinberg • 84163 Marklkofen • Germany • E-mail: schneider.e@phyto-consulting.de.

Towards a sustainable management of medicinal and aromatic plants: The case of the Agro-artesanal Association of Producers of Dried Medicinal Plants of Ecuador – AAPPSME

María Argüello & Zornitza Aguilar

Introduction

The Sustainable Biotrade Programme of Ecuador (Programa Nacional Biocomercio Sostenible del Ecuador – PNBSE) is a program of the Ministry of Environment (MAE) launched in 2002 as part of the Biotrade Initiative (Iniciativa Biocomercio – IB) of the United Nations Conference for Trade and Development (UNCTAD). PNBSE is executed by the Exports and Investment Promotion

Corporation of Ecuador (Corporación para la Promoción de Exportaciones e Inversiones del Ecuador – CORPEI) in strategic alliance with EcoCiencia, a conservationist NGO. For the Biotrade Initiative, CORPEI assists natural and legal persons (including community groups) dedicated to exports and local market activities in the development of processes such as diversification of markets and products; other tasks are increasing the value added of products and the volume of exports and identifying new products with export potential. On the other hand, EcoCiencia works with these organizations to assist them with the compliance of principles and criteria of sustainable use of biodiversity; this includes: assistance in the development of sustainable management plans, capacity building for sustainable use and ecological research.

The objective of IB and PNBSE is to promote biotrade, understood as “Harvest and/or production, processing and trade of goods and services derived from native biodiversity (species, genetic resources and ecosystems) under the frame of environmental, social and economic sustainability criteria”. Business in any development stage led by different economic stakeholders (communities, community associations, small and medium companies, among others) that comply with Biotrade principles and criteria are considered as Biotrade Initiatives (UNCTAD 2006).

The priority sector of PNBSE is that of Natural Ingredients for the Pharmaceutical and Cosmetic Industry (NIFC) and its derivative products. In this sector about 14 companies and/or organizations of producers, processors and traders of medicinal plants have conformed the Mashí Numi Network (a name made up of a word in Quechua language and one in shuar language that means Friend Hands – Manos Amigas). These companies are supported in the compliance of the Biotrade Principles and Criteria (UNCTAD 2006).

Regarding environmental issues, the companies and organizations are supported to comply with the environmental legislation and in the development of Good Agricultural and Collection Practices. As part of these two topics the development of management plans both for cultivated and wild harvested species is of high priority. Precedents in the development of Management Plans for wild collection practically don't exist in Ecuador due to the lack of incentives for wild life use, and because the legislation promotes cultivation. Through EcoCiencia and with the support of the UNCTAD Biotrade Facilitation Program (BTFP) PNBSE executes five pilot experiences for the development of management plans for wild harvested species with the aim of designing a field-validated methodology, which is cost-effective in temporary and economic terms to make it applicable by the companies and organizations of the Biotrade Initiative. One of the organizations having participated in this pro-

cess is the Agro-artesanal Association of Producers of Dried Medicinal Plants of Ecuador (Asociación Agroartesanal de Productores de Plantas Secas Medicinales del Ecuador – AAPPSME), which have received technical assistance of a local NGO called Agroecological Foundation Friends of the Earth – Fundatierra (AGUILAR et al. 2005, MATAMOROS CUEVA & RODRÍGUEZ 2004). Fundatierra has promoted agroecology systems to produce medicinal plants throughout the Loja Province.

Due to the advanced stage in the development of the management plan of AAPPSME and as part of the collaboration among UNCTAD-BTFP, PNBSE and EcoCiencia with the project of developing an International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) AAPPSME was selected as one of the projects for the ISSC-MAP field consultation (MPSG 2006). The field consultation was carried out between October and November 2005 in two phases: firstly, a preliminary field assessment financed by Manfred-Hermesen-Stiftung was carried out by Wolfgang Kathe with the help of Ximena Buitrón as independent external consultants. Their task was viewing the selected field sites, bringing in an external view and to develop a statement/written comment on the selected project and field consultation (the results are compiled in the Pre-Assessment Report, KATHE & BUITRÓN 2005). In a second phase, the field consultation¹ financed by the UNCTAD Biotrade Initiative was carried out by the local NGO Conservation and Development – Rain Forest Alliance (Conservación y Desarrollo/CCD – Rainforest Alliance) with Claire Nicklin and Mauricio Ferro and with María Argüello and Zornitza Aguilar of EcoCiencia as part of the field consultation team (for the field consultation report see Nicklin & Hauselmann 2005).

The Agro-artesanal Association of Producers of Dried Medicinal Plants of Ecuador (AAPPMSE)

AAPPMSE is an organisation founded in 2001 to produce and process medicinal plants with the purpose of elaborating the traditional “horchata lojana”. The association is located in the parish of Chuquiribamba, neighbourhood Simón Bolívar, Canton Loja, in the south of Ecuador. Presently, it has 40 active associates, 16 men and 24 women from 11 communities of indigenous peasants (AGUILAR et al. 2005).

The area is characterised by three ecosystems: i) the paramo, where the last remnant of Andean native forest remains as well as pine and eucalyptus plantations, and which is destined to cattle, ii) agro forestry lands, orchards and parcels, and iii) low valleys that are good for sugar cane and

¹ The field consultation focused on one of the identified scenarios for ISSC-MAP implementation: certification.

Table 1. Medicinal plants traded by AAPPSME, including their part in use and obtaining method.
C = Cultivation; W = wild origin (AGUILAR et al. 2005).

Scientific Name	Common Name Spanish, English	Family	Part in use	Origin
<i>Alcea rosea</i> L.	Malvón, Garden hollyhock	Malvaceae	Flower	C
<i>Aloysia triphylla</i> (L'Hér.) Britton	Cedrón, Cedron	Verbenaceae	Leaf, flower and stem	C
<i>Amaranthus cruentus</i> L.	Ataco, Purple amaranth	Amaranthaceae	Inflorescence and leaf	C
<i>Begonia x tuberhybrida</i> Lam.	Begonia, Tuberous Begonia	Begoniaceae	Petal	C
<i>Borago officinalis</i> L.	Borraja, Beebread	Boraginaceae	Leaf and flower	C
<i>Citrus sinensis</i> (L.) Osbeck	Naranja, Orange Tree	Rutaceae	Leaf	C
<i>Cymbopogon citratus</i> (AD.) Stapf	Hierba luisa, Lemon grass	Poaceae	Leaf	C
<i>Cynodon dactylon</i> (L.) Pers.	Gramma dulce, Bermudagrass	Poaceae	Branches and root	C
<i>Dianthus caryophyllus</i> L.	Clavel, Clove pink	Caryophyllaceae	Petal	C
<i>Equisetum bogotense</i> Kunth	Cola de caballo, Horsetail	Equisetaceae	Stem and leaf	W
<i>Fuchsia hybrida</i> Hort. ex Siebert & Voss.	Fucsia, Hybrid Fuchsia	Onagraceae	Petal	C
<i>Iresine herbstii</i> Hook.	Escancel, Escancel	Amaranthaceae	Bud	C
<i>Lavatera arborea</i> L.	Malva blanca, Tree mallow	Malvaceae	Leaf and flower	C
<i>Linum usitatissimum</i> L.	Linaza, Linseed or Flax	Linaceae	Seed	C
<i>Matricaria recutita</i> L.	Manzanilla, Chamomile	Asteraceae	Flower, stem and leaf	C
<i>Melissa officinalis</i> L.	Toronjil, Lemon Balm	Lamiaceae	Leaf and stem	C
<i>Mentha x piperita</i> L.	Menta, Peppermint	Lamiaceae	Leaf and shaft	C
<i>Oenothera rosea</i> L'Hér ex Aiton	Shullo, Shullo	Onagraceae	Stem, flower and leaf	C
<i>Oreocallis grandiflora</i> (Lam.) R. Br.	Cucharillo, Cucharillo	Proteaceae	Flower	W
<i>Pelargonium graveolens</i> L'Hér.	Esencia de rosa, Rose oil	Geraniaceae	Leaf and flower	C
<i>Pelargonium odoratissimum</i> (L.) L'Hér	Malva rosa, Apple geranium	Geraniaceae	Leaf and stem	C
<i>Peperomia inaequalifolia</i> Ruiz & Pav.	Congona, Camroric	Piperaceae	Leaf, flower and stem	C
<i>Plantago major</i> L.	Llantén, Plantain	Plantaginaceae	Whole plant	C
<i>Poterium sanguisorba</i> L.	Pimpinela, Salad burnet	Rosaceae	Leaf, stem and flower	C
<i>Rosa robustus</i> C. Presl	Rosa blanca, White Rose	Rosaceae	Petal	C
<i>Thymus vulgaris</i> L.	Tomillo u Orégano dulce, Thyme "oregano"	Lamiaceae	Stem, flower and leaf	C

fruit cultivation (MATAMOROS CUEVA & RODRÍGUEZ 2004). In general, the region is strongly disturbed.

"Horchata lojana" is a traditional beverage of the province of Loja, where it is daily consumed by the local population as a refreshing drink accompanying foods and also for its diuretic properties. The plants used to prepare "Horchata lojana" come from the families' organic or-

chards, six hectares in total, and from the surrounding native forests (MATAMOROS CUEVA & RODRÍGUEZ 2004). The product is traded locally and exported to the US.

The 'horchata' is prepared with 28 medicinal plant species, 26 of these are cultivated and two of them (*Oreocallis grandiflora*, known as 'cucharillo' and *Equisetum bogotense*, the 'horsetail') are collected from the wild (table 1).

Of the 26 cultivated plants, 20 are native, five introduced and one of unknown origin. These species are cultivated in orchards from 30 to 500 m². The associates are the land owners, who receive permanent training in organic agriculture.

Advances of APPSME in the compliance of Biotrade principles and criteria addressing sustainable use of biodiversity are summarised by NICKLIN & HAUSELMANN (2005). The first and the second of the seven BioTrade principles are related to the use and conservation of the species and of their related ecosystems. One of the main tools to achieve these principles is the management plan. Key aspects of the management plan are presented below.

Good Agricultural Practices include basically the development of training programs, elaboration of planting plans, implementation of areas or appropriate materials for the storage of the product, promotion of a domestication program for the two species collected from the wild ("cucharillo" and "horsetail"). Additionally, it is necessary to work on the implementation of irrigation systems, the establishment of marquees in each orchard to improve post harvest procedures, the protection of water basins, and the development of reforestation programs with partners and suppliers in each community (AGUILAR et al. 2005).

To assure Good Agricultural Practices AAPPSME determined a series of environmental and social policies for all members of the Association within its internal rules. Under this regulation either partners and suppliers commit not to use agrochemicals in their cultivations, but to work with organic agriculture models, while the Association commits i) to train partners and suppliers, providing them technical advice and monitoring field works with the purpose of guaranteeing the quantity and quality of the product, ii) to offer a stable market with fair prices, iii) to facilitate credit for the acquisition of seeds and compost and commercialization of products; iv) to promote the participation of the associates in fairs, and v) to facilitate the access of knowledge and technology for the suppliers' development easiness in the company and its management.

In general terms, AAPPSME has strengthened its organizational system and increa-

sed woman's participation. Simultaneously, partners' and suppliers' annual incomes have increased, which reduces the parents' migration rates and increases the children's attendance to school.

Good collection practices are another critical aspect of the Plan. Management plans have been developed for *Oreocallis grandiflora* and *Equisetum bogotense*, focusing on sustainable use of the resources including a geographic and socio-economic characterisation of the area, analysis of biological and ecological information, and a diagnosis of the species' populations through predictive models. Based on these analyses, Good Collection Practices were developed as well as environmental policies that companies, partners and suppliers have to comply within this process.

Oreocallis grandiflora (Lam.) R. Br. - Cucharillo

Tree or shrub, three to five meters high, up to 15 dbh in natural forests, horizontal roots, cylindrical stem. Leaves coriaceous, oblong, spiralled and lengthened petioles. Inflorescences 12-14 cm, approximately 60 or 80 flowers of reddish-white colour, conspicuous, numerous winged seeds (ULLOA & JØRGENSEN 1995). The active principle is the tannic acid (SATAMA 2005).

The natural habitat of cucharillo in the parishes of Gualiel, Chuquiribamba, Chantaco and Taquil is characterized for bigger slopes of more than 45 %. The species occurs frequently at altitudes between 1600 and 3000 m with a density of 4-6 trees/ha. Figure 1 shows the presumed distribution of the species in the area of Loja.

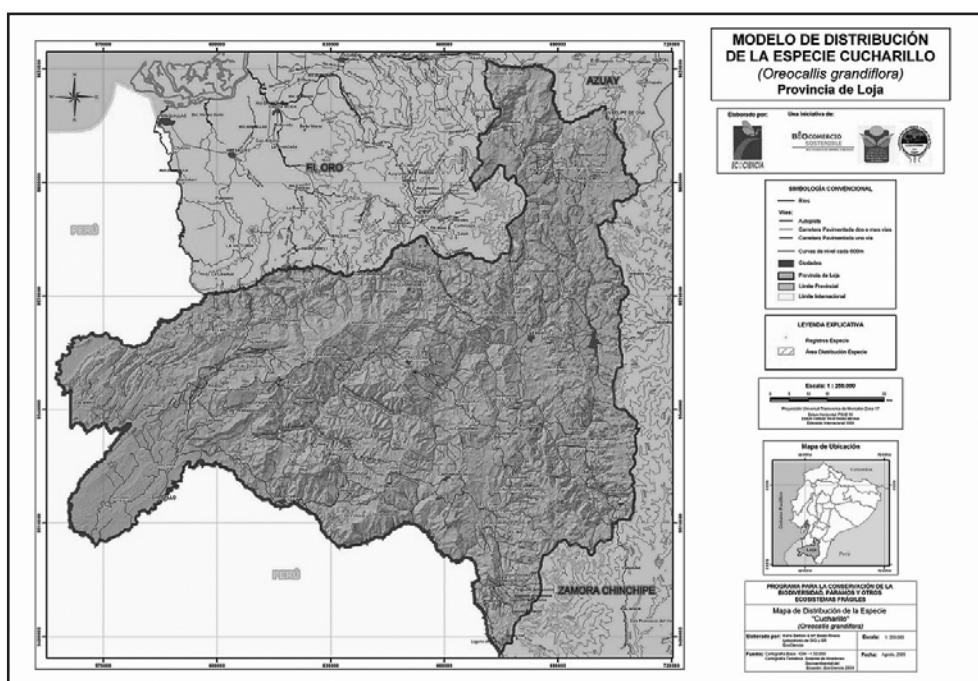


Figure 1. Presumed distribution of *Oreocallis grandiflora* in the area county of Loja (Source: Laboratory SIG - EC, 2005).

- To avoid collection of young plants' flowers (those in the first flowering period), which would decrease the reproductive potential of the tree;
- to only cut the mature inflorescences, and to avoid breaking the branches during the harvest to avoid elimination of apical buds;
- to avoid the collection of plants with tumours or injuries.
- to always leave three to five flowers per tree, so fruits can be produced.
- to maintain enough plants with flowers to sustain a new generation with enough individuals to guarantee a sustainable harvest without extinguishing the population. Therefore it is recommended to leave at least 6 mature plants per hectare without collecting;
- to separate flowers, eliminating sludge like chips, leaves, etc.;
- to avoid burning of collection areas to prevent delay in the production of flowers and influence natural regeneration.

Herb, from 0,30-1 m high. Preferably, the species grows in wet or marshy ecosystems, not very deep lagoons or along riversides. In some cases it may, however, grow in relatively dry pasture soils, gutters of the highways, and in arid lands (SÁNCHEZ & AGUIRRE 2005).

Horsetail, also well known as 'caballo chupa' (in Quechua), is widely distributed mainly in the Andean region. It grows preferably in open wet meadows or woods in the

Isolated plants of *Equisetum bogotense* are found in dense natural forests next to water basins, where they are much less developed compared to populations growing in secondary forests or open areas, where the species covers among 80-100 % of the area.

- To carry out the collection at the beginning of the winter season to help branches to regenerate quickly after rainfall;
- to collect only mature plants (dark green colour and more than 30 cm high) to guarantee reposition of the resource;
- to avoid the use of tools like sickle to prevent the superficial rhizomes from damage during the collection;
- to use two hands while collecting the plants, holding and pressing the low part strongly with one hand and starting up with the other, trying not to cause pressure to the rhizome and consequently to avoid plant stress.
- to avoid damage to the soil when collection is carried



out, since the plant has a perennial underground rhizome of which epigeal branches are born;

- to leave at least one square meter per collection area without harvesting or four plants (with strobilus) at random to guarantee dissemination of spores;
- not to shepherd ovine and bovine animals in the collection areas.

Good Agricultural and Collection Practices defined in the management plan will be monitored in the following years. EcoCiencia, through the national program Sustainable Biotrade of Ecuador and the Biotrade Initiative will give technical support to the Association of Producers of Dried Medicinal Plants of Ecuador in the implementation of an adequate monitoring system and the analysis of information to enable them establishing a reliable collection quota after the first year of monitoring.

ISSC-MAP Field Consultation

The ISSC-MAP field testing/consultation process contributed to enrich the discussions on ISSC-MAP. The results of this consultation were presented during the Expert Workshop *ISSC-MAP – Results of the Field Consultations* held in Vilm in December 2005 and contributed to the revision of the draft Standard document. Several inputs were also relevant for the discussions on Principles and Criteria of the Biotrade Initiative.

References

- AGUILAR, Z., RÍOS, M., RODRÍGUEZ, X., SAMANIEGO, L. & PADILLA, S. (2005): Plan de uso y aprovechamiento de los recursos naturales de la asociación agroartesanal de productores de plantas secas medicinales del Ecuador, AAPPSME. – 90 pp., Programa para la Conservación de la Biodiversidad, Páramos y Otros Ecosistemas Frágiles del Ecuador, EcoCiencia, Quito.
- KATHE, W. & BUITRÓN, X. (2005): ISSC-MAP Draft Standard Field Consultation. Pre-Assessment Report. – AAPPSME - Asociación Agro-Artesanal de Productores de Plantas Secas Medicinales del Ecuador, Chuquiribamba, Province of Loja, Southern Ecuador.
- MATAMOROS CUEVA A. & RODRÍGUEZ, P. (2004): Sistematización del proceso productivo de secado de plantas medicinales en la UNORCAHT. – 80 pp., Proyecto de Apoyo al Desarrollo Forestal Comunal de los Andes del Ecuador, Organización de las Naciones Unidas para la Agricultura y la Alimentación, Quito.
- MEDICINAL PLANT SPECIALIST GROUP (MPSG) (2006): International standard for sustainable wild collection of medicinal and aromatic plants (ISSC-MAP). Working Draft (June 2006). Steering Group for the Development of an International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants – www.floraweb.de/map-pro (viewed 22.11.2006).
- NICKLIN, P. & HAUSELMANN, P. (2005): ISSC-MAP Test Ecuador. Lessons from the field. Final Report. – 147 pp., Pi Environmental Consulting, United Nations Conference on Trade and Development (UNCTAD) Biotrade Initiative, Geneva (www.piec.org/publications/documents/ISSC-MAP%20Test%20Ecuador.pdf, viewed 22.11.2006).
- SÁNCHEZ, O. & AGUIRRE, Z. (2006): Plan de uso y aprovechamiento de Equisetum bogotense Kunth “cola de caballo”. – 100 pp., Programa de Manejo de la Biodiversidad y el Biocomercio, EcoCiencia, Quito.
- SÁNCHEZ, O. & AGUIRRE, Z. (2005): Estudio sobre la biología y el aprovechamiento de Oreocallis grandiflora en la zona de influencia de la AAPPSME. – Programa de Manejo de la Biodiversidad y el Biocomercio, EcoCiencia, Quito.
- SATAMA, G. (2005): Hierbas que curan. – 60 pp., Ed. Programa “Abriendo Horizontes” FENECLE. Loja.
- ULLOA, C. & JORGENSEN, P. (1995): Árboles y arbustos de los Andes del Ecuador. – 264 pp., Ed. ABYA-YALA, Quito.
- UNCTAD (2006): Biotrade Principles and Criteria. – 10 pp., Biotrade Initiative, Working document, Ginebra.
- María Argüello • Coordinator of the Biodiversity Management and Biotrade Program – PMBB • Ecological Research Foundation – EcoCiencia • Frco. Salazar E1434 y Av Coruña • Quito • Ecuador • Tel.: ++593/85296656, 2545999 ext. 113 • E-mail: manejo@ecociencia.org.
- Zornitza Aguilar • Research Coordinator of the Biodiversity Management and Biotrade Program – PMBB • Ecological Research Foundation – EcoCiencia • Frco. Salazar E1434 y Av Coruña • Quito • Ecuador • Tel.: ++593/95039319, 2545999 ext 113 • E-mail: biocomercio@ecociencia.org.

Regional File

The status of exudate species in Iran and existing challenges in their sustainable utilization

F. Nadjafi, A. Koochehi & A. Ghasemi Arian

Introduction

The vast country of Iran in south-west Asia constitutes a peculiar geographical unit in the northern hemisphere, which displays a remarkable biodiversity and various ecosystems with specific biological components. This unusual phytogeographical situation is due to certain factors, including diverse climate conditions, the existence of a central salt desert with an area of one million square kilometres, and the presence of high barrier-like mountains in some regions. The flora of the country is rich with nearly 8000 species and together with Turkey there is the most plant diversity and highest percentage of en-

demical plants across Near East and west Asia (FAO 1999). The exploitation of natural resources on the Iranian plateau goes back about 7000 years. The use of medicinal plants was the first method of treating diseases in ancient Iran and forms an important part of various cultures. It is estimated that nearly 13 percent of the plant flora (850-1100 species), is used as herbs in traditional medicine of this country (BAGHERI & RAGHAN 1994). Within this group exudate species have a special importance, because Iran is the main and in some cases the only producer and exporter of these products, including Gum Tragacanth (*Astragalus gummifer*), Galbanum (*Ferula gummosa*), Gum ammoniac (*Dorema ammoniacum*), and Asafetida (*Ferula assa-foetida*). Besides the ecological function of these species in natural ecosystems, growth of them in regions such as deserts and mountains which are not arable, has made them an important economical resource for poor people in these regions. Export of these species has a long history in Iran, for example Asafetida gum, has been exported since the 1820s, and in the 1880s more than 40 % of Iran's total export consisted of Gum Tragacanth, Galbanum, Opium, and Saffron (ABRISHAMI 1994). A main proportion of Iran's agricultural and natural products export still consists of exudates, as the country is the main producer of Gum Tragacanth (*Astragalus gummifer*) within the Asia-Pacific region. Export of natural products increased from 4000 tonnes in 1980 to 8000 tonnes in 1990 (MOINOLDIN 1994). Table 1 shows the quantities and values of non wood forest products from 1990-1994 (MOINOLDIN 1994).

Table 1. Quantities and values of NWFP in Iran from 1990-1994. 1 USD = 1,750 IRR.
Source: MOINOLDIN 1994.

Species	Production (tonnes)	Value (kg/1000 IRR)	Total value (1000 IRR)	Total value (1000 USD)
<i>Astragalus gummifer</i>	1,459.27	5.5	8,025,996.00	4,586.28
<i>Pistacia terebinthus</i>	1,566.47	3	4,699,408.00	2,685.38
<i>Ferula assa-foetida</i>	650.87	7	4,554,795.00	2,602.74
<i>Ferula gummosa</i>	200.07	12	2,400,780.00	1,371.87
<i>Dorema ammoniacum</i>	377.96	6	2,267,778.00	1,295.87
<i>Tamarix gallica</i>	31.60	20	631,920.00	361.10
Others	8,418.92	–	32,686,883.50	18,678.22
Total	12,705.15		55,267,560.50	31,581.46

Although the increasing demands of industrial countries for these products improved their total production (increase of Gum Tragacanth production from 91 tonnes in 1987 to 257 tonnes in 1990, see table 2), the carrying capacity of the habitats, ecological characteristics and conservation management practices have been neglected, and ecosystems of exudate species have been seriously

disturbed. Beside high exploitation, other factors such as unsustainable harvesting methods, conversion of natural ecosystems to agroecosystems (especially to rainfed farms), insisting on oil exports, neglecting of conservation of exudate species in governmental policies, the poverty of rural communities in these regions, and lack of legislation and appropriate enforcement of sustainable utilization of natural resources lead to this disturbance. Local extinction of *Ferula gummosa* in Abade and Eqld in Fars province and deterioration of *Ferula assa-foetida* habitat in Neiriz Firuz-Abad (Fars province) are examples of this unsustainable exploitation (SEHEDIN-NEJAD 1991).

The aim of this paper is to review the ecology and economy of these species and the perspective of their sustainable utilization in Iran.

1. Gum Tragacanth (*Astragalus gummifer*)

Description

Gum Tragacanth is the second most important commercial gum, which is produced by several shrubby plants of the genus *Astragalus* distributed from Pakistan to Greece, particularly in Iran and Turkey (ANDERSON 1989). *Astragalus gummifer* is considered to be the main Tragacanth yielding species. It is a small branching thorny shrub, 30-60 cm high. The exudate is produced spontaneously on the bark of the shrub, but the yield is often increased by making an incision into it.

Distribution and ecology

Gum producing *Astragalus* species are distributed in the Iran-Turan mountains with poor flora and soil conditions at altitudes of 1200-3100 m (SAMSAM-SHARIAT 1986). Also habitats at altitudes of 3760-4000 m have been reported (ZARINKAMMAR 1997). Annual precipitation of 200-400 mm and thermal range of -10° C (-30° C in some seasons) to +36° C are the main characteristics of their habitats in Iran (ZARINKAMMAR 1997).

Uses

Gum Tragacanth is one of the oldest gums known and its use dates back to 5000 years ago (ANDERSON & BRIDGEMAN 1985). This plant has been used in Iranian traditional medicine for improving the human immunological system and alleviating side effects of other pharmaceuticals. It is much used for the suspension of heavy, insoluble powders to impact consistence to lozenges, being superior to Gum Arabic,

also in making emulsions, mucilage, etc. It is also employed by manufactures for shifting calico, crape, etc. (AMELI 1963).

Production and export

Iran is the main producer of Gum Tragacanth (*Astragalus gummifer*) within the Asia-Pacific region (FAZEL 1995, IQBAL 1995). Small quantities are also produced in Afghanistan, but about 70 percent of export supply originates from Iran. According to agricultural products statistics of November 1991, annual average production has been an estimated 400 tons (IQBAL 1995). Table 2 shows Iran's export of Tragacanth from 1987-1990 (IQBAL 1995). Tragacanth finds markets in different countries, but USA, Japan, and the Former Soviet Union are the major importing regions (IQBAL 1995). Current prices (\$/lb) for Gum Tragacanth in New York market are 36-40 \$ and 12.50-14 \$ for ribbons and flaked powder, respectively.

Table 2. Iran's export of Gum Tragacanth from 1987-1990. Source: IQBAL 1995.				
Year	1987	1988	1989	1990
Export volume (tonnes)	91	142	176	257

According the Utilization & Trade Office, Ministry of Commerce, Gum Tragacanth produced in Iran from 1989-1993 has been valued at 4.5 million USD (SEIIEDIN-NEJAD 1992 and 1994). This gum like other NWFP is exported without any processing, except a limited por-

Table 3. Main regions of <i>Astragalus gummifer</i> in Iran & production values during 1988-1997. Source: AMELI 1963, SEIIEDIN-NEJAD 1991 and 1994.	
Provinces	Production value (kg)
Chahar Mahal-Bakhtiari	114,812
Fars	140,479
Hamadan	421,871
Ilam	800
Isfahan	2,155,062
Kerman	3,603
Kermanshah	66,582
Kohkiluyeh and Buyer-Ahmad	100
Kurdistan	100,507
Lorestan	9,139
Markazi	10,890
Semnan	1,096
Tehran	210,295
West-Azarbaijan	6,865
Yazd	2,225
Zanjan	2,720

portion which is used in cosmetic industries. The best qualified Gum Tragacanth is produced in the central and western parts of Iran including Isfahan, Shiraz, Kerman and Kermanshah provinces (SAMSAM-SHARIAT 1986). The yield of this gum depends on factors such as climatic conditions, plant species, plant density, age and incision methods. According to the Iranian Forests & Rangelands Organization the average yield of gum is 5 kg per hectare (SAMSAM-SHARIAT 1986).

The main regions of *Astragalus gummifer* in Iran

Table 3 shows the main regions of *Astragalus gummifer* active in gum production in Iran and their production yields from 1989-1997 (AMELI 1963, SEIIEDIN-NEJAD 1991 and 1994). Within these regions Isfahan province is the main producer and exporter of Gum Tragacanth. During this period the highest and lowest yield respectively was obtained in 1994 (461.985 tonnes) and 1993 (189.155 tonnes). From 1988-1997 an area of 688,156

hectares of *Astragalus gummifer* habitats has been evaluated, of which 214,302 hectares have the potential of gum harvesting, but gum was harvested from only 69,965 hectares (AMELI 1963, SEIIEDIN-NEJAD 1991 and 1994). A production value of 1,165,694 kg is predicted for the area of 214,302 hectares in a period of three years with an average yield of 5.44 kg/ha. It is also estimated that 521,930 labors per day could be employed in the area for Tragacanth harvesting.

Harvesting methods and timing

The harvest methods of Tragacanth in some parts of Iran are incompatible with ecological and botanical requirements of this species, and lead to serious damage of plant vegetation. Although in some areas plants are harvested in the first year of vegetation, plants are generally exploited in the second year of their life cycle. Harvesting in the first year shortens the total period of exploitation and decreases the quality of products. In warm climates plants are harvested in May, and in cold climates in June (SAFAR et al. 1993). It is recommended to consider a 2-4 years fallow period for plant recovery (SAFAR et al. 1993). Recent investigations show that the best harvest method involves use of plants with more than 25 cm canopy diameter, shallow incision, and avoiding cross section incisions (KHOSROGERDI 1999).

2. Galbanum gum (*Ferula gummosa*)

Galbanum gum is one of the most important rangeland products of Iran, which is exported in high values because of its high quality. The use of this gum in Iran is limited only to traditional medicine, and most of it is exported to European countries, especially Germany and France (ISLAMI 1994).

Description

The genus *Ferula* (Apiaceae) in Iran consists of 30 perennial species, which are generally distributed in mountain and desert regions. These species are classified as monocarpic plants (MOLAMOHAMMADI & MASOOD-REZA 1989, ZARGARI 1991). A research shows that only three species of this genus in Iran have the potential of exudate production, which are *Ferula gummosa* Boiss., *Ferula schair* Borsze and *Ferula rabriahus* Boiss. (BATULI 1994). *Ferula gummosa* is the main source of Galbanum gum. It is a perennial with a smooth stem and shining leaflets, ovate, wedge-shaped, acute, and finely serrated on the edges. The umbels of flowers are few. The best tears are palish externally and about the size of a hazel nut, and when broken open are composed of clear white tears. The common kind is an agglutinated mass, showing reddish and white tears (ZARGARI 1991).

Distribution and ecology

The main habitats of *Ferula gummosa* are located in Pakistan, Turkmenistan and a vast area in the north east of Iran at altitudes of 2000-4000 m with an average annual precipitation of 250-400 mm (BATULI 1994). *F. gummosa* habitats in Iran are distributed in Markazi, Isfahan, Zanjan, Tehran, Semnan, Khorasan, Golestan, and Mazandaran provinces. 70,000 hectares of these habitats are under exploitation (AHMADI 1991).

Uses

Ferula gummosa is used in the traditional medicine of Iran as a stimulant, expectorant in bronchitis, antispasmodic and in industry. It is used as jewelry glue and in cosmetics as a fixator in perfumes (MOLAMOHAMMADI & MASOOD-REZA 1989, SALAR 1997).

Table 4. Export of Galbanum gum from Iran during 1977-1981. Source: MOLAMOHAMMADI & MASOOD-REZA 1989.

Year	Production volume (tonnes)
1977	419,156
1978	200,887
1979	231,777
1980	84,478
1981	81,740

Production and export

330 tonnes of Galbanum gum was exported in 1987 with a value of 12 millions USD (BATULI 1994). Export of Galbanum gum from 1977-1981 is shown in table 4. Galbanum export has declined from 1980-1981 because of the enforced war between Iran and Iraq (MOLAMOHAMMADI & MASOOD-REZA 1989). Galbanum gum production in Iran increased from 61,466 tons in 1991 to 109,408 tons in 1992 (SHAD 1995). It should be

noted that there is no correct data of Galbanum gum export owing to the deficiency of control systems.

Harvesting methods and timing

Galbanum yield depends on several factors such as plant age and vigor, harvest methods, climatic conditions, incisions frequency and depth, and intervals between them, and intensity of utilization (AHMADI 1991). SALAR (1997) showed that the best time of harvesting is in the 5th year of the plant life period. There are several traditional harvesting methods. Some of them – including harvesting the whole tuber, vertical and deep incision, and cutting the flowering stem (as the plant is monocarpic) – give more yields, but lead to a serious damage of the plant and its recovery. Investigations have shown that three incisions in each harvesting season is the suitable manner which provides a yield of 25-30 g per plant (SALAR 1997). BATULI (1994) recommended a three years fallow for the recovery of this plant.

3. Gum ammoniac (*Dorema ammoniacum*)

Description

Dorema ammoniacum (Apiaceae) is a perennial forb growing to heights about 1-2 m and containing a milky juice in spring and early summer. The gum resin is found in special cavities in tissues of the stem, root and petioles of the leaves (MOZAFARIAN 1983). The name of the drug is said to be derived from the temple Jupiter, Ammon, in the Libyan Desert, where it was collected by the ancients. The gum resin occurs in commerce in two forms: tear ammoniacum and lump or block ammoniacum. Tear ammoniacum has a better quality and a higher price. It is created by incisions of bees and other natural factors in the stem.



Figure 1. *Dorema ammoniacum* (with its roots dug out) at Sabzevar in the province Khorasan, northeast of Iran. – Photo: A. GHASEMI ARIAN (2004).

Distribution and ecology

Main habitats of *Dorema ammoniacum* are located in arid and semi-arid regions of Central Asia including Pakistan, India, Afghanistan, and Iran. In Iran this plant is mostly distributed in Tehran, Isfahan, Kerman, Sistan-Baluchestan, Semnan, Khorasan, and Golestan provinces in an area of 140,000 hectares (MOZAFARIAN 1983). Its habitats locate at altitudes of 1250-2500 m (GHASEMI 1994). The best growth of this species is reported in arid regions with an average annual precipitation of 140-170 mm and a thermal range of -5 °C to 38 °C (GHASEMI 1994).

Uses

In traditional medicine *Dorema ammoniacum* is used in chronic bronchitis. The resin has a mild diuretic action. It is antispasmodic and stimulant and is given sometimes as a diaphoretic (ZARGARI 1991). It is also used widely in food, cosmetic, and the detergent industries.

Export and production

There is limited information about gum ammoniac export from Iran. Table 5 shows the production of gum ammoniac in Iran during 1989-1992 (SHAD 1995).

Table 5. Gum ammoniac production in Iran from 1989-1992. Source: SHAD 1995.	
Year	Production (tonnes)
1989	67,625
1990	103,800
1991	153,118
1992	25,300

Harvesting methods and timing

Exploitation of this plant is conducted in two ways: harvesting of stem exudates (injuries caused by insects or other natural factors), which has the best quality and price, and root incisions which have more yield. Investigations have shown that the highest yield (24.8 g/plant) is provided with two incisions (GHASEMI 1994). It is also recommended to avoid harvesting plants younger than three years (GHASEMI 1994).

4. Asafetida (*Ferula assa-foetida*)

Description

A coarse umbelliferous plant growing to 2 m with numerous stem leaves with wide sheathing petiols. Flowers are pale greenish yellow (MOZAFARIAN 1983).

Uses

Ferula assa-foetida is much used in India and Persia in spite of its offensive odour of the gum resin that depends on the volatile oil. It is a local stimulant to the mucous membrane, especially to the alimentary tract, and therefore it is a remedy of great value as a carminative in flatulent

colic and a useful addition to laxative medicine. There is evidence that the volatile oil is eliminated through the lungs, therefore Asafetida is excellent for asthma, bronchitis, whooping-cough, etc. (ZARGARI 1991).

Distribution and ecology

The main origin of *Ferula assa-foetida* are the steppes of Iran and Afghanistan (AKHLAGHI 1986). This species is distributed to the Zagros and Alborz mountain chain and south of the country at the Persian Gulf (MOZAFARIAN 1983). Habitats of the species are located at altitudes of 190-2400 m and in lands with slopes of 15-70 % with an average annual precipitation of 250-350 mm (SHAD 1995).

Export and production

Asafetida gum is exported from Iran mostly to India and Arabian countries. Table 6 shows Asafetida gum production in Iran from 1989-1992 (SHAD 1995).

Table 6. Asafetida gum production in Iran from 1989-1992. Source: SHAD 1995.	
Year	Production (tonnes)
1989	55,746
1990	99,981
1991	169,939
1992	175,734

Harvesting methods and timing

Research has shown that four times incision is the best harvest method, which provides 26.95 g/plant gum (KHOSROGERDI 1999). In this method plant productivity and growth are not impacted.

Perspectives for sustainable utilization

As most of the species dealt with in this paper are monocarpic and domestication of them is not economically sustainable (because of short utilization and long vegetation period) it seems that in-situ conservation is the best strategy for them.

To ensure the sustainable harvest of the exudate species from the wild in the future, some strategies are suggested to be considered by national and international institutions and organizations in Iran:

- to give governmental and international support for projects about conservation of these species and their habitats in Iran, with the special focus on sustainable harvesting techniques and their implementation;
- to create and implement legislation related to natural resource utilization systems, export, harvesting methods and intensity, rangeland use management and executive agencies for monitoring of these activities;
- to establish and support processing industries for the

species concerned in Iran, because most of the products today are exported crudely and unprocessed, in order to improve the income, which may result in lower pressure on natural resources;

- to consider conserving and improving the rich indigenous knowledge in the utilization of the species in Iran and integrate it with scientific data;
- to support rural people and local gatherers by providing economical facilities, establishing rural cooperative societies, and supplying a stable market for their products and training them sustainable utilization principles.

Rural cooperative societies improve the economic income of rural communities and share them in conservation and utilization policies and decision-making. Thus, they can be more suitable and effective than governmental or international agencies protecting natural resources, because they create a direct relation between rural economy and conservation.

References

- ABRISHAMI, M.H. (1994): A Historical View to Iranian Pistachio (in Farsi). – Markaze Nashre Daneshgahi, Tehran, Iran.
- AHMADI, A. (1991): Study of the propagation and cultivation of Galbanum (*Ferula gummosa*) (in Farsi). – Jihade Daneshgahi Research Institute Pub. Iran.
- AKHLAGHI, Z. (1986): Study of the characteristics of *Ferula gummosa* and its gum resin (in Farsi). – PhD Thesis, University of Tehran.
- AMELI, A. (1963): Physiochemical characteristics of gum tragacanth (in Farsi). – PhD Thesis. Faculty of Pharmacy, Tehran University.
- ANDERSON, D.M.W. & M.E. BRIDGEMAN (1985): The composition of the proteinaceous polysaccharides exuded by *Astragalus microcephallus*, *A. gummifer* and *A. kurdicus*. The sources of Turkish gum tragacanth. – *Phytochemistry* 24 (10): 2301-2304.
- ANDERSON, D.M.W. (1989): NFT Gums, Ancient and Modern Commercial Products. – NFT highlights, 89-1-01. Nitrogen Fixing Association. Hawaii.
- BAGHERI, M. & M.S. RAGHAN (1994): Study the status and use of medicinal plants in Iran and in the world (in Farsi). – *Forest & Rangeland. J.* 33: 15-19.
- BATULI, H. (1994): The effects of harvesting methods on production and viability of Galbanum (*Ferula gummosa*) (in Farsi). Proceeding of the first national conference on rangeland and range management in Iran. – Faculty of Natural Resources, Isphahan University.
- FAZEL, M. (1995): A glance at the production and trade of Saffron and other medicinal herbs. – *Commercial Studies* 92: 18-25.
- FAO (1999): State of the World's Forests. – Rome. Italy.
- GHASEMI, A. (1994): Study of the ecology, propagation and conservation of Gum ammoniac (*Dorema ammoniacum*) in the south east region of Sabzevar (in Farsi). – M.S.C. Thesis, Tehran University.
- IQBAL, M. (1995): International trade in non-wood forest products in the Asia-Pacific region. Beyond timber: social, economic and cultural dimensions on non wood forest products in Asia and the pacific. Proceedings of a regional export consultation. 28 November – 2 December 1994. – FAO/RAP, Bangkok.
- ISLAMI, M.B. (1994): Utilization of non-wood forest products in Iran (in Farsi). – *Journal of Forest and Rangeland* 25: 22-30.
- KHOSROGERDI, A.H. (1999): Report of Tragacanth utilization project in Kooch-Mish rangelands of Sabzevar (in Farsi). – Natural Resources Organization. Pub. Iran.
- MOINOLDIN, H. (1994): Rangeland, an other view (in Farsi). – *Journal of Forest and Rangeland* 33: 22-31.
- MOLAMOHAMMADI, M. & A. MASOOD-REZA (1989): Galbanum (*Ferula gummosa*) in Iran (in Farsi). – *Research Institute of Forests and Rangelands Bulletin* 56, Tehran, Iran.
- MOZAFARIAN, V. (1983): Apiaceae Family in Iran (in Farsi). – Research Institute of Forests and Rangelands Pub.Tehran.
- SAFAR, M.T., M. REZVANI & R. MOVAHED (1993): Utilization project of Tragacanth and conservation of its habitat in Kuon-Najaf. Abad rangelands (in Farsi). – Isphahan Natural Resource Organization, Iran.
- SALAR, N. (1997): Study cultivation and propagation methods of *Ferula gummosa* (in Farsi). – A Report of the Research Institute of Forests & Rangelands, Semnan, Iran.
- SAMSAM-SHARIAT, H.M. (1986): Medicinal and Natural Pharmaceuticals (in Farsi). – Ruzbahan. Pub. Iran.
- SEIIEDIN-NEJAD. S.H. (1991): Report of Utilization & Trade Office in 1991. Ministry of Agriculture, No. 163, Iran.
- SEIIEDIN-NEJAD, S.H. (1992): Report of wood and non-wood forest products in Iran during 1989-1992. – Utilization & Trade Office. Ministry of Agriculture, No. 144, Iran.
- SEIIEDIN-NEJAD, S.H. (1994): Report of Utilization & Trade Office. – Ministry of Agriculture, No. 158.
- SHAD, G.A. (1995): Autoecology of *Dorema ammoniacum* and study of the harvesting methods at Mohammad-Abad, Kashmar (in Farsi). – M.S.C. Thesis, Agricultural University of Gorgan, Iran.
- ZARGARI, A. (1991): Medicinal Plants, Vol.2 (in Farsi). – Tehran University. Pub.
- ZARGARI, A. (1992): Medicinal Plants, Vol.5 (in Farsi). – Tehran University. Pub.
- ZARINKAMMAR, F. (1997): Anatomy-ecology studies of *Astragalus* species (producers of gum tragagantin) in Iran (in Farsi). – *Research Institute of Forests and Rangelands Bulletin* 156, Tehran, Iran.
- F. Nadjafi • Ferdowsi University of Mashhad • College of Agriculture • Department of Agronomy • Fax: ++98/511/ 8787430 • E-mail: f.nadjafi@isrdmap.com.
- A. Koocheki (mailing address see above) • E-mail: akooch@ferdowsi.um.ac.ir.

Alleviating poverty in Afghanistan through sustainable resource management and marketing of medicinal and aromatic plants

Bert-Jan Ottens, Klaus Dürbeck & Geertje Otten

Introduction

In 2005, after a period of identification and feasibility analysis, the “OXFAM-Novib/RALF Multi-Stakeholder Programme on Natural Ingredients for Food, Pharmaceuticals and Cosmetics in Afghanistan” took off. This 2-year research project aims to improve the living conditions of rural communities in Afghanistan through developing and promoting innovative alternative livelihood options.

To achieve this objective, the programme works on promoting employment and income opportunities at community level through the value chain analysis and development of six wild-collected medicinal and aromatic plants (used as natural ingredients for food, pharmaceuticals and cosmetics), including knowledge of, and access to processing technologies for these ingredients, allowing for quality improvements and market access.

Moreover, the project addresses ecological, technological, socio-economic and market constraints at all levels through a multi-stakeholder approach. It evaluates requirements at all levels for NGOs, government institutions, universities/research institutes, private sector and donors. The research results are implemented in selected target areas, as suited for the establishment of a sustainable natural ingredients sector that can supply to food, pharmaceutical and cosmetic industries.

The project focus is on alleviating poverty rather than just on economic growth. The project works closely with field-based NGOs that liaise with communities for further analysing

and determining economic (including subsistence) opportunities. Resulting from a participatory identification process, the six selected ingredients (Licorice, Heng, Artemisia, Cumin, Caraway, Jujube) are focus of research, with special attention for fair sharing of benefits and forging sustainable supply chain linkages. For more background information on these six products, see below table 1.

The benefits deriving from the research are directly applied through a complementing OXFAM-Novib program-

The **Value Chain Approach (VCA)** is a systemic approach for designing a product strategy, extending from research and development regarding raw material supply and all production activities to delivery of the product to a (international) buyer, and beyond that to disposal and recycling.

With the VCA, well-informed decisions can be taken in designing and prioritising this strategy with respect to when, where and how to add value in the chain from resource to market. This links supply assessment, product selection and market opportunities, and defines which players in the market chain need to be involved. Therefore, VCA is closely related to Resource Assessment, an important subject in sustainable wild collection. Both are complementary steps in matching the supply side to the market demand.

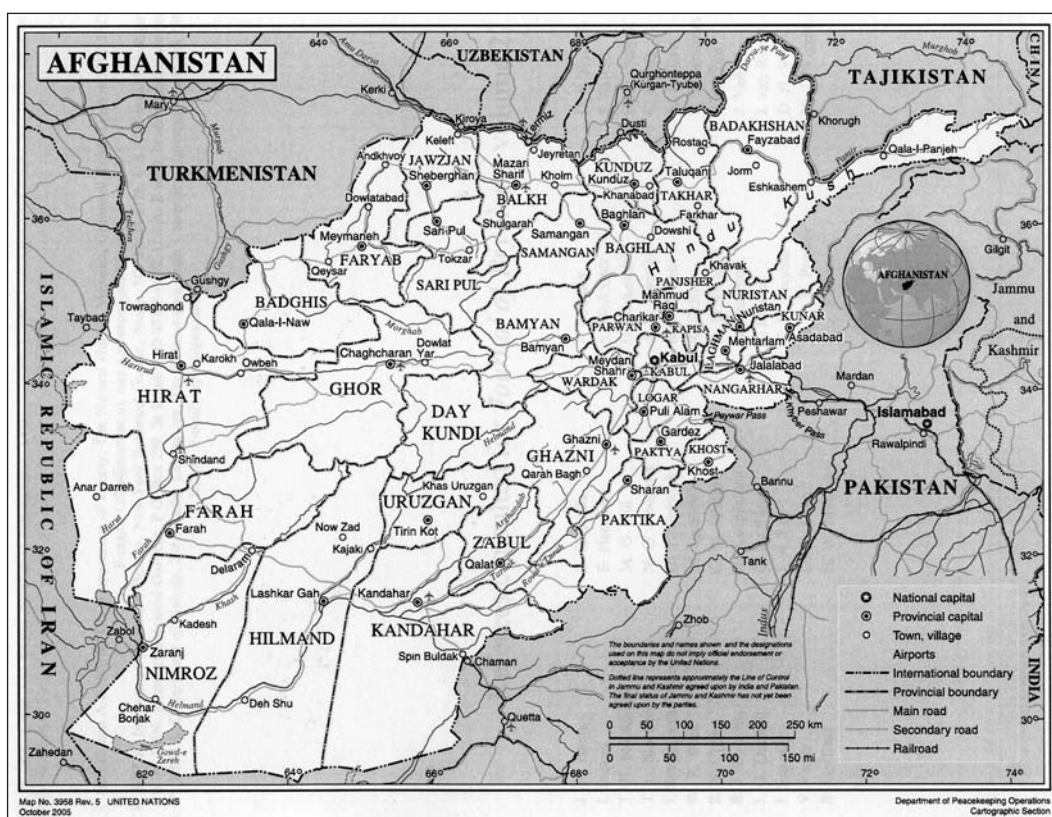


Figure 1. Map of Afghanistan (Source: UN Department of Peacekeeping 2005)

Table 1. Background of the six selected products

Common name	Scientific name	Application/use	Corresponding provinces and working areas	Trade
Liquorice	<i>Glycyrrhiza glabra</i>	food industry and medicines	Badakshan, Baghlan, Bamyán, Herat	Trade reportedly 141 tonnes export annually, but local collection is higher and export is increasing.
Cumin	<i>Cuminum cyminum</i>	Culinary (as spice) and medicinal use	Khost, Paktia, Badakshan	Trade reports of 90 metric tons of export, which is not meeting demand.
Devil's dung	<i>Ferula assa-foetida</i>	Pharmaceuticals and food (especially in India).	Baghlan, Herat, Ghor, Faryab	Trade reports of 377 tonnes of export annually excluding unknown level of local consumption.
Caraway	<i>Carum carvi</i>	Culinary, pharmaceutical and cosmetic use.	Bamjan, Herat	Trade reports export of 739 tonnes annually excluding considerable local market.
Worm-seed	<i>Artemisia cina</i>	Pharmaceuticals and possibly in cosmetics and food.	Khost, Paktia, Bamyán, Ghor	Unknown local market, no export. High demand in EU.
Jujube	<i>Ziziphus jujuba</i>	Pharmaceutical, food, dyeing agent, wood, fodder.	Farah	Some export to India and Pakistan, but mostly used in local market.

Source for trade data: Natural ingredients for pharmaceuticals, cosmetics and food in Afghanistan. A feasibility study carried out by Novib, AKF, CHA and Swisspeace. With technical inputs from ProFound, June 2004.

me that will focus on the implementation of the research and lessons learned in the field, together with other stakeholders.

Actors involved in this programme share the following aims:

- Sustainable natural resources management and utilisation in Afghanistan.
- Generating economic opportunities from these re-

sources, with special attention to fair sharing of benefits of economic and social activities and forging sustainable supply chain linkages.

- Human resources development, institutional development for the sector, and transfer of technical knowledge and capacities.
- Contribution to people-oriented policy shifts both at national and international levels.



Figure 2. Resource assessment with partners (Photo: B.J. OTTENS, November 2005).



Figure 3. Market assessment with partners. (Photos: B.J. OTTENS, November 2005).

Partners

As mentioned before, several national NGOs and national universities/research institutes play an important role in the research and project implementation. Relevant government institutions are involved for developing rules and regulations regarding natural resource management, national quality standards, policies with respect to communal resource bases and land-ownership, and promotion of trade and investment at a level that is necessary to ensure equitable development in Afghanistan. The private sector is included throughout the research programme for addressing commercialisation requirements (table 2).

Besides, partnerships with other organisations/institutes are being developed as required for sustainable supply chain management, such as in the field of resource assessment, conservation, value addition, legislation and control, quality (control), trust among stakeholders, (business) management tools, market development and marketing, etc.

Results to date

The project focuses on the service functions of NGOs, University and Environment Directorate, and the development of research in alternative livelihoods. This is achieved through the following project activities:

- The mapping of first stages of **value addition** to species and products.
- Botanical identification and establishing herbarium; documentation of access rights and resource assessment (based on Standard Operating Procedures).
- Collectors training for and monitoring of good natural resource management practices (sustainable harvesting levels for ecological sustainability), and for establishing sustainable supply chain management.
- Analysis of harvesting efficiency: stage of harvesting, maturation, flowering stage, time and day when the product is harvested.

Table 2. Stakeholders that have partnered up to work on the agreed objectives

Stakeholder	Responsibility
Tribal Liaison Office (TLO; established with support of Swisspeace)	Coordination of Humanitarian Assistance (CHA)
Aga Khan Foundation (AKF)	Linkage to the field-based research and operations with the communities
University of Kabul - Faculty of Pharmacy	R&D and quality control components
Ministry of Agriculture - Department of Forestry - Directorate of Environment	Areas of natural resource management and required rules and regulations
UNIFEM Afghanistan	Involved for the gender components of the programme
Anadolu University - Faculty of Pharmacy (Turkey)	Well-known for its technical and technology expertise for natural ingredients sector development
OXFAM-Novib (Netherlands, www.novib.nl ; top right for English version)	As applicant (for ICARDA's research grant) and co-funder responsible for coordinating and streamlining all activities, overall management and monitoring, informing donors and all parties involved on the project's progress, lobby and advocacy
International Center For Agricultural Research In The Dry Areas (ICARDA) / Research in Alternative Livelihood Funds (RALF) (www.icarda.org/RALFweb/AboutRALF.htm)	Co-funder of the project
ProFound - Advisers In Development (Netherlands, www.ThisIsProFound.com)	As Executive Manager and Chief Technical Adviser responsible for programme development and management support, technical support (resource assessment and management), institutional arrangements (inter-organisational collaboration and public-private partnerships), training in Value Chain Analysis, product & market development, and marketing advice

- Analysis of post-harvesting requirements: rate and temperature of drying, moisture content after drying; storage, storing conditions, storage time before processing.
- Processing requirements and (appropriate technology) opportunities.
- Analysis of international quality standards for harvesting and/or processing.
- Organic and Fair Trade certification of wild collection.

At present opportunities for organic and fair trade certification of sustainable wild-collection are being explored in collaboration with the organic certifier IMO (Institut für Marktökologie, Switzerland).

All internet resources in this paper have been viewed on 24.7.2006.

Bert-Jan Ottens (Managing consultant ProFound – Advisers In Development, Executive Manager OXFAM Novib/RALF Multi-Stakeholder Natural Ingredients Programme Afghanistan) • Klaus Dürbeck (Special Technical Adviser of ProFound) • Geertje Otten (Consultant ProFound)

Contact details Netherlands: ProFound – Advisers In Development • Lange Smeestraat 55 • 3511 PV Utrecht • The Netherlands • Tel.: ++31/30/2762824 • Fax: ++31/30/272 0878 • E-mail: profound@knoware.nl • www.ThisIsPro Found.com

Contact details Afghanistan: p/a TLO office • Hs #83, St. 1 Qalla-e-Fatullah • Kabul • Afghanistan • Tel. mobile: ++93/799/297449.

Prioritisation of medicinal plants for conservation through threat assessment in Madhya Pradesh, India. A paradigm shift from prescription to practice

G. A. Kinhal, D.K. Ved & B.M.S. Rathore

1. Introduction

The Conservation Assessment and Management Prioritisation (CAMP) process has been effectively utilized by Foundation for Revitalisation of Local Health Traditions (FRLHT) over the past 12 years to undertake rapid assessment of the threat status of prioritised medicinal plant species of conservation concern in different states and regions of India (for more information please refer VED et al. 2005). FRLHT has so far facilitated 11 CAMP workshops for different states of India. These exercises have resulted in assessment for a total of over 350 medicinal plant taxa including more than 100 endemic and/or near endemic ones. Of the 350 taxa assessed 306 taxa have been assigned Red List status of “threatened cate-

gory” i.e. Critically endangered (CR), Endangered (EN) and Vulnerable (VU).

A rapid threat assessment workshop was held for selected medicinal plants of Madhya Pradesh in 2003, the results and recommendations of which suggested certain actions at the state level, as a geographical unit (VED et al. 2003). Due to lack of field level population data and clarity related to interventions, not much action was initiated. As a measure to rectify and improve the uptake of such results, eco-regionwise field information based threat assessment exercise was contemplated to be useful. So a CAMP workshop for assessment of threat for prioritised Medicinal plant species of Madhya Pradesh was held at Bhopal, India, during 3rd to 7th January 2006, based on species information collected from eco-regions.

A total of 37 Indian participants from several well-known institutions like Botanical Survey of India (BSI), Madhya Pradesh State Biodiversity Board, State Forest Research Institute (SFRI) of Madhya Pradesh, Universities, other research Institutions and colleges of Madhya Pradesh state, forest managers from the State Forest Department actively participated in the workshop. Most of the participants were experienced field botanists, taxonomists and foresters.

Conservationists and scientists alike have accentuated the need for a convenient geographical scale for sustained conservation action. The eco-region thus becomes an ideal plane for macro-level planning, informed by field-based actions following conventional approaches viz. micro/milli-watersheds.

The uniqueness of an eco-region in terms of geo-morphology, vegetation, faunal elements, watersheds, and culture requires that sectoral action programmes acknowledge these elements of diversity in order to be effective; rather than prescribing uniformly for the state as a unit. Wildlife scientists and managers require larger landscapes to ensure connectivity amongst protected areas so as to ensure gene flow across populations. Eco-regions also make sense and provide feasibility when it comes to economy of scale in case of large number of bio-resources based livelihood interventions.

2. Biogeography of Madhya Pradesh

The forests of Madhya Pradesh cover about 76,429 sq. kms, which comes to approximately 24.79 % of the total geographical area and which is about 11.27 % of India’s forest cover (FSI 2005, see also www.fsiorg.net/fsi2003/states/index.asp?state_code=15, viewed 4.9.2006).

2.1 Phytogeographic zones

According to SHARMA (2000), two major forest types, viz. tropical forests and montane subtropical forests are represented in Central India. Tropical moist deciduous

forests occur on hilly ground. Tropical dry deciduous forests, tropical thorn forests, are quite conspicuous. Montane subtropical forests are found on some hill tops of Madhya Pradesh. SHARMA (2000) also described that two important mountain ranges, Vindhya and Satpura, are found right across Madhya Pradesh from Southwest to Northeast and distinctly meet the Chhota Nagpur plateau of Bihar. These ranges have played an important role in migration of plants from Eastern Himalaya, Assam, Myanmar, Malaya and other countries of the Southeast. Plants have migrated from here to the Western and Eastern Ghats and Sri Lanka. Some of the species from these regions are still found in the Central Indian region. However, the Eastern and Western Ghats have a larger number of migrants as compared to Central India.

The phytogeographic region in this part of India appears to have contributed to species diversity in other regions, and maybe migration of a few of the species is still continuing. This volatile nature of the regions makes it more special for considering the study and assessment of vegetation at clearly discernable eco-regions, both biologically and culturally.

2.2 What is an eco-region?

An eco-region can be defined by using a range of parameters including landforms, geomorphology, biogeography, vegetation, and the cultural context of the area. These attributes could provide a distinct identity to the region. In the context of Madhya Pradesh, six eco-regions have been identified using the criteria listed above (figure 1).

Eco-regions in the Satpuda landscape: The landscape of Satpuda is a distinct geo-morphological landform formed by the Satpura ranges running from east to west. It is punctuated by a series of valleys, ridges and plateau formations. The larger Satpura landscape may be sub-divided into the political and cultural areas of Mahakoshal in the East and the south central and Nimar regions in the West. Using agro-ecological zonation, the larger Satpura landscape can be divided into the agro-ecological sub-regions of Nimar, Satpura and Wainganga.

Eco-regions in the Vindhyan landscape: The landscape of Vindhyan houses the Vindhyan ranges running from east to west and is punctuated by innumerable valleys, ridges and plateau formations. It houses the area of the Vindhya ranges and plateau in the east called Vindhya Pradesh or Baghelkhand; Vindhyan spurs comprising Bundelkhand; the central Vindhyan region; and Malwa plateau in the west. Agro-ecologically, the larger landscape of Vindhyan has been divided into Baghelkhand in the east, Vindhyan in the central and Malwa in the west.

Chambal eco-region: The northern Chambal eco-region of the state corresponds with the grid region under agro-ecological sub-regions. In addition to biophysical parameters, each of the eco-regions/agro-ecological sub-regions is distinguishable by a unique cultural context of its own.

The eco-regionwise districts with forest cover details and their contribution to the extent of forests in Madhya Pradesh revealed that among the six eco-regions Satpura contributed most to state forest cover (44.3 %) followed by Central (14.4 %), Vindhyan (14.1 %), Chambal (13.9 %), Malwa (7.1 %), and Bundelkhand (6.2 %) (table 1).

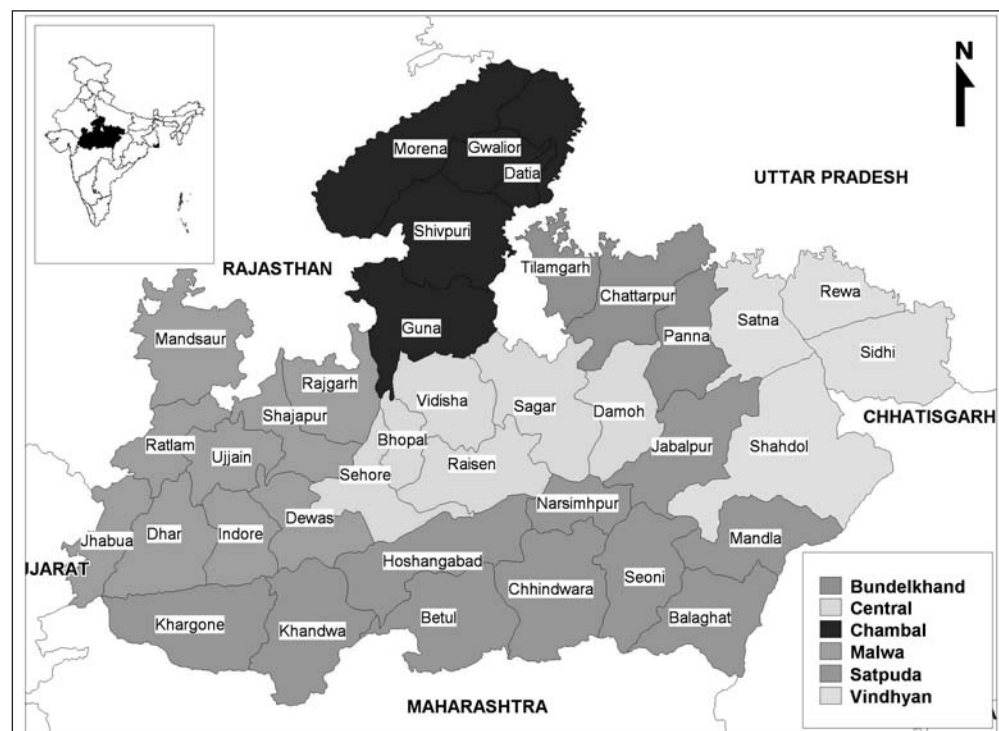


Figure 1. Eco-regions of Madhya Pradesh

2.3 Using the eco-region as a unit for conservation action through the CAMP Process

The International Taxonomic Database Working Group (TDWG) recognizes constituent states or provinces as 'Basic Recording Units' for the assessment of vegetation and its components (BRUMMITT 2001). Hence, FRLHT has been undertaking such assessments at the states level. The CAMP process has been well tested for assessing the status of taxa of medicinal value, using

state as a unit. While these state level exercises have helped to generate awareness about the threatened medicinal plants, action oriented application of results of these assessments have been limited. Examples of some of these applications are establishment of Medicinal Plants Conservation Areas for capturing and conservation of specific threatened medicinal plants species in south India viz. *Saraca asoca* (in Karnataka), *Janakia arayalpathra* (in Tamil Nadu), *Uleria salicifolia* and *Coscinium fenestratum* (in Kerala). This effort of threat assessment at the state level with clear orientation and mandate to derive information for conservation action at the eco-regional level is new and progressive.

Eco- regions as rallying point for pre-CAMP events

Pre-CAMP events in each of the eco-regions engaged Eco-regional Research Coordinators (ERCs) who were identified as focal persons for each of the regions. Series of meetings were held with eco-regional coordinators. The ERCs were required to identify knowledgeable individuals and relevant resource persons from their respective eco-region, who can help them in narrowing down on eco-regional lists of taxa of medicinal importance to be taken up for assessment. Criteria viz. endemism, narrow distribution, high volume of trade, vulnerability to exploitation in future, if rapidly declining, and uniqueness of taxa (e.g. monotypic or phylogenetic/ genetic significance) were agreed upon to help ERCs to come up with such list for their eco-region; Taxon sheets used by FRLHT were introduced to the ERCs so that they can organise information on the taxa prioritised for their eco-region through targeted field visits. The ERCs also identified knowledgeable individuals, who were to participate in the CAMP workshop at the state level.

Eco-regions to secure conservation action in the field with respect to threatened taxa

Following pre-CAMP events at eco-regional level, the state level CAMP workshop brought together all the ERCs and their teams for assessment of taxa selected from the regional lists, removing overlaps and applying the criteria rigorously enough so as to arrive at a common list of taxa for assessment during the CAMP. While each taxon was assessed using state as a unit, slight modification in the taxon sheet was made in order to accommodate the field level location details and population estimates (in categories of <100, 101-500, 501-1000 and

>1000) of the taxon being assessed. Using eco-regional units and units below it for locational and population details will help to identify specific areas with viable populations of targeted species for conservation action. Some of this information is also envisaged to be put up in a biodiversity atlas being prepared for the state of Madhya Pradesh.

2.4 Results of the threat assessment process

A total of 48 species belonging to 45 genera and 32 plant families were included in the final list. The most species rich families were Asclepiadaceae, Fabaceae and Orchidaceae (4 species each), followed by Mimosaceae (3 species). Five families were represented by 2 species and the majority of the plant families were represented by single species (23 species). The most represented genera were *Butea*, *Drosera* and *Nervilia* (2 each). The habitwise grouping of taxa assessed showed that the most represented life form in the list was herbs (21 species) followed by trees (12 species), climbers (10 species) and shrubs (5 species). Of the 48 taxa assessed for threat category, 41 taxa were found to be Threatened, including 2 Critically Endangered (CR), 17 Endangered (EN), and 22 Vulnerable (VU).

The eco-regionwise results (figure 2) showed that among six eco-regions, the highest number of taxa were from Satpuda region (17 taxa) followed by Malwa (10), Central and Vindhyan (six each), Bundelkhand (five) and Chambal region (four).

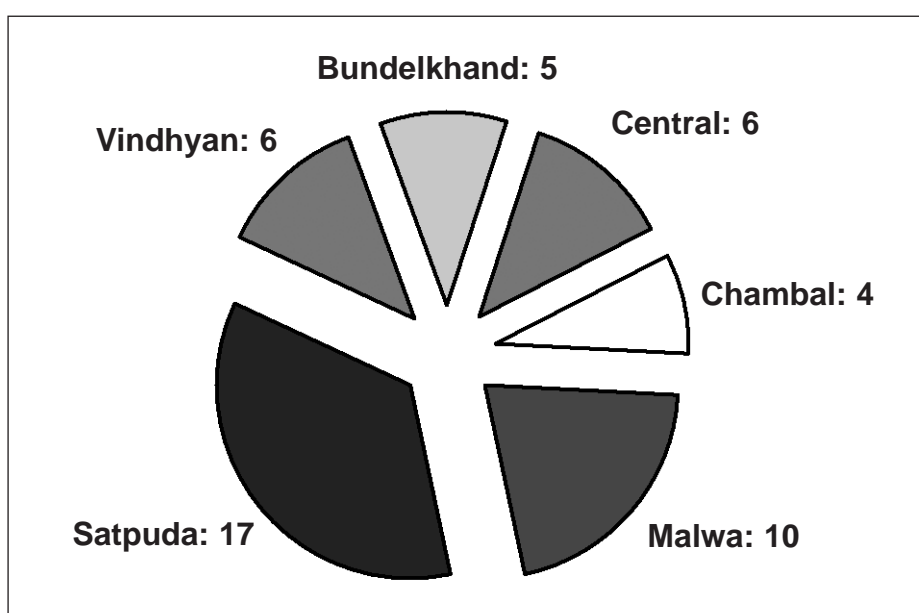


Figure 2. Eco-regionwise taxa assessed.

Table 1. Eco-regionwise districts with forest cover details and percent contribution to the extent of forests in Madhya Pradesh. Source: (FSI 2005).

Sl. No.	Eco-region and district	Geographic area (km ²)	Total Forest area (km ²)	Forest cover (%)	Contribution to state forest (%)
	Bundelkhand				
1.	Chhatarpur	8,687	1,706	19.6	2.2
2.	Panna	7,135	2,728	38.2	3.6
3.	Tikamgarh	5,048	325	6.4	0.4
	Total		4,759		6.2
	Central				
4.	Bhopal	2,772	312	11.3	0.4
5.	Damoh	7,306	2,678	36.6	3.5
6.	Raisen	8,466	2,732	32.3	3.6
7.	Sagar	10,252	2,922	28.5	3.8
8.	Sehore	6,578	1,464	22.3	1.9
9.	Vidisha	7,371	902	12.2	1.2
	Total		11,010		14.4
	Chambal				
10.	Bhind	4,459	121	2.7	0.2
11.	Datia	2,691	164	6.1	0.2
12.	Guna	11,064	2,092	18.9	2.7
13.	Gwalior	4,56	1,323	29	1.7
14.	Morena	4,989	777	15.6	1.0
15.	Sheopur	6,606	3,632	55	4.8
16.	Shivpuri	10,277	2,479	24.1	3.2
	Total		10,588		13.9
	Malwa				
17.	Dewas	7,020	1,803	25.9	2.4
18.	Dhar	8,153	585	7.2	0.8
19.	Indore	3,898	554	14.2	0.7
20.	Jhabua	6,778	842	12.4	1.1
21.	Mandsaur	5,535	264	4.8	0.3
22.	Nemach	4,256	895	21	1.2
23.	Rajgarh	6,153	179	2.9	0.2
24.	Ratlam	4,861	182	3.7	0.2
25.	Shajapur	6,195	123	2	0.2
26.	Ujjain	6,091	13	0.21	0.0
	Total		5,440		7.1
	Satpuda				
27.	Balaghat	9,229	4,859	52.6	6.4
28.	Barwani	5,422	901	16.6	1.2
29.	Betul	10,043	3,537	35.2	4.6
30.	Chhindwara	11,815	4,409	37.3	5.8
31.	Dindori	7,470	2,643	35.4	3.5
32.	Harda	3,330	1,045	31.4	1.4

continued...

Table 1. ... continued

Sl. No.	Eco-region and district	Geographic area (km ²)	Total Forest area (km ²)	Forest cover (%)	Contribution to state forest (%)
33.	Hoshangabad	6,707	2,402	35.8	3.1
34.	Jabalpur	5,211	1,078	20.7	1.4
35.	Katni	4,950	1,191	24.1	1.6
36.	Khandwa	10,776	3,580	33.2	4.7
37.	Khargone	8,030	1,089	13.6	1.4
38.	Mandla	5,800	2,732	47.1	3.6
39.	Narsimhapur	5,133	1,374	26.8	1.8
40.	Seoni	8,758	3,038	34.7	4.0
	Total		33,878		44.3
	Vindhyan				
41.	Rewa	6,314	708	11.2	0.9
42.	Satna	7,502	1,678	22.4	2.2
43.	Shahdol	9,952	2,483	24.9	3.2
44.	Sidhi	10,526	4,013	38.1	5.3
45.	Umaria	4,076	1,872	45.9	2.4
	Total		10,754		14.1

The most important advantage of this process has been the identification of regional experts who stand by the assessment and exhibit commitment to monitor and track the status of different medicinal plants and meanwhile help in developing strategies for effective conservation actions. This is observable in the responses received from the participants about their keenness to continue working on the selected medicinal plants.

2.5 Recommendations

While the rapid threat assessment exercises, hitherto undertaken by the FRLHT, had given a clear theoretical understanding about the importance of such assessments, the eco-regionwise planning and implementation of such assessment exercises provide a strong footing for initiating conservation action with complete grassroots level ownership over the results. The major lessons learnt from this exercise are as under:

- There must be clarity in understanding the process of CAMP among the resource persons and participants that the assessment for each of the prioritized species is being done at the State level with an objective of initiating action in the respective eco-region.
- The resource persons for eco-regions must be carefully selected based on their field experience.
- The experts and the resource persons selected for gathering field information must have preliminary knowledge about IUCN Red list criteria and guidelines, preferably participated in an earlier CAMP exercise.
- The results of the assessment must be assorted eco-

regionwise to assist the field foresters to evolve strategies for conservation action based on field information about the species.

- The benefits of such eco-regional assessments must be taken to prepare species specific action projects in each eco-region.

3. References

- BRUMMITT, R.K. (2001): World geographical scheme for recording plant distributions. Plant Taxonomic Database Standards No. 2. 2nd edition. – 137 pp., Hunt Institute for Botanical Documentation, Pittsburgh.
- SHARMA, B.D. (2000): Affinities - Palaeobotanical and geological evidences, relationship with adjacent regions, past and recent plant migration. In: SINGH, N.P., D.K. SINGH, P.K. HAJRA & B.D. SHARMA (Eds.): Flora of India. – pp. 1-200, Botanical Survey of India, Calcutta.
- FOREST SURVEY OF INDIA (FSI) (2005): State of Forest Report 2003. – xii+134 pp., Dehradun.
- VED, D.K., G.A. KINHAL, K. RAVIKUMAR, MOHAN KARNAT, R. VIJAYA SANKAR & J.H. INDRESHA (Eds.) (2003): Report of the Threat Assessment and Management Prioritisation for the medicinal plants of Chhattisgarh & Madhya Pradesh. 23rd to 26th July 2003, Bhopal. – 165 pp., unpublished report.
- VED, D.K., G.A. KINHAL, K. RAVIKUMAR, R. VIJAYA SANKAR & K. HARIDASAN (2005): Conservation Assessment and Management Prioritisation (CAMP) for wild medicinal plants of North-East India. – Medicinal Plant Conservation 11: 40-44.
- D.K. Ved & G.A. Kinhal • *Foundation for Revitalisation of Local Health Traditions* • 74/2 Jarakabande Kaval, Post Attur • Via Yelahanka • Bangalore - 560064, Kar-

nataka • India • Tel.: ++91/80/2856-0001 • Fax: ++91/80/2856-5873 • E-mail: dk.ved@frlht.org; ga.kinhal@frlht.org.

B.M.S. Rathore • Madhya Pradesh State Biodiversity Board • 3rd floor, Beej Nigam Complex • Mother Teresa Marg • Arera Hills • Bhopal - 462 011, Madhya Pradesh • India • Tel.: ++91/755/2554539 • Fax: ++91/755/2764912 • E-mail: mp_biodiversityboard@yahoo.com.

Medicinal plants of the Canary Islands

David Bramwell

Introduction

In the Canary Islands both the native, endemic flora and some introduced, mainly Mediterranean region species make up the local plant pharmacy. Some of the traditional uses of Canarian plants have surely been handed down through unwritten, verbal traditions from the original native inhabitants. Others were brought in by the first Spanish colonists of the Islands and now the two co-exist side by side almost without any local distinction between them (BRAMWELL 2004).

Endemic medicinal plants

About 250 endemic plants are currently used, or have in the past been used as medicinal plants (PEREZ DE PAZ & MEDINA 1987). The original inhabitants of the Islands (popularly but not always correctly known as the “Guanaches”) certainly used a number of species before the Spanish conquest and settlement of the archipelago in the late 15th Century, though there are no written records from the pre-Spanish era. There is, however, some circumstantial evidence provided by archaeological excavations and from the chronicles of some of the early Spanish inhabitants. These recount the use of local species such as the Dragon tree (*Dracaena draco*), Spurge Olive (*Neochamaelaea pulverulenta*) and Mocán (*Visnea mocanera*) in the mummification of corpses and, in the case of the last-named, as a tonic and for the preparation of an alcoholic beverage. Some species such as *Aloe vera* and the North African date Palm (*Phoenix dactylifera*) were almost certainly introduced by Arab traders and sailors who visited the Canaries to obtain a purple dye from *Rocella* lichens (orchilla). *Aloe vera* has been in the Canaries so long that Reynolds in his book on the Aloes of Africa erroneously considered the islands to be the original home of this ubiquitous medicinal plant.

Many of the medicinal herbs used traditionally were brought to the islands by the early colonists and settlers and are typical Mediterranean Region species such as marigold (*Calendula officinalis*), Rosemary (*Rosmarinus officinalis*) and Fennel (*Foeniculum vulgare*) that are still in use today.

The most interesting element amongst the Canarian medicinal flora is, however, the endemic one. Many of these were probably first used because of their similarity to or relationship with Mediterranean and Iberian species already known to the Spanish settlers for example several of the mints (*Mentha*), rue (*Ruta*) and lavender (*Lavandula*) and the medicinal properties of the rest were surely discovered by trial and error or through the verbal traditions of the pre-Hispanic inhabitants of the islands. The 18th Century cleric and historian Jose Viera y Clavijo, in his classic “Diccionario de Historia Natural de las Islas Canarias”, the original manuscript of which dates from about 1800 mentions a number of such plants but the medicinal plants of the islands were largely ignored until late in the 20th Century when PEREZ DE PAZ & MEDINA-MEDINA (1987) published the first comprehensive catalogue of the medicinal flora of the Canaries listing 580 species with their applications and uses.

Threatened medicinal plants

The Macaronesian Islands Specialist Group has recently provided a Red List of the endemic flora of the region and from this a subset of data on the conservation status of the medicinal plants of the Canaries has been extracted. Though the red list is continuously in revision it has provided the first opportunity to evaluate the medicinal species. Although 68% of the endemic medicinal species are considered to be Not Threatened of Low Risk (LR), 32% are classified as threatened plants (tables 1 and 2).

Critically Endangered species

The greatest threat to these species is not, however, their over-exploitation except, perhaps for *Sambucus palmerensis*, but rather the loss of primary habitat such as laurel and thermophile forests in the islands. Both these ecosystems have been seriously depleted since the Spanish con-

Table 1. Number of threatened endemic medicinal plants in the Canary Islands. – Source: BELTRAN TEJERA (1999).

Threat category	Medicinal plants (%)	Number of plant species
Not Threatened/Low Risk	68 %	172
Threatened endemic medicinal plants	32 %	81
Vulnerable (VU)		59
Endangered (EN)		12
Critically Endangered (CR)		10
Total	100 %	253

Table 2. Endemic medicinal plants considered to be Critically Endangered (CR). – Source: Atlas y libro rojo de la flora amenazada de España (2004)

Scientific name	Common name	Individuals
<i>Anagyris latifolia</i>	Oro de Risco	380-390 individuals
<i>Isoplexis chalcantha</i>	Cresta de gallo	About 400 individuals
<i>Micromeria glomerata</i>	Tomillo	About 500 individuals
<i>Micromeria rivas-martinezii</i>	Tomillo	800-1000 individuals
<i>Ruta microcarpa</i>	Ruda de La Gomera	270 individuals
<i>Sambucus palmensis</i>	Sauco	140 individuals & some reintroduced
<i>Scrophularia calliantha</i>	Bella del Risco, fistulera	300 individuals
<i>Sideritis discolor</i>	Salvia blanca de Los Tiles	Less than 100 individuals
<i>Solanum lidii</i>	Tomatero silvestre	About 90 individuals
<i>Solanum vespertilio</i>	Rejalgadera	230 individuals

quest until recently when most of the remaining laurel forests (Laurisilva) were included in protected natural areas, National parks or, in the case of the Garajonay Park on the island of La Gomera, in a World Heritage Site.

The sauco or Canary Islands black elder (*Sambucus palmensis*) is extremely rare and though it is known from four islands, Gran Canaria, Tenerife, La Palma and La Gomera, the total sum of naturally occurring individuals is less than 50 (41 at the last count, BELTRAN TEJERA et al. 1999). On the island of La Gomera the sauco is subject to a recovery plan and about 200 individuals have been reintroduced. BRAMWELL (2004) suggests that the rarity of *S. palmensis* is due the fact that the principal medicinal parts of the plant are the flowers and ripe fruits and that their over-collection has severely limited its capacity for natural propagation.

Isoplexis chalcantha and *Sideritis discolor* are both extremely rare species of the laurel forests of Gran Canaria. These forests suffered extreme exploitation over the past 400 years to the extent that less than one percent of their original extension now remains. The richest surviving site is at Los Tiles de Moya where both species still occur in small populations. BELTRAN TEJERA et al. (1999) estimate the total population of *Isoplexis chalcantha* to be about 200 individuals and of *Sideritis discolor* to be less than 70. SUAREZ RODRIGUEZ (1994) suggests over-collection of the latter species for medicinal purposes, as an antiseptic and anti-inflammatory, to be one of the factors responsible for its decline. *I. chalcantha* is of particular pharmacological interest because of its cardiac glycoside content making it a potentially important source of these and other phytosteroids. BELTRAN TEJERA et al. (1999), however, report its recent probable extinction in two of the five known localities.

Several of the other critically threatened species have probably never been other than rare and are very local endemics with small natural populations, these include *Anagyris latifolia* which, despite occurring on several of the islands, is usually found as isolated individuals and the largest population from the island of La Palma has no more than 20 plants. Fortunately it appears no longer to be used medicinally. *Solanum lidii*, restricted to a small area of the south of Gran Canaria, also occurs in less than ten small, scattered populations, the largest with less than 50 individuals. Apparently liquor prepared by steeping a few berries in red wine was traditionally employed as a tranquilliser and as an antispasmodic but this now appears to be in disuse. The same can be said for *Solanum vespertilio*, a local endemic of the laurel forest



Figure 1. *Anagyris latifolia*, a critically endangered medicinal species from the Canary Islands. (Photo: ALEX BRAMWELL, 2005).

zones of Tenerife and Gran Canaria reduced to a single population of 3 individuals on the latter island and to a few (7) relictual populations with a total of less than 200 individuals on the forest margins of northern Tenerife.

Scrophularia calliantha is an exclusive endemic of the island of Gran Canaria. As a medicinal plant, the leaves are used in an infusion to treat inflammation, infections and skin disorders. It appears to be particularly effective for fistulas and haemorrhoids. It grows in humid habitats, often in fissures with permanent seepage or near streams. The over-exploitation of natural water resources and the channelling of ground water has had a severe effect on the distribution of this once relatively frequent species and now probably no more than 500 individuals distributed in about half a dozen populations can be found in the wild state.

Ruta microcarpa was not described until the 1960's though its presence and use as a medicinal plant was well known to the inhabitants of some of the small villages (Epina, Alojera) in the north and west of La Gomera where it is endemic. Traditionally the leaves and fruits have been used as a mild stimulant in cases of nervous depression and, as an infusion, to cure coughs and calm throat irritation. On La Gomera the natural populations are small and very fragmented with little sign of natural regeneration and total less than 300 individuals in all.

The two species of *Micromeria* are both rare, local endemics of the Anaga mountains on the island of Tenerife. *M. glomerata* is a cliff plant known only from two localities, one with about 460 individuals and the other with less than 30. *M. rivas-martinezii* is also a cliff plant found in two localities, one with about 800 individuals and the other with only two. Both species appear to be naturally very rare but especially in the case of *M. rivas-martinezii*, traditional collecting as a medicinal herb may have contributed to its scarcity.

Legal protection

Although most Canarian endemic species enjoy some degree of local legal protection, there is no specific legislation for medicinal plants. Many are also included in the Spanish National Catalogue of Threatened Species (Catalogo Nacional de Especies Amenazadas CNEA)

This is a national catalogue that gives legal protection to the species and some are protected by European legislation such as the Bern Convention and the EU Habitats Directive. The protective cover for the critically endangered species listed above is shown in table 3.

Table 3. Legal protection for critical species.				
Species	EU Habitats Directive	Bern Convention	National catalogue	Local
<i>Anagyris latifolia</i>	X	X	X	X
<i>Isoplexis chalcantha</i>	X	X	X	X
<i>Micromeria glomerata</i>	—	X	X	X
<i>Micromeria rivas-martinezii</i>	—	—	—	X
<i>Sambucus palmensis</i>	X	X	X	X
<i>Scrophularia calliantha</i>	—	—	—	X
<i>Sideritis discolor</i>	X	—	X	X
<i>Solanum lidii</i>	X	X	X	X
<i>Solanum vespertili</i>	—	—	—	X
<i>Ruta microcarpa</i>	—	X	X	X

Sustainable use of Canarian medicinal plants

Without doubt sustained over-collecting can eventually threaten even some of the more common species and in the Canary Islands over 80 of the species listed by PEREZ DE PAZ & MEDINA (1987) in their catalogue of medicinal plants are currently considered to be threatened. The need for a sustainable supply of medicinal plants is urgent as the urban population of the islands returns increasingly to medicinal “herbs” for primary medical care. For many of them cultivation is a practical alternative to collecting in the wild especially for the more widely used ones and those with the most potential for future use.

Amongst the latter are:

Canarian St John’s Wort (*Hypericum canariense*), with many medicinal properties including the treatment of joint pain, mild hysteria, wounds and ulcers and inflammation, these are based on its unique content of xanthones that function as excellent antioxidants and are strongly anti-inflammatory.

Artemisia canariensis (*A. thuscula*), (Canary wormwood, incienso), generally considered to be a digestive system tonic and stimulant to relieve aches and pains, this species is also used as an insecticide and vermifuge, it has a high content of sesquiterpenes lactones and other terpene compounds as well as coumarins that account for its antiparasitic properties.

Nepeta teydea (Gatera Del Teide or Canary catnip), is used locally to reduce blood sugar levels and to inhibit tumours. These properties seem to be due to the pre-

sence of triterpenoid acids and several steroids of the sitosterol family are said to block the absorption of cholesterol and protect against heart disease. Their anti-inflammatory properties are reported to help decrease the risk of colon cancer.

Maytenus canariensis (Peralillo or Canary Islands spindle tree), a Canarian endemic found on all the islands with the exception of Lanzarote. Its high content of sesquiterpenoid and triterpenoid compounds give it enormous potential as an antiviral and anticancer plant. It has about 20 unique triterpene compounds that have not yet been clinically tested for their potential medicinal properties.

Aeonium lindleyi (Bejeque, verol, Canary Island house-leek), traditionally used to treat wounds and burns and particularly to counteract the irritant effect of Euphorbia latex, this species contains, in addition to a number of typical anti-inflammatory flavonoids a tannin-related aromatic phenyl butanone glucoside known as lindleyin with excellent inflammation-reducing properties.

Echium species (taginaste, viper's bugloss), the leaves are used locally to relieve joint pain, and treat fevers but recent research has shown the seeds to be extremely rich in the sterol gamma-linoleic acid (GLA) with important medical uses particularly in cell function and the rejuvenation of peripheral nerve fibres. It is also effective in the treatment of some of the most common forms of brain and optic nerve tumours. Some of the Canarian endemic *Echium* species have a massive seed production and could possibly be an important industrial source of GLA in the future.

Research on medicinal plants

No article on the medicinal plants of the Canary Islands would be complete without a mention of the work of the late Professor Antonio Gonzalez y Gonzalez, professor of biochemistry at the University of La Laguna on Tenerife. Professor Gonzalez devoted his professional career of over 40 years to the study of plant products of the Canarian endemic flora. He discovered, isolated and worked out the structure of several thousand specific compounds, many of them of considerable medicinal value. He published the results in several hundred scientific papers. The research of Professor Gonzalez and his collaborators means that we have a great deal of understanding about why local medicinal plants have the properties that they do and his work is well summarized in the book "Investigaciones Fitoquímicas en Plantas Canarias" compiled by AUREA VALERA MOLINA & ARNOLDO SANTOS GUERRA (2002).

Traditional knowledge, plant conservation etc.

Several other books about medicinal plants in the Canaries and, particularly their folklore have been pub-

lished in the last couple of decades (JAEN OTERO 1984; NODA GOMEZ 1984; CONCEPCIÓN 1985 etc.) and PEREZ DE PAZ & MEDINA produced the first comprehensive catalogue of Canarian plants and their medicinal uses in 1987 listing their traditional uses and applications. A recent project, BIOMABANC, funded by the European Union INTERREG Programme for Macaronesia is developing a data-base of traditional knowledge and uses of plants in the Canary Islands including a survey of local people, shepherds, farmers etc. still living in the countryside who are contributing valuable information on the subject. It is urgent to obtain this information, as traditional knowledge is dying out with the decline of rural communities and the migration of the population into the cities.

Medicinal plants, however, still form an important part of traditional life in the Canary Islands and, as in many places, the use of herbal medicine is increasing even amongst the urban population so there is a need to provide both a sustainable supply through cultivation thus ensuring quality control and, at the same time, to legislate for their specific protection in the wild.

References

- BELTRAN TEJERA, E. et al. (1999): Libro Rojo de las especies de la Flora Canaria incluidas en el Anexo II de la Directiva 92/43/CEE. – 694 pp. Organismo Autonomo de Parques Nacionales, La Laguna, Tenerife.
- BRAMWELL, D. (2004): Medicinal Plants of the Canary Islands. – 153 pp. Editorial Rueda, Madrid.
- CONCEPCIÓN, J.L. (1985): Costumbres, tradiciones y remedios medicinales canarios. – 87 pp. Santa Cruz de Tenerife.
- JAÉN OTERO, J. (1984): Nuestras Hierbas Medicinales. – 82 pp. Las Palmas de Gran Canaria.
- NODA GOMEZ, T. (1984): Medicina popular en la Isla de La Palma. – 200 pp. Santa Cruz de La Palma.
- PEREZ DE PAZ, P.L. & MEDINA MEDINA, I. (1987): Catalogo de las plantas medicinales de la flora canaria. – 132 pp. La Laguna, Tenerife.
- SUAREZ RODRIGUEZ, C. (1994): Estudio de los relictos actuales del "Monte verde" en Gran Canaria. – 617 pp. Las Palmas de Gran Canaria.
- VALERA MOLINA, A. & SANTOS GUERRA, A. (2002): Investigaciones fitoquímicas en plantas canarias. – 387 pp. Madrid
- Dr. David Bramwell • Jardín Botánico 'Viero y Clavijo' • 14 Tafira Alta • Ap. de Correos • 35017 Las Palmas • Gran Canaria • Spain • Tel.: +34/928/2195-82 • Fax: +34/928/2195-81 • E-mail: dbramwell@grancanaria.com.

Conservation strategies for *Commiphora wightii*. An important medicinal plant species

Vineet Soni & P.L. Swarnkar

Commiphora wightii (Arnott) Bhandari, is an important medicinal plant of herbal heritage of India (figure 1). In Indian languages, it is known by various names like guggul in Hindi, gukkulu and maishakshi in Tamil, guggulu in Sanskrit and Indian bdellium in English. This plant is distributed in arid areas of India, Bangladesh, Pakistan, and Arabia. In India it is found in arid, rocky tracts of Rajasthan, Gujarat, Maharashtra, and Karnataka states. However, Rajasthan and Gujarat are the main Indian commercial centers (ATAL et al. 1975). The use of plants in the treatment of diseases occupies an important place in Ayurveda, the traditional medicine of India (SATYAVATI 1988). The Atharva Veda, one of the four well-known Holy Scriptures (Vedas) of the Hindus, is the earliest reference to the medicinal and therapeutic properties of guggul. Sushruta Samhita (600 B.C.), a well-known Ayurvedic medical text, describes the usefulness of the gum resin from the tree *Commiphora wightii* in the treatment of a number of ailments, including obesity and disorders of lipid metabolism (URIZAR & MOORE 2003).



Figure 1. *Commiphora wightii* plant growing in natural habitat at Gulta hills, Jaipur, India. (Photo: RAJKUMAR, April 2003).

The plant *Commiphora wightii* provides oleo gum resin mentioned by Sushruta (3000 years ago) as being a valuable drug. The oleo gum resin commonly known as “gum guggul” or “Indian myrrh” is the economically important product of Indian bdellium. The oleo gum is collected as exudates from woody stem (figure 2). In each collecting season a guggul tree yields between 250-500 grams of dry

resin, which is extracted from the bark through a process called tapping. A plant generally takes 10 years to reach tapping maturity under the dry climatic conditions. The thick branches are incised during the winter to extract the oleo gum resin.

Guggul gum is a mixture of 61 % resins and 29.3 % gum, in addition to 6.1 % water, 0.6 % volatile oil and 3.2 % foreign matter. During the separation of various products from the complex mixture, the biologically important active principles of C21 or C27 steroids are found in neutral fraction. These are guggulsterol-I, guggulsterol-II, guggulsterol-III, guggulsterol-IV, guggulsterol-V, E-guggulsterone, Z-guggulsterone and some defense related secretory ketones (KUMAR & DEV 1987). Clinical analysis revealed that the isomers E- and Z-guggulsterone [cis- and trans-4, 17(20)-pregnadiene-3, 16-dione] are responsible for the hypolipidemic activity of gum guggul (GHORAI et al. 2000, URIZAR & MOORE 2003, WANG et al. 2004). In addition to the hypolipidemic effect, gum guggul has been reported to have beneficial effects on inflammation (KIMURA et al. 2001), atherosclerosis (LATA et al. 1991), ischemic heart disease (CHANDER et al. 2003), thrombosis (OLAJIDE 1999), nodulocystic acne (THAPPA & DOGRA 1994) and thyroid disorders (PANDA & KAR 1999). Currently several formulations of guggul gum are available in the markets.

Generally the oleo gum resin of the plant is collected by the tribal people using the traditional methods i.e. they give several deep incisions on the stem to get maximum amount of the guggul gum. Further, they apply a paste around the incision consisting of horse or wild ass urine, oleo gum resin and copper sulphate. This crude method increases the amount of guggul gum three to four times over that obtained under normal tapping procedures, but the shrub becomes unfit for tapping after the next couple of years and ultimately dies due to the injurious effect of copper sulphate (KSHE-TRAPAL & SHARMA 1993). It is now believed that unscientific tapping methods to increase yield of oleo gum resin cause mortality of plants leading to the extinction-danger of the species. BHATT et al. (1989) developed an improved tapping technique, which involves the use of a so-called ‘mitchie golledge’ knife coupled with ethephon (2 chloroethylphosphonic acid, an ethylene releasing synthetic chemical). The application of ethephon on the cuts enhances guggul gum production several times over that obtained in control. But in the long run excessive production through this technique, too, exhausts and kills the plant.

Commiphora wightii has become endangered because of its slow growing nature, poor seed setting, lack of cultivation, poor seed germination rate and excessive and

unscientific tapping for its gum resin by the pharmaceutical industries and religious purposes (BHATT et al. 1989). The demand supply gap of gum guggul is increasing very fast. According to an estimate, the domestic demand of gum guggul is to the tune of 300 tonnes, while the supply is only 75 tonnes. To meet the domestic demand, presently India is importing substantial quantities of guggul. In Gujarat, which is the major supplier of gum guggul in our country, the present collection is not sufficient to meet the annual demand of 100 tonnes by the pharmacies in the state. This may be viewed from the background that about 25 years back, production/collection of guggul in the state was to the tune of 500 tones (National Bank for Agriculture and Rural Development, s. dat.). As a result of increasing exploitation, on 30 March 1994 the Ministry of Environment and Forest, Government of India has banned the export of this high valued medicinal plant species (SHANKAR & MAJUMDAR s. dat.). Presently some research institutes in India i.e. the Central Institute of Medicinal and Aromatic Plants (CIMAP) Lucknow, the Central Drug Research Institute (CDRI) Lucknow, the Central Arid Zone Research Institute (CAZRI) Jodhpur are carrying out research on *Commiphora wightii* mostly related to the conservation of genetic resources and development of superior oleo gum strains.

To identify high guggulsterone yielding ecotypes we analysed the oleo gum resins collected from *Commiphora wightii* plants growing wild at twelve different geographical locations of Rajasthan state, India. Wide variations ranging from 0.60 % to 2.85 % were observed in guggulsterone contents. An interesting relationship between the guggulsterone yield data and rainfall was also observed in the present investigations. Higher yield of guggulsterone (>1.66 %) was found in the area having rainfall between 40-50 cm/year, while low guggulsterone contents were recorded in the plants growing in very high (50-90 cm/year) or low (10-40 cm/year) rainfall area. However, the lowest guggulsterone contents were recorded in the plants growing under highest rain fed area. Identification of high guggulsterone yielding ecotypes of guggul plants has paved the way for multiplication and mass propagation through tissue culture and vegetative propagation methods as well as selection of suitable geographical locality for large-scale cultivation of this high valued medicinal plant.

We developed an in vitro method for the propagation of this endangered medicinal plant species through the plant tissue culture techniques. In order to screen higher guggulsterone yielding plants of *Commiphora wightii*, oleo gum resin samples were collected from 56 plants growing naturally at 12 different geographical locations of Rajasthan. On the basis of phytochemical analysis plants having higher yield were multiplied vegetatively in the research nursery at the Birla Institute of Scientific

Research, Jaipur and were used as a source of explants for all morphogenetic work.

Guggul seeds are polyembryonic in nature (GUPTA et al. 1996, PRAKASH et al. 2000). We found that embryo culture is a rapid method for in vitro mass propagation of *Commiphora wightii* as compared to shoot tip and nodal explant culture. Due to presence of polyembryony, 2-4 plants can rapidly propagate through one seed. The embryo possessed natural dormancy that could be broken only using appropriate hormonal regime.

Besides vegetative multiplication and embryo culture, we isolated the guggulsterone contents from the aerial stems of *Commiphora wightii* plants. Though the amount of guggulsterone contents recorded was very low in the aerial stems as compared to the oleo gum resin, the yield can be enhanced using elite plant propagation method coupled with improvised extraction technique.



Figure 2. Exudation of oleo gum resin from woody stem of *Commiphora wightii* (Photo: RAJKUMAR, April 2003).

The study concluded that this highly valued medicinal plant species can be conserved through in vitro and in vivo mass propagation methods and the guggulsterone contents can be isolated from the aerial branches of the plant thereby saving the entire plant.

References

- ATAL, C.K., GUPTA, O. P. & S.H. AFAQ (1975): *Commiphora wightii*: source of guggul in Indian system of medicine. – *Economic Botany* 29: 208-218.
- BHATT, J.R., NAIR, M.N.B. & H.Y. MOHAN RAM (1989): Enhancement of oleo-gum resin production in *Commiphora wightii* by improved tapping technique. – *Current Science* 58(7): 349-357.
- CHANDER, R., RIZVI, F., KHANNA, A.K. & R. PRATAP (2003): Cardioprotective activity of synthetic guggulsterone (E- and Z-isomers) in isoproterenol induced myocardial ischemia in rats: a comparative study. – *Indian Journal of Clinical Biochemistry* 18(2): 71-79.
- GHORAI, M., MANDAL, S.C., PAL, M., PAL, S. P. & B.P. SAHA (2000): A comparative study on hypocholesterolaemic effect of allicin, whole germinated seeds of bengal gram and guggulipid of gum gugglu. – *Phytotherapy Research* 14: 200-202.
- GUPTA, P., SHIVANNA, K.R. & H.Y. MOHAN RAM (1996): Apomixis and polyembryony in guggul plant, *Commiphora wightii*. – *Annals of Botany* 78: 67-72.
- KIMURA, I., YOSHIKAWA, M., KOBAYASHI, S., SUGIHARA, Y., SUZUKI, M., OOMINAMI, H., MURAKAMI, T., MATSUDA, H. & V.V. DOIPHODE (2001): New triterpenes, myrrhanol-A and myrrhanone-A, from guggul-gum resins, and their potent anti-inflammatory effect on adjuvant-induced air-pouch granuloma of mice. – *Bioorganic & Medicinal Chemistry Letters* 11(8): 985-9.
- KSHETRAPAL, S. & R. SHARMA (1993): Studies on the effect various plant extracts on the sprouting behaviour of cuttings of *Commiphora wightii* (Arnott) Bhandari and *C. agallocha* Engl. – *Journal of Indian Botanical Society* 72: 73-75.
- KUMAR, V. & S. DEV (1987): Chemistry of Ayurvedic crude drugs-V11: Guggulu-6 absolute stereochemistry of guggulsterols. – *Tetrahedron* 43: 5933-5948.
- LATA, S., K.K. SAXENA, V. BHASIN, R.S. SAXENA, A. KUMAR & V.K. SRIVASTAVA (1991): Beneficial effects of *Allium sativum*, *Allium cepa* and *Commiphora mukul* on experimental hyperlipidemia and atherosclerosis - a comparative evaluation. – *Journal of Postgraduate Medicine* 37: 132-135.
- National Bank for Agriculture And Rural Development (s. dat.): Indian Bdellium – promising medicinal plant for wastelands of dry. Retrieved on 22 May 2003 from www.nabard.org/whats/guggul.htm (viewed 23.5.2006).
- OLAJIDE, O. A. (1999): Investigation of the effects of selected medicinal plants of experimental thrombosis. – *Phytotherapy Research* 13(3): 231-232.
- PRAKASH, J., KASERA, P.K. & D.D. CHAWAN (2000): A report on polyembryony in *Commiphora wightii* from Thar desert, India. – *Current Science* 78(10): 1185-1187.
- PANDA, S. & A. KAR (1999): Guggulu (*Commiphora mukul*) induces triiodothyronine production: possible involvement of lipid peroxidation. – *Life Sciences* 65(12): 137-141.
- SATYAVATI, G.V. (1988): Gum guggul (*Commiphora mukul*) – the success story of an ancient insight leading to a modern discovery. – *Indian Journal of Medical Research* 87: 327-335.
- SHANKAR, D. & B. MAJUMDAR (s.dat.): Beyond the biodiversity convention: the challenges facing the biocultural heritage of India's medicinal plants. Retrieved on 18 March 2005 from www.fao.org/documents/show_cdr.asp?url_file=/docrep/W7261E/W7261e11.htm.
- THAPPA, D.M. & J. DOGRA (1994): Nodulocystic acne: oral guggulipid versus tetracycline. – *Journal of Dermatology* 21: 729-731.
- URIZAR, N. L. & D.D. MOORE (2003): Guggulipid: a natural cholesterol lowering agent. – *Annual Reviews of Nutrition* 23: 303-313.
- WANG, X., GREILBERGER, J., LEDINSKI, G., KAGER, G., PAIGEN, B. & G. JÜRGENS (2004): The hypolipidemic natural product *Commiphora mukul* and its component guggulsterone inhibit oxidative modification of LDL. – *Atherosclerosis* 172 (2): 239-246.
- Vineet Soni • Department of Botany and Biotechnology • Mahatma Gandhi Institute of Applied Sciences • Shri Ram Ki Nangal, EPIP Gate, Sitapura • Jaipur, Rajasthan - 303905 • India • Tel.: ++91/9829009377 • E-mail: vineetuor@rediffmail.com.
- P. L. Swankar • Department of Botany • University of Rajasthan • Jaipur, Rajasthan - 302001 • India • E-mail plswarnkar@rediffmail.com.

Podophyllum hexandrum and its conservation status in India

Niranjan Chandra Shah

Introduction

In recent times, the rhizomes and roots of *Podophyllum* species have gained much importance throughout the world as being the main source or the starting material for the alkaloid podophyllotoxin and its semi-synthetic compounds, the etoposide, teniposide, and etoposide phosphate used in treatment of specific types of cancers.

In USA Bristol Co. and in Switzerland Sandoz prepared hundreds of semi synthetic compounds. Out of these only above three are widely used as anti-tumor agent with minimal toxic or side effects. These compounds are useful in the treatment of refractory testicular carcinomas, non lymphocytic leukemias and non-hodgkins lymphomas and etoposide in the treatment of lung cancer in addition to its therapeutic value against the AIDS associated Kaposi Sarcoma. Podophyllotoxin is also the precursor to a new derivative CPH 82 that is being tested for rheumatoid arthritis in Europe, and to other derivatives used for the treatment of psoriasis and malaria (BLASKO & CORDELL 1988 and MORAES et al. 2001).

Two species of *Podophyllum*, viz. the American *Podophyllum* or Mayapple (*P. peltatum*), the New World species, and the Himalayan *Podophyllum*, *P. hexandrum* (syn. *P. emodi*), are the main sources. In early days, the

rhizome of *P. peltatum* was used by the Penobscot American Indian as a purgative, in stomach problems and to stimulate salivation. Not only this, it became an official drug of United States and British Pharmacopoeias and was also used considerably in European countries, the supply of which was met by import from USA and Canada. When the Britishers arrived in India and were well established during the nineteenth century, their physicians also used the American Podophyllum for treatment, and the drug was also imported into India. Later, they came to know about the Himalayan species *P. hexandrum*, which was found to be a very good substitute of the American Podophyllum.



Figure 1. *Podophyllum* colony, Bhuna (Dist. Chamoli), Uttaranchal, height asl about 3,200 m (Photo: N.C. SHAH, 1988).

In 1942, podophyllin, a mixture of podophyllum resin and podophyllotoxin was eventually introduced as a topical remedy for cancerous growth in the USA, and later podophyllotoxin was discovered and extracted from the rhizomes for the use of cancerous growth. At that time, M/S Sandoz brought the product on the market, and there was a good demand for the product. It was already well known that *P. hexandrum*, a good substitute of the May Apple or American Podophyllum, was abundantly available in the Himalayas in the wild. Thereafter, *Podophyllum hexandrum* was intensely used by the British physicians in India for medical treatment. It was collected from the Himalayan region and also exported to England for medical treatment, which probably led to over-exploitation soon and after half a century or so to extreme depletion.

Description

Morphology: An erect, un-branched tall herb with a somewhat fleshy and smooth stem, 35-60 cm high. Mostly found in aggregation, which gives the plant a shrubby look. Leaves usually palmate, peltate deeply 3-5 lobed, the sharply toothed lobes encircle the large solitary flower or fruit (figure 1). Flowers white or pink.

Fruit a berry, 2.5-5 cm, oblong ovoid or oblong-ellipsoid, scarlet or red when ripe and many seeded. Rhizome fleshy, short, horizontally creeping with long dense fibrous roots, the underground part is known as rhizomatous root (figure 2). Each node has the tendency to develop into a new plant offshoot.



Figure 2. Uprooted root-rhizome of *Podophyllum*, which yields the podophyllum resin, from which podophyllotoxin is extracted for the manufacture of etoposides to be used in treatment of cancer (Photo: N.C. SHAH, 1988).

SOEJARTO et al. (1981) have correctly typified the taxon as described under *Podophyllum hexandrum* Royle syn. *P. emodi* Wallich ex Honigsberger syn. *P. emodi* var. *hexandrum* (Royle) Chatterjee (Podophyllaceae).

Common names: nirbishi, papra, bhavan bakra, banwangan (Kashmiri); ban kakri, kakariya (Himachali, Kumaoni & Garhwali); ghi-cupra (Bhotias in Uttaranchal), Indian or Himalayan Podophyllum, Himalayan Mayapple or Indian Mayapple (Common English and trade names).

'Nirbishi' means non poisonous; 'papra' means which corrects the liver functions; 'ban kakri ban' means forest and 'kakri' is cucumber because the fruit when ripe smells like a cucumber, hence called 'the forest cucumber'. 'Kakariya' is cucumber; the ripe berry pulp is greasy like 'ghi' or clarified butter so called 'ghi-cupra'.

Ecoprofile and phenology

Podophyllum hexandrum is found at a level of 2800-3000 m in the Indian Himalayas, in the wet alpine zones, in humus rich and shaded localities or near stream banks as an under growth and also in open wet alpine meadows along with other herbs. The diversity of the genus *Podophyllum* and its distribution in the Kumaon region have been dealt in detail by Airi et al. (1997), and it has been found that the species performs best in the specific habitats, i. e., Quercus-Abies association in lower altitude and in acidic soils. In the Himalayas it flowers from July to August and fruits from September to October.

Distribution

The species is found in most of the Himalayan countries like Afghanistan, Pakistan, India, Nepal, Bhutan, and in S. W. China. In India, it is distributed in all the Himalayan states like Jammu & Kashmir, Himachal Pradesh, Uttaranchal, and Sikkim. To record its distribution the following publications were consulted: NAYAR & CHOPRA (1951), UNIYAL (1977), KUMAR et al. (1997). In the above publications localities have been noted by the authors from the main herbaria of the country mainly BSI, Calcutta & Dehradun, and FRI Dehradun.

Jammu & Kashmir – Daitwas forest; Gilgit Gulmarg (2,700-3,000 m); Jagran river bank between Kundi & Shikar (3,000-3,600 m) Kishenganga valley; Kanasar, Jhelum basin (2,400-2,700 m); Khelan marg (2,700-3,000 m); Lidwas; Muzafarabad range forest (2,400 m); Sind Valley; Tanmarg forest (2,200-2,600 m); Zaskar (3,500 m); Mechigaon, Zozila pass (3,500 m). Trumba, Dagoum, Chandanwadi, Seshnag, Kargil, Pissughile, Pahalgam, Tanmarga.

Himachal Pradesh – Chamba, Chulkot forest (3,000 m), Killar, Pangi, Kilar pass and Pangi, Sach valley and Pass (Chamba); Pulga, Haranghati pass (3,600 m), Pandra bis (2,400 m) (Bashar); Kala Tope forest (2,438 m), Keylong, Kulu, Lahul, Pulga (2,400 m) (Kangra); Matian, in Shali hills, Narkunda, Dencho, Sissoo, Koksar, Dalhousie, (Simla).

Uttaranchal – Deoban (2700 m), Kanjatra (2,600 m), Konain (Dt. Dehra Dun); Rudgaria Gar (4,000-4,300 m), Bhillangana, Panwali (Dt. Tehri); Jamnotri, Jamuna chat-ti, Barkot (in Yamuna valley), Dodital, Gaumukh, Kedar Kanta (3,000-3,300 m) (Uttarkashi); Dasoli, Mundali (2,300 m), Bhyander, Hemkund (Dt. Chamoli); Madhya Maheshwar, Tunganath (Dt. Rudraprayag); Pindari glacier (Almora); Kuti, Yankti river valley (3,700-4,000 m), Bogudiar (2,400 m) (Pithoragarh). The author recorded its presence in the abandoned Bhuna nursery of the U. P. forest Dept. at 3,000 m in dist. Chamoli, which was established for cultivation of *Saussurea costus* (Kuth) and other medicinal plants in the year 1929.

Sikkim – Chamnaga (3,600 m), Thangu, Tsomgo, Chana, Thangu (3000-4200 m).

Uses of resin during the British period in India

When the British physicians arrived in India in the nineteenth century they had the knowledge of the use of American Podophyllum as a cathartic or purgative to be used in stomach troubles, etc. Earlier, they used to import the resin of American Podophyllum for the British officials to be used for medical treatment. Later, they came across the existence of the Indian species of *Podophyllum*, i. e. *P. hexandrum* in the Himalayas. However, Dr. Watt (1889-96) carried out investigations on the

Himalayan Podophyllum and claimed that it is a very good substitute of American Podophyllum and contains resin three times higher. The British physicians like Dymock & Hooper in 1889, Umney in 1892 and many others used it as the substitute of American Podophyllum, as follows; *P. hexandrum* from Kulu (Himachal Pradesh [H.P.]) podophyllotoxin 2.8 % and resin 9.55 %; Bashar (H.P.) podophyllotoxin 3.5 % and resin 9 %; Chamba (H.P.) podophyllotoxin 4.7 % and resin 11.2 %; Hazra (H.P.) podophyllotoxin 2.9 % (resin no data). In comparison in *P. peltatum* podophyllotoxin found was 0.77 % and 0.3 % and resin 5.2 % and 4.1 %, respectively (CHOPRA et al. 1958).

During those days, the drug was collected in large quantities from wild sources from the North West Frontiers Provinces in the Himalayas, which included a part of present Pakistan and Indian Kashmir and a part of Afghanistan. And possibly its resin or rhizome was exported to England and other countries to be used as the substitute of American Podophyllum.

Adulterant

The rhizomes in trade are also adulterated with the rhizome of wild growing *Ainsliaea latifolia* (Asteraceae) in Himachal Pradesh (PURI & JAIN 1988).

Production and turnover of the resources

American Podophyllum is mostly found in the eastern U.S. and east of Oklahoma and in the Canadian woodlands, part of Quebec in Canada. Once these were the main original supplies for raw material to be used as podophyllum resin and later for extraction of podophyllotoxin. The leading companies, who were mainly concerned with production, manufacture and distribution of podophyllotoxin, etoposide and teniposide are M/S R.P. Scherer GmbH & Co. KG, Eberbach/ Baden, Germany and Bristol-Myers Squibb Company, Princeton, New Jersey, USA.

M/S Sandoz Co. Ltd. licensed for production of both the compounds, etoposide and teniposide, which is marketed under the brand name VePesid (VP-16) and which had peak annual sales of \$300 million per annum.

Podophyllotoxin, etoposide and teniposide are mostly manufactured and produced in Switzerland, USA and Japan. However, the Chinese pharmaceutical companies are also main suppliers of these preparations in bulk quantities. An Indian company – CIPLA Ltd, Bombay – had also started producing etoposide on a commercial scale, from the technology developed by the Indian Institute of Chemical Technology (IICT), Hyderabad, for converting the semi-synthetic compound from podophyllotoxin (ANONYMOUS 1989) but the present status is not known.

However, it is stated by MORAES et al. (2001) that currently the commercial source of podophyllotoxin are the rhizomes and roots of *Podophyllum emodi* Wall. syn. *P. hexandrum* Royle, an endangered species from the Himalayas.

Presently it is recorded that the following pharmaceutical companies in India supply in bulk Podophylline (the resin with podophyllotoxin) (ANONYMOUS 2005): M/S Aswin Drugs & Pharmaceutical Ltd. Chennai; M/S Hindustan Pharmaceuticals, Amritsar and M/S Bactochem Laboratories, Hyderabad.

Efforts for conservation in the past

During the British period the collection of the crude drug from the wild was continued and the wild resources dwindled very fast. For the first time in 1907-08 and again in 1910, an attempt was made by the Imperial Forest Economist to cultivate this crop under experimental scale at Deoban in Chakrata (Uttaranchal). It was concluded that the rhizome matures after 5 to 6 years and further noted that it is a saprophytic plant (notes taken from Reference Files FRI, Dehradun Minor Forest Office by the author). In 1913 it was cultivated in Hazara in the North West Frontiers Provinces and at Bashar in Panjab (now in Himachal Pradesh), but this was also abandoned (CHOPRA et al. 1958).

The final blow

Earlier, during the mid fifties the Drug Research Laboratory of Jammu & Kashmir State also processed the rhizome and roots of the drug collected from wild sources for podophyllum resin of British Pharmacopoeial standard and was exported. At that time the use of resin in cancerous growth also began.

The crude drug had already been under continued collection from wild sources for quite a long time. It was under depletion to a very large extent and the final blow came during the sixties, when M/S Sandoz Co. Ltd. started the production of podophyllotoxin from American *Podophyllum*. Later they also switched over to India for raw material obtained from the Himalayan *Podophyllum*, which was further uprooted from the Himalayan region. When it was realized that it was depleted to a great extent M/S Sandoz conducted a survey to collect the planting material and to locate a suitable location for its cultivation. During 1962-63, they tried to cultivate the plant on commercial scale at Ghesh (3,500 m) near Mt. Trisul in district Chamoli of Uttaranchal (then Uttar Pradesh) but due to unknown reasons, possibly the economics, the cultivation was abandoned (SHAH & YADAVA 1967 and SHAH 1970). However, since then no serious efforts have been made for its cultivation and the material is still being collected clandestinely from wild resources.

Conservation aspects

For the first time it was cautioned that in the Uttar Pradesh (U.P.) Himalayas (Uttaranchal) the Himalayan *Podophyllum*, *P. hexandrum* was being exterminated due to ruthless collection and due to indiscriminate exploitation (SHAH & KAPOOR 1978). In 1983, HUSAIN reported that the species is being exploited by the forest contractors mainly from the three Indian Himalayan states for the purpose of export to the European countries. Again SHAH (1997b, 1998 and 1999) emphasized that *P. hexandrum* was much depleted in the Indian Himalayas and suggested for its systematic cultivation. An assessment was also made in respect of its threat and trade information on *Podophyllum hexandrum* as Critical (ZOOS' PRINT 1998).

Ban on collection: In the year 1985, a committee of experts was constituted by the Forest Department of Govt. of U.P., and the author was the Coordinator of the Committee. The committee recommended the ban of 34 species for collection and marketing from Uttaranchal. *Podophyllum hexandrum* was one of the listed species. Under the trade names "Podophyllum" and "Bankakri" it was banned from all the Himalayan districts of Uttaranchal for a period of four years vide State Govt. Order no. 535/1-9-20 dated Jan 1986. This was the first serious step undertaken by any government for conservation – not only for *Podophyllum* but also for other species, which were under threat in Uttaranchal.

Ban on export: In the year 1994 the Govt. of India Ministry of Commerce vide their circular Public Notice No. 47(PN)/92-97 (www.envfor.nic.in/legis/wildlife/wildlife9.html, viewed 6.7.2006) dated 30 March 1994 prohibited the export of 56 plant species. One item in the list was *Podophyllum hexandrum* and its derivatives and extracts. The list was further amended vide Notification no. 24(RE-98)/1997-2002 (dgftcom.nic.in/exim/2000/not/not98/not2498.htm, viewed 6.7.2006). In this list only 29 plant species were prohibited for export and *Podophyllum hexandrum* was again included. It was the right step taken, but too late as already the banned species were being exported under faulty export policies (SHAH 1997a).

In 2004 the Government of Uttaranchal published a list of protected and banned medicinal plants (vide Government Orders no. 761/van.gra.vi./2004, dated 15 December 2004, and 2882/thus-22004-9(4)/2001, dated 27 December 2004), in which however, *Podophyllum hexandrum* was not included.

In a recent proposal the Forest Department, Uttaranchal recommended the inclusion of this species in the list mentioned above, which hopefully will be implemented soon to ensure the survival of the species in nature.

Still some of the companies in India are trading Podophylline, a mixture of resin and podophyllotoxin (ANON. 2005).

Discussion

Cultivation aspects: In the late nineteenth century, *Podophyllum peltatum* was one of the most important botanical drugs of America and earlier, annual production was stated to be several hundred tons for meeting the domestic and export demands. In present times it is not very clear, if *P. peltatum* or *P. hexandrum* (imported from India, Bhutan, Nepal, and western China) are being used in the production of the semi-synthetic therapeutic chemicals etoposide, teniposide, etc. Additionally, nothing is known if they are supplied in extract or semi-processed form.

However, Himalayan Podophyllum contains less or no α -peltatins making the process of isolation of Podophyllotoxin simpler than that from American podophyllum (*P. peltatum*). Thus it is preferred much by the pharmaceutical industries to obtain podophyllotoxin for producing the semi synthetic anti-cancer drugs etiposide and teniposide.

In view of its commercial importance and demand in USA and other countries cultivation in large scale would be a wise step at suitable places in the Himalayan countries. This would not only help the plant from depletion but also stimulate the economy of the poor people of the Himalayan countries. As an example, *P. hexandrum* and *Aconitum heterophyllum*, which are in good demand, have been cultivated ex situ in a sub-alpine garden at Kyongnosla Sikkim (Prasad 2000).

Leaf biomass as a new source: In India, it has already been found that the leaf contains 7.83-9.7% resin, which contains an essential oil and also podophyllotoxin, picro-podophyllin and quercetin (CHOPRA et al. 1969). Thus similar efforts should be taken to present *Podophyllum hexandrum* leaves as a new source of raw material for the manufacture of semi-synthetic anti-cancer medicines, if the leaf biomass should be containing a reasonable percentage of podophyllotoxin (MORAES et al. 2001).

References

AIRI, S., RAWAL, R.S., DHAR, U. & PUROHIT, A.N. (1997): Population studies on *Podophyllum hexandrum* Royle – A dwindling, medicinal plant of Himalaya. – Plant Genetic Resources Newsletter 110: 29-34.

ANON. (1989): *Podophyllum & Picrorhiza kurroa*. – CSIR News 39: 237-238.

ANON. (2005): The Comprehensive directory on the Indian Pharmaceutical and allied Industry. The Indian Pharma Search 2005 (5th edition). – Express Pharma Pulse, Mumbai.

BLASKO, G. & CORDELL, G.A. (1988): Recent developments in the chemistry of plant derived anticancer agents. – In: Economic and Medicinal Plant Research 2: 119-182.

CHOPRA, R.N., CHOPRA, I.C., HANDA, K.L. & KAPUR, L.D. (1958): Chopra's Indigenous Drugs of India (Second Edn). – pp. 227-228, UN Dhar and Sons (p) Ltd., Calcutta.

HUSAIN AKHTAR (1983): Conservation of Genetic resources of medicinal plants in India. – In: JAIN, S.K. & MEHRA, K.L. (Eds.): Conservation of Tropical plant resources. Proceedings of the Regional Workshop on Conservation of Tropical Plant Resources in South-East Asia, New Delhi, March 8-12, 1982. pp. 110-117, Botanical Survey of India Department of Environment Govt. of India Howrah.

KUMAR, S., SINGH, J., SHAH, N.C. & RANJAN, V. (1997): Indian Medicinal Plants Facing Genetic Erosion. – 205 pp., Central Institute of Medicinal & Aromatic Plants, Lucknow, CSIR.

MORAES, R.M., LATA, H., BEDIR, E., MAQBOOL, M. & CUSHMAN, K. (2001): The American Mayapple and its potential for podophyllotoxin production. – In: JANICK, J. (Ed): Trends in New Crops and New Uses. pp. 527-532. ASHS Press, Alexandria, VA.

NAYAR, S.L. & CHOPRA, I.C. (1951): Distribution of British pharmacopoeial drug plants and their substitutes growing in India. – 56 pp., Pharmaceutical and Drugs Research Committee, Council of Scientific & Industrial Research, New Delhi.

PRASAD P. (2000): Impact of cultivation on active constituents of the medicinal plants *Podophyllum hexandrum* and *Aconitum heterophyllum* in Sikkim. – Plant Genetic Resources Newsletter 124: 33-35.

PURI, H.S. & JAIN, S.P. (1988): *Ainsliaea latifolia*: An adulterant of Indian Podophyllum. – Planta Medica 54: 269.

SHAH, N.C. (1970): Special crop in Kumaon and Uttarakhand. – Indian Drugs Pharmaceutical Ind. 2: 1-5.

SHAH, N.C. (1997a): Faulty export policy of herbs and crude drugs in India. – Medicinal Plant Conservation 4: 4-5.

SHAH, N.C. (1997b): Conservation of wild medicinal plants: need for a comprehensive strategy. – Kurukshetra XLVI(3): 15-18

SHAH, N.C. (1998): The Status of medicinal plants in the Indian Himalayas. – Workshop on "Himalayan Medicinal Plants" held at G. B. Pant Institute of Himalayan Environment & Development, Katarmal, Kosi (Almora).

SHAH, N.C. (1999): Present status constraints and future strategy of medicinal & aromatic plants in Kumaon Himalaya. – National Seminar on "Drugs from Himalayan Herbs: Present status and Future Strategies" held at Dept. of Chemistry, Kumaon University, Nainital U. P. from 25th -28th March.

SHAH, N.C. & KAPOOR, L.D. (1978): Depletive medicinal plants of Kumaon Himalayas. – Jour. Res. Ind. Med. Yoga & Homoeo 13(3): 38-43.

SHAH, N.C. & YADAVA, B. B. L. (1967). Cultivation of Medicinal Plants in Kumaon. – Indian Drugs 6(1): 11-14.

SOEJARTO, D.D., GREENWOOD, B.D., LAUENER, L.A. & FARNSWORTH, N.R. (1981): Typification of *Podophyllum hexandrum* Royle. – Taxon. 30: 652-655.

UNIYAL, M.R. (1977): Uttarakhand Vanaushdh Darshika. – Pub. Indian system of Medicine and Homeopathy, New Delhi. (In Hindi)

WATT, G. (1889-93): A Dictionary of the economic products of India. Vol. 6. – W.H. Allen & Co., London.

ZOOS' PRINT (1998): Report Biodiversity Conservation Prioritisation Project (BCPP) Endangered Species Project vol. XIII(6). – pp. 5 & 22-23.

Dr. N. C. Shah • Coordinator • Centre for Indigenous Knowledge of Indian Herbal Resources (CIKIHR), MS-78 • Sector- "D", Aliganj • Lucknow - 226 024 • India • E-mail: ncshah@sancharnet.in.

***Nepeta binaludensis*, a highly endangered medicinal plant of Iran**

Farsad Nadjafi

Nepeta is a genus of perennial or annual herbs which is found in Asia, Europe and North Africa. About 250 species of *Nepeta* are reported worldwide (MABBERLEY 1997). *Nepeta* species are still used in the traditional medicine of many countries as diuretic, diaphoretic, vulnerary, antitussive, antispasmodic, anti-asthma, tonic, febrifuge, emmenagogue and sedative agents (TZAKOU et al. 2000, ZARGARI 1990, RAPISADRA et al. 2001). The genus *Nepeta* with the common Persian name Pune-sa includes 67 species that are found all over Iran, many of them endemic (MOZAFFARIAN 1996). Some Iranian *Nepeta* species have been of great interest as Iranian folk and traditional medicines are used in the treatment of various disorders, such as some nervous, respiratory and gastrointestinal diseases (ZARGARI 1990, AMIN 1991). *Nepeta* species which are frequently used as medicinal plants in Iran are: *Nepeta bracteata*, *N. ispanica*, *N. binaludensis*, *N. pogonosperma* and *N. pungens*. *N. crispata* also is used as culinary herb (Jamzad et al. 2003).

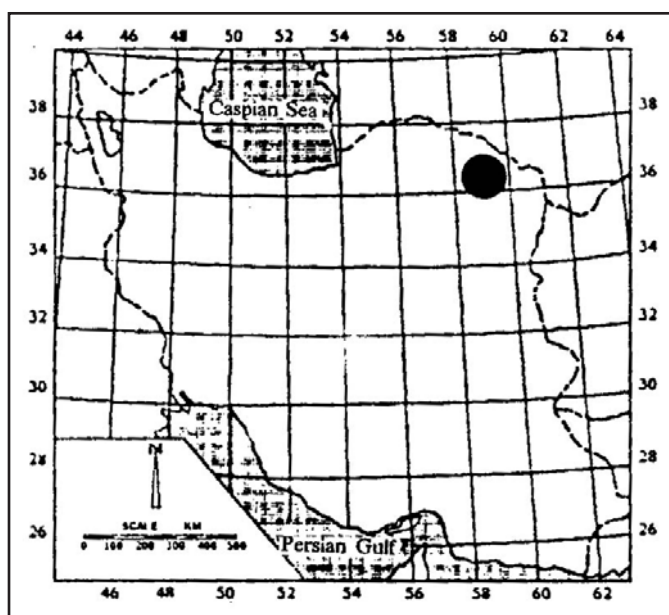


Figure 1. Distribution of *Nepeta binaludensis* (Lamiaceae) in Iran (GHAHREMAN & ATTAR 1999).

Nepeta binaludensis Jamzad is an endemic and rare perennial aromatic herb which is distributed in a limited area in the Binalud mountains in Northeast of Iran (figure 1) (GHAHREMAN 1999). This plant is widely used in traditional medicine of Khorasan province (with the common name Ostekhodus), northeast of Iran, as an antispasmodic, nervine, tonic, stimulant and diuretic. The species grows in habitats at altitudes of 2300-2700 m with an annual rainfall ranging from 350 to 370 mm and a mean annual temperature of 6 to 7 °C. The plant grows mainly in north-facing slopes up to 50 %, preferably on light soils with a neutral pH and poor in mineral content. The height of individual plants of this species is varying from 50-70 cm. Flowering starts mid of June and seeds mature in late July which extent to late August (NADJAFI 2006) (figure 2). Nepetalactone (25.2%) and 1,8 cineole (42.5%) were reported (RUSTAIYAN & NADJI 1999) as the major components of the oil of aerial parts of this plant. *Nepeta binaludensis* is a plant endemic to the Binalud Mountains of Iran and no provenances in other parts of the country or even the world have been reported (GHAHREMAN 1999). Over-utilization, habitats degradation and extension of dry land farming in the area have caused a severe negative impact on this species. *Nepeta binaludensis* has a sexual regeneration by seeds, so intensive harvesting of this species in flowering stage and before seed formation by local gatherers is probably the main factor that endangers this species (NADJAFI 2006). Collection of spontaneous plants is extremely problematical, if the reproductive organs (flowers, fruits, seeds) or the permanent organs (roots, rhizomes) are used and the geographic distribution is very restricted (FRANZ 1992, HARNISCHFEGER 2000). Therefore, a proper conservation strategy (including in-situ and ex-situ) seems to be necessary in order to save this rare plant. In this respect collection by local people should be monitored. Encroachment of cultivated practices should be kept in minimum level in order to preserve the natural habitats. Domestication under field condition with an



Figure 2. A. *Nepeta binaludensis* in wild habitat. (Photo: NADJAFI, 2005).

emphasis on low input and sustainable management could be another alternative. Attempts have been made to cultivate this species under field conditions and satisfying progress has been continued (Nadjafi 2006) (figure 2).

References

- AMIN, G.R. (1991): Popular Medicinal Plants of Iran. Vol. 1. – p. 40-41, Ministry of Health Publications, Tehran.
- FRANZ, C. (1992): Domestication of wild growing medicinal plants. – Plant Research and Development 37: 101-111.
- GHahreman, A. & ATTAR, F. (1999): Biodiversity of plant species in Iran. Vol. 1. – 1176 pp. Tehran University Publications, Tehran.
- HARNISCHFEGER, G. (2000): Proposed guidelines for commercial collection of medicinal plant material. – Journal of Herbs, Spices and Medicinal plants 7 (1): 43-50.
- JAMZAD, Z., GRAYER, R.J., KITE, G.C., SIMMONDS, M.S.J., INGROUNILLE, M. & JALLILI, A. (2003): Leaf surface flavonoids in Iranian species of *Nepeta* (Lamiaceae) and some related genera. – Biochemical Systematics and Ecology 31: 587-600.
- MABBERLEY, D.J. (1997): The plant-book. 2nd edition. – xvi+858 pp., University Press Cambridge.
- MOZAFFARIAN, V. (1996): A Dictionary of Iranian Plant Names. – 360 pp. Farhang Moaser, Tehran.
- NADJAFI, F. (2006): Evaluation of the ecological criteria of *Nepeta binaludensis* Jamzad for domestication under low input agroecosystems. – PhD Thesis of Agroecology, Faculty of Agriculture, Ferdowsi University of Mashhad, Iran.
- RAPISDARA, A., GALATI, E.M., TZAKOU, O., FLORES, M. & MICELI, N. (2001): *Nepeta sibthorpii* Benth (Lamiaceae). Micromorphological analysis of leaves and flowers. – II Pharmaco 56: 413-415.
- RUSTAIYAN, A. & NADJI, K. (1999): Composition of the essential oils of *Nepeta ispahanica* Boiss and *N. binaludensis* Jamzad from Iran. – Flavour and Fragrance Journal 14: 35-37.
- TZAKOU, O., HARVALA, C., GALATI, E.M. & SANOGO, R. (2000): Essential oil composition of *Nepeta argolica* Bory & Chaub. subsp. *argolica*. – Flavour and Fragrance Journal 15(2): 115-118.
- ZARGARI, A. (1990): Medicinal Plants. Vol. 4. – p. 106-111, Tehran University Publications.
- Farsad Nadjafi • Ferdowsi University of Mashhad, School of Agriculture • P.O. Box 91775-1163 • Mashhad • Iran • Tel: +98/511/8795612 • Fax: +98/511/8787430 • E-mail: fnadjafi@isrdmap.com.*

Conferences and Meetings

Coming up

Natalie Hofbauer

All websites viewed 7 November 2006.

☞ **Second International Agarwood Conference.** 4-11 March 2007, Bangkok, Thailand.

Contact: The Rainforest Project Foundation (TRP), Netherlands • Damrak 68 • 1012 LM Amsterdam • The Netherlands • Tel.: ++31/20/624-8508 • Fax: ++31/20/624-0588 • E-mail: trp@euronet.nl OR The Rainforest Project Foundation (TRP), Vietnam • 71 Lam Son • Tan Binh District • Ho Chi Minh City Vietnam • Tel.: ++84/8/848-7198 • Fax: ++84/8/848-7223 • E-mail: info@therainforestproject.net.

☞ **1. International Medicinal and Aromatic Plants Conference on Culinary Herbs.** 29 April-4 May 2007, Antalya, Turkey. Conveners: Prof. Dr. Ibrahim Baktir and Prof. Dr. Kenan Turgut, Akdeniz University, Turkey.

Contact: Prof. Dr. Ahmet Naci Onus • Akdeniz University • Turkey • Tel.: ++90/242/3102441 • Fax: ++90/242/2274564 • E-mail: onus@akdeniz.edu.tr • Website: www.mapc2007ant.org/.

☞ **1st International Biodiversity Congress: Working Together for Livelihood Security, Food Security and Ecological Security for Life on Earth.** 22-25 May 2007, Bangkok, Thailand.

Contact: Ram Bhandari, E-mail: hirinepal@mail.com.np OR ibc2007@yahoo.com.

☞ **14th meeting of the Conference of the Parties to CITES.** 3-15 June 2007, The Hague, The Netherlands.

Contact: CITES Secretariat • International Environment House • Chemin des Anémones • 1219 Châtelaine, Geneva • Switzerland • Tel.: ++41/22/917-8139/40 • Fax: ++41/22/797-3417 • Email: info@cites.org.

☞ **The First Regional Scientific Conference on Traditional Arabic and Islamic Medicine.** 8-10 August 2007, Amman, Jordan.

Contact: Ms. Razan A. Zuayter • APN • P.O. Box 811815 • Amman 11181 • Jordan • Tel.: ++962/6/5673331 • Fax: ++962/6/5699777 • E-mail: agpnature@go.com.jo OR medplantamman@gmail.com • Website: www.arabic-islamic-medicine.com/.

☞ **5th Planta Europa Conference on the Conservation of Wild Plants in Europe.** 5-9 September 2007, Cluj-Napoca, Romania.

Contact: Trima Events SRL • Iuliu Maniu Blvd 7 • sector 6, Bucharest • Romania • Tel./Fax: ++40/21/316-9981, -1017, -3830, -3070 • E-mail: events@trima.ro.

Table 1. Medicinal plant species under the Significant Trade process (see www.cites.org/eng/com/PC/16/E-PC16-WG01-Doc01.pdf)

Taxon	Stage	Category	Action
<i>Aloe ferox</i>	1	Excluded	None
<i>Nardostachys grandiflora</i>	1	Excluded	None
<i>Pterocarpus santalinus</i>	1	Included: India	Review to be drafted
<i>Rauvolfia serpentina</i>	1	Included: India, Myanmar, Thailand	
<i>Taxus wallichiana</i>	1	Included: India	
<i>Prunus africana</i>	2	Urgent concern: Burundi, Cameroon, Dem. Rep Congo, Equ. Guinea, Kenya, Madagascar, Tanzania	Decision on recommendations taken
<i>Cibotium barometz</i>	2	Possible concern: Viet Nam	
<i>Dendrobium nobile</i>	2	Viet Nam: Urgent concern Laos: Possible concern Indonesia: Least concern	

CITES News

Uwe Schippmann

Plants Committee

The 16th meeting of the CITES Plants Committee (PC16) was held 3-8 July 2006 in Lima (Peru). It discussed a number of issues related to medicinal plants. Most of these issues have already been introduced under this heading in issue 11 of MPC, please refer to this paper for background information.

Significant Trade Reviews

Among many other species, the medicinal plant species in table 1 are in various stages of this important review process. For some of them, recommendations have been formulated, others are in earlier stages of the process. Decisions adopted by PC16 can be found at www.cites.org/eng/com/PC/16/E-PC16-WG01-Doc01.pdf.

Trade review of seven Asian CITES medicinal species

This topic relates to the BfN funded TRAFFIC review on the status, use, trade, and trade controls for seven of Asian medicinal plant species – *Cistanche deserticola*, *Dioscorea deltoidea*, *Nardostachys grandiflora*, *Picrorhiza kurrooa*, *Pterocarpus santalinus*, *Rauvolfia serpentina*, and *Taxus wallichiana*.

Based on earlier reports (www.cites.org/eng/com/PC/15/E-PC15-10-02-02.pdf), the German delegation has again tabled a series of recommendations for these species in the light of their poor implementation and enforcement under CITES (www.cites.org/eng/com/PC/16/E-PC16-10-05.pdf). The Plants Committee endorsed these implementation and enforcement recommendations presented and requested the Chairman of the Plants Committee to forward them to the Secretariat in accordance for further action.

Controlling trade in these species remains very difficult in the Himalayan region. The ongoing illegal trade between Nepal and India is of particular concern. The Committee agreed that in its report for the 14th meeting of the Conference of the Parties to CITES (CoP14), the PC Chairman should draw attention to ongoing problems with the effective implementation of the Convention for trade in CITES listed medicinal plant species, and the urgent need for a coordinated regional effort in Himalayan range States to improve the management of and trade in the seven species of medicinal plants discussed. Furthermore, this effort could include measures to combat illegal trade, regional capacity-building workshops, harmonization of regulations and legislation, etc.

Annotations of medicinal plants in Appendix II

This item, too, has made progress since last year. PC16 took decisions on several outstanding cases (*Hydrastis canadensis*, *Podophyllum hexandrum*) and finally agreed to all proposed changes to the annotations (www.cites.org/eng/com/PC/16/E-PC16-17-01.pdf). Consequently, the Plants Committee requested the Scientific Authority of Germany to draft, with editorial assistance of an intersessional working group, a proposal to amend the annotations for medicinal plant species on Appendices II and III. This will be submitted at CoP14 on behalf of the Plants Committee. It was also decided that a glossary of terms be included in the Interpretation of the Appendices after CoP14.

The 14th meeting of the Conference of the Parties to CITES will meet June 3-15, 2007 in The Hague (Netherlands).

All internet resources mentioned in the 'CITES News' have been viewed on 12.11.2006.

For author's address see list of members.

Lista de especies, nomenclatura y distribución en el género *Guaiacum*

Patricia Davila Aranda & Uwe Schippmann

Introducción

Este documento representa el primer esfuerzo por conjuntar la información disponible de tipo taxonómico - nomenclatural y de distribución del género *Guaiacum*, en el ámbito de la CITES. Para este fin se utilizaron diferentes fuentes de información que se señalan en el apartado final (Referencias). Es importante mencionar que la información vertida en este documento no representa una revisión taxonómica formal, sino una recopilación de los datos disponibles. Con base en esta información, se tendrá que realizar un estudio taxonómico formal que sirva como la lista de referencia de este género en la CITES.

Guaiacum L., Sp. Pl. 1: 381-382. 1753.

Typus: *Guaiacum officinale* L., Lectotype designated by VAIL & RYDBERG, N. Amer. Fl. 25: 105 (3 Jun 1910)

1. *Guaiacum angustifolium* ENGELM. in A. WISLIZENUS, Mem. Tour N. Mexic. 113. 1848.

Sinónimos: *Porliera angustifolia* ENGELM.

Distribución: Mexico, USA

2. *Guaiacum coulteri* A. GRAY, Mem. Amer. Acad. Arts, n.s. 5(2): 312. 1855.

Sinónimos:

Guaiacum palmeri VAIL, N. Amer. Fl. 25: 107. 1910.

Guaiacum parvifolium PLANCH. ex A. GRAY, Smithsonian Contr. Knowl. 3(5): 29. 1852.

Guaiacum planchonii A. GRAY, Proc. Amer. Acad. Arts 22: 306. 1887.

Distribución: Guatemala, México, USA (not indigenous)

3. *Guaiacum officinale* L., Sp. Pl. 1: 381-382. 1753.

Sinónimos: *Guaiacum bijugum* STOKES

Distribución: Antigua and Barbuda, Anguilla, Barbados, Bahamas, Colombia, Cuba, Dominica, Grenada, Guadeloupe, Haiti, Honduras, Islas Virgenes, Jamaica, Netherlands Antilles, Martinique, Montserrat, Panama, Puerto Rico, República Dominicana, Turks and Caicos Islands, Saint Vincent and the Grenadines, Venezuela

4. *Guaiacum sanctum* L., Sp. Pl. 1: 382. 1753.

Sinónimos:

Guaiacum guatemalense PLANCH. ex RYDB., N. Amer. Fl. 25(2): 106-107. 1910.

Guaiacum guatemalense PLANCH. ex HEMSL., Biol. Cent.-Amer., Bot. 1(2): 159. 1879.

Guaiacum multijugum STOKES

Guaiacum sloanei SHUTTLEW. ex A. GRAY, Smithsonian Contr. Knowl. 3(5): 29. 1852.

Guaiacum verticale ORTEGA, Nov. Pl. Descr. Dec. 8: 93. 1798.

Distribución: Bahamas, Belize, Cuba, Costa Rica, El Salvador, EUA, Guatemala, Haiti, Honduras, México, Nicaragua, Panama, República Dominicana, USA

Nota: *Guaiacum guatemalense* ha sido también ubicado como un híbrido entre *G. sanctum* y *G. coulteri* (PORTER 1972).

5. *Guaiacum unijugum* BRANDEGEE, Univ. Calif. Publ. Bot. 6(8): 183. 1915.

Distribución: México

Referencias

BLANK, P. & al. (2000): *Guaiacum sanctum*. Population status and trade in Mexico with CITES recommendations. University of Maryland. Unpublished report, s.loc.

ENCKE, F., BUCHHEIM, G. & SEYBOLD, S. (1993): Zander, Handwörterbuch der Pflanzennamen. 14th edition. Ulmer, Stuttgart.

GROW, S. & SCHWARTZMAN, E. (2001): *Guaiacum sanctum*. Document 8.2. of the 11th Meeting of the CITES Plants Committee.

MISSOURI BOTANICAL GARDEN (s.dat.): VAST (VAScular Tropicos) nomenclatural database. Retrieved from <http://mobot.mobot.org/W3T/Search/vast.html>, viewed: 4.11.2006.

OLDFIELD, S., LUSTY, C. & MACKINVEN, A. (1998): The world list of threatened trees. – 650 pp., World Conservation Press, Cambridge.

PORTER, D.M. (1972): The genera of the Zygophyllaceae in the Southeastern United States. – Journal of the Arnold Arboretum 53: 531-532 (fide GROW & SCHWARTZMAN 2001).

SCHIPPMMANN, U. (2001): Medicinal plants significant trade study. CITES project S-109. Plants Committee Document PC9 9.1.3 (rev.). Bundesamt für Naturschutz, Bonn (BfN-Skripten 39).

UNEP-WCMC (s.dat.): CITES-listed species database. Retrieved from www.cites.org/eng/resources/species.html, viewed: 4.11.2006.

FES-Iztacala, UNAM database. Nomenclatural and curatorial database of Mexican plants: For research purposes and not available online.

Patricia Davila Aranda • Facultad de Estudios Superiores de Iztacala • Universidad Nacional Autónoma de México • Av. de los Barrios 1 • Col. Los Reyes Iztacala • Edo México 54090 • Mexico • Tel.: ++52/55/5623-1219 • Fax: 0052/55/5623-1225 • E-mail: pdavilaa@servidor.unam.mx

For Uwe Schippmann's address see list of members.

Notices of Publication

Uwe Schippmann

ALLEN, D.E. & HATFIELD, G. (2004): Medicinal plants in folk tradition. An ethnobotany of Britain and Ireland. – 432 pp., Timber Press, Portland.

“The book brings together a wealth of scattered and unpublished information, filling in details of medicinal usage of plants often omitted in ethnobotanical works that concentrate on folklore and, to a lesser extent, the economic value of wild flora. Assiduous research, including study of extensive unpublished records of the Irish Folklore Commission, reveals considerable differences in plant medicinal use between Britain and Ireland. The book is relevant to much of western Europe; also North America where many of the plants are native or introduced.” (from Plant Talk 39, p. 39, 31.1.2005)

ARVIND BHATT, RAWAL, R.S. & UPPEANDRA DHAR (2006): Ecological features of a critically rare medicinal plant, *Swertia chirayita*, in Himalaya. – Plant Species Biology 21 (1): 49-52. Retrieved from www.blackwell-synergy.com/doi/full/10.1111/j.1442-1984.2006.00150.x?cookieSet=1, viewed: 18.10.2006.

BALICK, M.J. & O'BRIEN, H. (2005): Ethnobotanical research in Belize. Accomplishments, challenges and lessons learned. – Ethnobotany 17 (1/2): 79-88.

BARSCH, F. (2004): Preliminary assessment of the trade and use of *Euphorbia antisyphilitica*. – TRAFFIC Bulletin 20 (1): 6-8, 13.

BRINCKMANN, J. (2005): Market News Service. Medicinal plants and extracts. No. 17. – s.pag., International Trade Centre UNCTAD/WTO, Geneva.

CARR, S.J. (2004): Namibia propagates *Hoodia*. – Sabonet News 9 (1): 43-44.

DE WET, L.-A. (2005): Is *Pelargonium reniforme* in danger? The effects of harvesting on *Pelargonium reniforme*. – Veld & Flora 91 (4): 182-184.

FASHING, P.J. (2004): Mortality trends in the African cherry (*Prunus africana*) and the implication for colobus monkeys (*Colobus guereza*) in Kakamega Forest, Kenya. – Biological Conservation 120: 449-459.

“*Prunus africana* (Hook.f.) Kalkm. is a secondary forest canopy tree species that has been declining over much of its geographical range in sub-Saharan Africa during recent decades due to unsustainable harvesting of its bark for the international medicinal plant trade. One of the locations where the species is experiencing rapid mortality is Isecheno study site in the Kakamega Forest, Kenya where this study was conducted. Between 1997 and 2003, 21 % of the *P. africana* (more than or equal to 10 cm DBH) at Isecheno died and an additional 9 % experienced more than or equal to 50 % canopy dieback. However, scars from bark harvesting on *P. africana* were relatively small and scarred trees were not more likely to be dead or dying than unscarred trees, suggesting that bark exploitation is not causing *P. africana* mortality at Isecheno. Other possible causes that require further evaluation

include disease, insect attack, nutrient deficiency, and/or climatic fluctuation. The poor regeneration of *P. africana* at Isecheno can likely be explained by the relative lack of recent disturbance coupled with the thick undergrowth layer at this site. *P. africana* mortality is of concern not only because the species is listed as Vulnerable by IUCN, but also because black and white colobus monkeys [*Colobus guereza* (Rüppell, 1835)] at Isecheno exploit it as their top food species and are particularly reliant on its leaves during times of ‘preferred’ Moraceae fruit scarcity. The anticipated continued decline of *P. africana* may have adverse effects on *C. guereza* feeding habits, intergroup relations, and population density at Isecheno. Conservation of *P. africana* offers a formidable challenge since the species appears to require disturbance for regeneration, yet at sites where disturbance is occurring, *P. africana* is often a target of bark harvesters engaging in unsustainable levels of exploitation.” (from CABI-RAMP, 20053050273).

FONTANEL, D. (2005): L'Harpagophytum. – La Lettre de Phytothérapie. Revue d'Information Pharmaceutique et Médicinale. 5: 1-6.

GHIMIRE, S.K., MCKEY, D. & AUMEERUDDY-THOMAS, Y. (2005): Conservation of Himalayan medicinal plants. Harvesting patterns and ecology of two threatened species, *Nardostachys grandiflora* DC. and *Neopicrorhiza scrophulariiflora* (Pennell) Hong. – Biological Conservation 124: 463-475.

GOTZMANN, I.H. & HONNEF, S. (2006): Wildsammlungen von Heilpflanzen. Globale soziale und ökologische Aspekte. – Kirche im ländlichen Raum 3: 11-16.

HAMILTON, A. (2004): Medicinal plants, conservation and livelihoods. – Biodiversity and Conservation 13: 1477-1517.

HONNEF, S. (2005): Sustainable wild collection of medicinal and aromatic plants. Development of an international standard. – TRAFFIC Bulletin 20 (3): 94.

HUNT, B. & VINCENT, A.C.J. (2005): Scale and sustainability of marine bioprospecting for pharmaceuticals. – Ambio 35 (2): 57-64.

KALA, C.P. (2005): Indigenous uses, population density, and conservation of threatened medicinal plants in protected areas of the Indian Himalayas. – Conservation Biology 19 (2): 368-378.

KALPESH ISHNAVA, RAO, V.R., MOHAN, J.S.S., KOTHARI, I.L. & PARABIA, F.M. (2005): Occurrence of a rare medicinal plant *Schweinfurthia papilionacea* A.Br. (Scrophulariaceae) in Gujarat. – Journal of Economic and Taxonomic Botany 29 (1): 192-197.

LALOO, R.C., KHARLUKHI, L., JEEVA, S. & MISHRA, B.P. (2006): Status of medicinal plants in the disturbed and the undisturbed sacred forests of Meghalaya, northeast India. Population structure and regeneration efficacy of some important species. – Current Science 90 (2): 225-232.

LANGE, D. (2004): Medicinal and aromatic plants: trade, production, and management of botanical resources. – In:

- CRAKER, L.E., SIMON, J.E., JATISATIENR, A. & LEWIN-SOHN, E.J. (ed.): The future for medicinal and aromatic plants: Proceedings of the XXVI International Horticultural Congress, Toronto, Canada, 11-17 August 2002. pp. 177-197 (Acta Horticulturae 629).
- MAHDEI, K.N. (2005): A "SWOT" analysis of medicinal plant production in Iran. – Acta Horticulturae 678: 23-27.
- MIKAGE, M. & KAKIUCHI, N. (2005): The recent situation of the resources of Chinese crude drug Ma-huang, Ephedrae Herba. – Journal of Traditional Medicines 22 (Suppl. 1): 61-69.
- MITHTHAPALA, S. (ed.) (2006): Conserving medicinal species. Securing a healthy future. – vii+180 pp., IUCN Ecosystems and Livelihoods Group, Asia, Colombo.
- MOHD AZMI, M. I. , MOHD SHAHWAHID, H. O. , AWANG NOOR, A. G. , NORINI, H. , RUSLI, M. (2005): Harvesting activities of medicinal plants in Peninsular Malaysia. – International Journal of Forest Usufructs Management 6(1): 65-76.
- "The increasing awareness on herbal remedies and the demand for herbal products leads to rising requirements for local raw medicinal resources by the traditional medicine industries. Although the dependence of the industries on the amount of local medicinal plants required for the production of herbal products is still low when compared to imports, but some local medicinal plants are known to be used as the main ingredients in the herbal products processing by Malay traditional medicine manufacturers. Using data from a survey on 33 medicinal plant collectors in Peninsular Malaysia, a descriptive profile of collectors of medicinal plant resources was obtained to provide an overview of the socioeconomics of the industry in terms of demographic characteristics of collectors, frequency, duration and travel distance of collecting trips, cost and revenue structure, and production inputs and output. The efficiency of inputs utilization and the optimal level of input combination was also examined to determine the level of collectors effectiveness in the harvesting activities." (from CABI-RAMP, 20053178479).
- NAKASHIMA, E.M.N, MAI THANH THI NGUYEN, QUAN LE TRAN & KADOTA, S. (2005): Field survey of agarwood cultivation at Phu Quoc Island in Vietnam. – Journal of Traditional Medicines 22 (5): 296-300.
- OCAMPO SANCHEZ, R. (2005): Estado de conservación de las plantas medicinales TRAMIL. Un aporte a la implementación de la estrategia global para la conservación vegetal. – 72 pp., Lara Segura & Asoc., San José, Costa Rica.
- OLSEN, C.S. (2005): Trade and conservation of Himalayan medicinal plants. *Nardostachys grandiflora* DC. and *Neopicrorhiza scrophulariiflora* (Pennell) Hong. – Biological Conservation 125: 505-514.
- OLSEN, C.S. & NIRMAL BHATTARAI (2005): A typology of economic agents in the Himalayan plant trade. – Mountain Research and Development 25 (1): 37-43.
- PÄTZOLD, B., LEAMAN, D. & HONNEF, S. (2006): Sustainable wild collection of medicinal and aromatic plants. The need for an international standard. – TRAFFIC Bulletin 21 (1): 41-45.
- RAHMAN, M.A., MOSSA, J.S., AL-SAID, M.S. & AL-YAHYA, M.A. (2004): Medicinal plant diversity in the flora of Saudi Arabia 1. A report on seven plant families. – Fitoterapia 75 (2): 149-161.
- RAIMONDO, D., NEWTON, D., FELL, C., DONALDSON, J. & DICKSON, B. (2005): Devil's claw *Harpagophytum* spp. in South Africa. Conservation and livelihoods issues. – TRAFFIC Bulletin 20 (3): 98-112.
- RIJKERS, T., WOLDESELIASSIE, O., WESSEL, M. & BONGERS, F. (2006): The effect of tapping for frankincense on sexual reproduction in *Boswellia papyrifera*. – Journal of Applied Ecology 43 (6): 1188-1195.
- RIVIÈRE, C., NICOLAS, J.-P., CARADEC, M.-L., DÉSIÉ, O. & SCHMITT, A. (2005): Les plantes médicinales de la région nord de Madagascar. Une approche ethnopharmacologique. – Ethnopharmacologia 36: 36-50.
- SADLER, L. (2005): Wild ginseng harvest. – American Herb Association Quarterly Newsletter 21 (1): 14.
- SANDERS, S. & MCGRAW, J.B. (2005): Harvest recovery of goldenseal, *Hydrastis canadensis* L. – American Midland Naturalist 153 (1): 87-94.
- SINCLAIR, A. (2005): American ginseng. Assessment of market trends. – TRAFFIC Bulletin 20 (2): 71-81.
- STEWART, K.M. & COLE, D. (2005): The commercial harvest of devil's claw (*Harpagophytum* spp.) in southern Africa. The devil's in the details. – Journal of Ethnopharmacology 100: 225-236.
- VAN DER VOORT, M.E. & MCGRAW, J.B. (2006): Effects of harvester behaviour on population growth rate affects sustainability of ginseng trade. – Biological Conservation 130 (4): 505-516.
- VAN WYK, B.-E. & WINK, M. (2004): Medicinal plants of the world. – 480 pp., Timber Press, Portland.
- Most of the text is a handsomely and profusely illustrated dictionary-type reference, with detailed full-page entries on important medicinal plants, including descriptions and geographical data and information on part used, the usage, properties, active ingredients and pharmacological effects of the medicines, and 1-3 high quality colour photographs. Other sections cover health disorders and plants used in their treatment, an outline of the chemistry of the secondary metabolites (with structural formulae) that constitute plants medicines, and a data table of medicinal plants in commerce. (from Plant Talk 39, p. 39, 31.1.2005).
- WILLIAMS, V., WITKOWSKI, E.T.F. & BALKWILL, K. (2005): Application of diversity indices to appraise plant availability in the traditional medicinal markets of Johannesburg, South Africa. – Biodiversity and Conservation 14: 2971-3001.

List of MPSG Members

The following list of members is as of 1 November 2006. Please look through it and advise the editor on all errors and missing information (e.g. e-mail addresses).

Prof. Dr. Bill AALBERSBERG
University of the South Pacific • PO Box 1168 • Suva • Fiji
Tel.: 00679/3312952
Fax: 00679/3300373
E-mail: Aalbersberg@usp.ac.fj

Sudhakar AGRAWAL
Indian Herbs Research & Supply Co. Ltd. • P.B. No.5 Sharda Nagar • Saharanpur – 247 001, Uttar Pradesh • India
Tel.: 0091/132/725044,5,6,9
Fax: 0091/132/726288
E-mail: ihsre@vsnl.com

Prof. Dr. Laurent AKE-ASSI
Centre National de Floristique de l'Université • 08 B.P. 172 • Abidjan 08 • Ivory Coast
Tel.: 00225/22448614
E-mail: c/o • emmaaak@yahoo.fr

Dr. Janis B. ALCORN
World Resources Institute • 10 G Street, NE (Suite 800) • Washington, DC 20002 • USA
Tel.: 001/202/729-7600
Fax: 001/202/729-7610
E-mail: jalcorn@wri.org

Prof. John Thor ARNASON
University of Ottawa, Faculty of Science • 30 Marie Curie St., P.O. Box 450, Stn. A • Ottawa, Ontario K1N 6N5 • Canada
Tel.: 001/613/562-5262
Fax: 001/613/562-5765
E-mail: jarnason@science.uottawa.ca

Sema ATAY
Dogal Hayati Koruma Dernegi (DHKD) • PK 971 Sirkeci • 34436 Istanbul • Turkey
Tel.: 0090/212/528-2030
Fax: 0090/212/528-2040
E-mail: satay@wwf.org.tr

Dr. Yildiz AUMEERUDDY-THOMAS
WWF/UNESCO People & Plants Programme • Centre d'Ecologie Fonctionnelle et Evolutive (CEFE), CNRS • 1919 route de Mende • 34293 Montpellier Cedex 5 • France
Tel.: 0033/4/67613234
Fax: 0033/4/67412138
E-mail: thomas@cefe.cnrs.fr

Dr. Reza AZMI
47B Sri Hartamas 2 • 50480 Kuala Lumpur • Malaysia
Tel.: 0060/3/6201-0125
E-mail: reza@wildasia.net

Manjul BAJAJ
301, Block 23 • Heritage City, Gurgaon, Haryana – 122002 • India
Tel.: 0091/11/6891695
Fax: 0091/11/6121181
E-mail: manjul@nde.vsnl.net.in

Prof. Michael J. BALICK
The New York Botanical Garden • Kazimiroff Blvd. & 200 Street • Bronx, New York 10458-5126 • USA
Tel.: 001/718/817-8763
Fax: 001/718/220-1029
E-mail: mbalick@nybg.org

Dr. Nirmal Kumar BHATTARAI
Department of Plant Resources • P.B. 20568 • Thapathali, Kathmandu • Nepal
Tel.: 00977/1/436356
Fax: 00977/1/473020
E-mail: mansa@ccsl.com.np

Dr. Emilio BLANCO CASTRO
Estudio de Botánica • C/. Pez Austral 14, 1° A • 28007 Madrid • Spain
Tel.: 0034/91/5733343
Fax: 0034/91/5528797
E-mail: emiliobc@teleline.es

Mark BLUMENTHAL
American Botanical Council • P.O. Box 144345 • Austin, Texas 78714-4345 • USA
Tel.: 001/800/373-7105
Fax: 001/512/926-2345
E-mail: abc@herbalgram.org

Ximena BUITRÓN CISNEROS
Martínez Mera N 37-82 y Arosemena Tola • Planta baja, Quito • Ecuador
E-mail: ximenabuitronc@hotmail.com

Prof. Dr. Robert A. BYE
Universidad Nacional Autónoma de México (UNAM) • Apdo. Post. 70-226 • 04510 México, D.F., Del. Coyoacán • Mexico
Tel.: 0052/5/616-1297, 622-9057
Fax: 0052/5/616-2326, 622-9046
E-mail: rbye@ibunam.ibiologia.unam.mx

Dr. Michel CAMBORNAC
Département Ethnobotanique et Agromonie des Laboratoires Yves Rocher • La Croix des archers • 56200 La Gacilly • France
Tel.: 0033/2/9908-2838
Fax: 0033/2/9908-2893
E-mail: michel.cambornac@yrnet.com

Daisy CASTILLO DE VÁSQUEZ
Jardin Botanico Nacional • Apartado Postal 21-9, Ave. Rep. de Colombia, esq. Ave. Los Próceres • Santo Domingo • Dominican Republic
Tel.: 001809/385/2611, -1213
Fax: 001809/385/0446
E-mail: j.botanico@codetel.net.do

Prof. Dr. Chaudhary Mahendra KUMAR
Universidad Arturo Prat • Av. 11 Septiembre, 2120 • 121 Iquique • Chile
Tel.: 0056/57/445190
Fax: 0056/57/445190
E-mail: mahendra.kumar@cec.unap.cl

Prof. Dr. Rachid CHEMLI
Association Tunisienne Plantes Médicinales, Faculté de Pharmacie de Monastir • Monastir 5000 • Tunisia
Tel.: 00216/73/461000
Fax: 00216/73/461830
E-mail: rachid_chemli@yahoo.com

Dr. Tony CUNNINGHAM
WWF/UNESCO/Kew People and Plants Initiative • 84 Watkins St. • White Gum Valley, Fremantle, 6162 • Australia
Tel.: 0061/8/93366783
Fax: 0061/8/93366783
E-mail: tonyc05@bigpond.net.au

Dr. Ermias DAGNE
University of Addis Ababa • Miazia 27 Square, P.O. Box 30270 • Addis Ababa • Ethiopia
Tel.: 00251/1/126276 • 114854
Fax: 00251/1/551244
E-mail: eda@telecom.net.et

Dr. Patricia S. DE ANGELIS
US Fish and Wildlife Service, Department of the Interior • 4401 N. Fairfax Dr., Rm 750 • Arlington, VA 22203 • USA
Tel.: 001/703/358-1708 x 1753
Fax: 001/703/358-2276
E-mail: Patricia_DeAngelis@fws.gov

Prof. Dr. Elaine ELISABETSKY
Federal University of Rio Grande do Sul, Brazil • C.P. 5072 • 90041-970 Porto Alegre RS • Brazil
Tel.: 0055/51/316-3121 • -3183
Fax: 0055/51/316-3121
E-mail: elisasky@vortex.ufrgs.br

Dr. Victor Ramón FUENTES FIALLO
Instituto de Investigaciones en Fruticultura Tropical • 7ma Avenida No. 3005, Miramar • 11300 La Habana, Ciudad de La Habana • Cuba
Tel.: 0053/7/2027844
Fax: 0053/7/2046794
E-mail: vfuentes@infomed.sld.cu

Dr. Doug O. FULLER
The George Washington University •
619 21st Street, NW • Washington DC
20052 • USA
Tel.: 001/202/994-8073
Fax: 001/202/994-2484
E-mail: dfuller@gwu.edu

Dr. Ganesan BALACHANDER
Asian Programs, The Mountain Insti-
tute • 1828 L Street, NW Suite 725 •
Washington, DC 20036 • USA
Tel.: 001/202/452-1636
Fax: 001/202/452-1635
E-mail: gbalachander@mountain.org

Dr. Nigel P. GERICKE
P.O. Box 937 • Sun Valley 7985 •
South Africa
E-mail: ngericke@mweb.co.za

Dr. Shahina Agha GHAZANFAR
Herbarium • Richmond, Surrey, TW9
3AB • United Kingdom
Tel.: 0044/20/8332-5286
Fax: 0044/20/8332-5278
E-mail: s.ghazanfar@kew.org

Suresh Kumar GHIMIRE
WWF Nepal Program • P.O. Box 7660
• Kathmandu • Nepal
Tel.: 00977/1/331322
E-mail: yeshi@wwfnepal.org.np

Dr. Gurinderjit Singh GORAYA
Foundation For Revitalisation Of Lo-
cal Health Traditions • 735-B, A.W.
H.O. Flats, Sector-54 (Phase-2) •
S.A.S. Nagar, Mohali (Chandigarh) -
160054 • India
Tel.: 0091/172/3099384
E-mail: gurinder9@hotmail.com

Prof. Dr. Stephan R.P. HALLOY
Crop and Food Research, Invermay
Agricultural Research Centre • Private
Bag 50034 • Mosgiel • New Zealand
Tel.: 0064/3/489-0160
Fax: 0064/3/489-0674
E-mail: halloys@crop.cri.nz

Dr. Alan HAMILTON
Plantlife International • 14 Rolleston
Street • Salisbury, Wiltshire SP1 1DX •
United Kingdom
Tel.: 0044/1722/342757
Fax: 0044/1722/329035
E-mail: alan.hamilton@plantlife.org.
uk

Dr. Paul HERSCH MARTÍNEZ
Proyecto Actores Sociales de la Flora
Medicinal en Mexico, Instituto Nacional
de Antropología e Historia (INAH) •
Matamoros No. 14, Col. Acapantzingo,
Cuernavaca • Morelos, CP 62440 •
Mexico

Tel.: 0052/777/312-3108 x 14
Fax: 0052/777/312-3108
E-mail: leon@buzon.uaem.mx

Dr. Madhav B. KARKI
International Centre for Integrated
Mountain Development (ICIMOD) •
Khumaltar, Lalitpur, P.O. Box 3226 •
Kathmandu • Nepal
Tel.: 00977/1/5525313
Fax: 00977/1/5524 509, 5536747
E-mail: mkarki@icimod.org.np

Dr. Steven R. KING
Napo Pharmaceuticals Inc. • 1170 Ve-
teran Blvd., Suite 244 • South San
Francisco, CA 94080-4812 • USA
Tel.: 001/650/616-1905
Fax: 001/650/873-8367
E-mail: sking@napopharma.com

Dr. Sonia LAGOS-WITTE
Jardín Botánico Nacional • Apartado
Postal 21-9 • Santo Domingo • Domi-
nican Republic
Tel.: 001809/3852611
Fax: 001809/3850446
E-mail: tramilca@codetel.net.do

Sarah LAIRD
People and Plants International • 12
Laveta Place • Nyack, NY 10960 • USA
E-mail: sarahlaird@aol.com

Dr. John D.H. LAMBERT
The World Bank, AFTS3, Africa Re-
gion • Room J6-52, 1818 H Street,
N.W. • Washington DC. 20433 • USA
Tel.: 001/473/473-3913
Fax: 001/202/473-5147
E-mail: jlambert@worldbank.org

Dr. Dagmar LANGE
Barbarossastraße 38 • 76855 Annwei-
ler am Trifels • Germany
Tel.: 06346/308-204
Fax: 06346/308-0262
E-mail: dagmarlange@t-online.de

Christine LEON
Royal Botanic Gardens • Kew, Rich-
mond, Surrey TW9 3AB • United
Kingdom
Tel.: 0044/20/8332-5702
Fax: 0044/20/8332-5768
E-mail: c.leon@rbgkew.org.uk

Edelmira LINARES MAZARI
Ciudad Universitaria • Apdo. Post. 70-
614 • 04510 México, D.F., Del. Co-
yoacán • Mexico
Tel.: 0052/5/622-9047 • 50
Fax: 0052/5/622-9046
E-mail: mazari@mail.ibiologia.unam.
mx

Dr. Samar Bahadur MALLA
Biodiversity Study Centre • 22/348
Ganabahal • Khichapokhari, Kathman-
du • Nepal
Tel.: 00977/1/4220262
Fax: 00977/1/4242516
E-mail: samarbmalla@mail.com

Dr. Narayan Prasad MANANDHAR
Nepalese Resource Centre for Inde-
genous Knowledge • P.O. Box 3389 •
Kathmandu • Nepal
Tel.: 00977/1/479436
Fax: 00977/1/225145 • 479436
E-mail: sanjay@freak_st.mos.com.np

Dr. Robin J. MARLES
Bureau of Research and Science,
Natural Health Products Directorate,
Health Products and Food Branch,
Health Canada • 2936 Baseline Rd •
Ottawa, Ontario K1A 0K9 • Canada
Tel.: 001/613/948-6142
Fax: 001/613/94-1615
E-mail: robin_marles@hc-sc.gc.ca

Nina MARSHALL
P.O. Box 123 • Heath, Massachusetts
01346 • USA
Tel.: 001/413/339/4756
Fax: 001/202/912-1045
E-mail: n.marshall@conservation.org

Maritza MARTÍNEZ MOLINA
Universidad Nacional Autónoma de
Honduras, Departamento de Biología •
Bulevard Suyapa, Tegucigalpa M.D.C.
Honduras C.A., Apartado Postal #24 •
Tegucigalpa, Francisco Morazan •
Honduras
Tel.: 00504/2/322110 x 193
E-mail: marmol@cablecolor.hn

Dr Victor Ivanovich MELNIK
Central Republic Botanical Garden,
Ukrainian Academy of Sciences •
Timiryazevska Str., 1 • 252014 Kiev •
Ukraine
Tel.: 00380/44/295-0480
Fax: 00380/44/295-2649
E-mail: melnik@botanical-garden.ki
ev.ua

C. Dr. Martha Elena MÉNDEZ GON-
ZÁLEZ
Centro de Investigación Científica de
Yucatán • Calle 43 # 130 Col. Chu-
burná de Hidalgo • 97200 Mérida, Yu-
catán • Mexico
Tel.: 0052/999/981-3914
Fax: 0052/999/981-3900
E-mail: mar@cicy.mx

Susan MINTER
Eden Project • Bodelva, Cornwall,
PL24 2SG • United Kingdom

Tel.: 0044/1726/8119-79
Fax: 0044/1726/8119-12
E-mail: SMinter@EdenProject.com

Magdalena MLADENOVA
Tel.: 00359/2/700100
Fax: 00359/2/705154
E-mail: mmladenova@instrade.org

Prof. Dr. Daniel E. MOERMAN
Dept. of Behavioral Sciences, University of Michigan-Dearborn • 4901 Evergreen Rd. • Dearborn, MI 48128 • USA
Tel.: 001/313/593-5016
Fax: 001/313/593-5016
E-mail: dmoerman@umich.edu

Prof. Gloria MONTENEGRO
Pontificia Universidad Católica de Chile, Departamento de Ciencias Vegetales, Facultad de Agronomía e Ingeniería Forestal • Campus San Joaquín, Av. Vicuña Mackenna 4860 • Santiago • Chile
Tel.: 0056/2/686-4117, -6216
Fax: 0056/2/552-0780
E-mail: gmonten@puc.cl

Prof. V.P.K. NAMBIAR
IDRC Medicinal Plant Conservation Project, Arya Vaidya Sala • Kottakkal – 676 503, Malappuram District, Kerala • India
Tel.: 0091/493/7422-16, -19
Fax: 0091/493/7422-10
E-mail: kottakal@vsnl.com

Prof. Èva NEMETH-ZÁMBORI
Corvinus University of Budapest • P.O. Box 53 • 1518 Budapest • Hungary
Tel.: 0036/1/482-6252
Fax: 0036/1/482-6330
E-mail: eva.nemeth@uni-corvinus.hu

Rafael Angel OCAMPO SANCHEZ
Jardín Agroecológico Bougainvillea S. A. • Apartado Postal 764-3100 • Santo Domingo, Heredia • Costa Rica
Tel.: 00506/241-1978
Fax: 00506/241-1978
E-mail: quassia@racsa.co.cr

Sara OLDFIELD
The Old Plough, 2 Caxton Road • Great Gransden, Nr. Sandy, Beds. SG19 3BE • United Kingdom
Tel.: 0044/208/332-5953
Fax: 0044/208/332-5956
E-mail: sara.oldfield@bgci.org

Dr. Carsten SMITH OLSEN
The Royal Veterinary and Agricultural University • Rolighedsvej 23 • 1958 C Frederiksberg • Denmark

Tel.: 0045/3528-1763
Fax: 0045/3528-1598
E-mail: cso@kvl.dk

Prof. Dr. PEI Shengji
Dept. of Ethnobotany, The Kunming Institute of Botany, CAS • Kunming 650204 • China
Tel.: 0086/871/5150-660
Fax: 0086/871/5150-227
E-mail: peisj@public.km.yn.cn

Alan PIERCE
1061 Mountainview • Waterbury, Vermont 05676 • USA
Tel.: 001/802/244-5875
E-mail: arp@sover.net

Prof. Dr. Claudio Urbano PINHEIRO
Universidade Federal do Maranhão - UFMA Departamento de Oceanografia e Limnologia • Av. dos Portugueses, s/n – Campus do Bacanga • CEP 65.085-580 São Luís, Maranhão • Brasil
Tel.: 0055/98/217-8561, -8564
Fax: 0055/98/217-8569
E-mail: cpinheiro@elo.com.br

Dr. Laurent PORDIÉ
24, ch. du roussimort • 31270 Frouzins • France
Tel.: 0033/4/4295-2420
Fax: 0033/4/4295-0209
E-mail: nomadplant@hotmail.com

Rebecca PRADHAN
Royal Society for Protection of Nature • Thimphu • Bhutan
E-mail: rebecca@druknet.net.bt

Dr. Nat QUANSAH
Noir Eclair, Salon de Beauté, Morondava Centre • Morondava 619 • Madagascar
Tel.: 00261/209592707
E-mail: quansah@wanadoo.mg

Rubina RAFIQ
National Herbarium, Pakistan Agricultural Research Council • NARC, Park Road • Islamabad - 45500 • Pakistan
Tel.: 0092/51/240-151
Fax: 0092/51/240-909

Ajay RASTOGI
ECOSERVE • Majkhali • Uttaranchal, Ranikhet - 263 652 • India
Tel.: 0091/5966/28-338
Fax: 0091/5966/28-723
E-mail: slg_ecoserve@sancharnet.in

Prof. Dr. Gopal Singh RAWAT
Wildlife Institute of India (WII), Faculty of Wildlife Biology • P.O. 18, Chandrabani • Dehra Dun – 248 001,

Uttaranchal • India
Tel.: 0091/135/264011-1/-2,3,4,5
Fax: 0091/135/264011-7
E-mail: rawatg@wii.gov.in

Dr. Marileen REINDERS
Utrecht University • P.O. Box 80.140 • 3508 TC Utrecht • The Netherlands
Tel.: 0031/30/253-1903, -2111
Fax: 0031/30/253-4666
E-mail: m.reinders@fss.uu.nl

Prof. Moh REJDALI
Institut Agronomique et Vétérinaire Hassan II, Dpt. d'Ecologie Végétale • B.P. 6202 Rabat Instituts • Rabat • Morocco
Tel.: 00212/7/774093
Fax: 00212/7/774093
E-mail: rejдали@iav.refer.org.ma

Adriana RIVERA-BRUSATIN
Ministerio de Ambiente, Vivienda y Desarrollo Territorial • Calle 37 No. 8-40 piso 2 • Bogotá • Colombia
Tel.: 0057/1/3406274
Fax: 0057/1/3406212
E-mail: arivera@minambiente.gov.co

Christopher S. ROBBINS
The Nature Conservancy, Oregon Field Office • 821 SE 14th Avenue • Portland, OR 97214 • USA
Tel.: 001/503/972-0378
E-mail: crobbins@tnc.org

Dr. SANAGAVARAPU Vedavathy
Herbal Folklore Research Centre • B-23, Vaikunatapuram, M.R. Palli • Tirupati – 517 502, Andhra Pradesh • India
Tel.: 0091/877/2242605
Fax: 0091/8574/54830
E-mail: vedavathy@hotmail.com

Dr. Anca SARBU
Botany Department • Faculty of Biology • University of Bucharest • Aleea Portocalelor 1-3 • 77206 Bucharest • Romania
Tel.: 0040/1/6387175
Fax: 0040/1/9614090
E-mail: asarbu@bio.bio.unibuc.ro

Dr. Y. K. SARIN
Herbal Research Development Institute • C-21, Chandralok Colony, Rajpur Road • Dehra Dun - 248 001, Uttar Pradesh • India
Tel.: 0091/135/2748184
E-mail: drsarin@rediffmail.com

Dr. Uwe SCHIPPMANN
Bundesamt für Naturschutz • Konstantinstraße 110 • 53179 Bonn • Germany
Tel.: 0228/8491-1440

Fax: 0228/8491-1419
E-mail: uwe.schippmann@bfn.de

Dr. Niranjan Chandra SHAH
Centre for Indigenous Knowledge of
Indian Herbal Resources (CIKIHHR) •
MS-78 • Sector 'D' • Aliganj, Lucknow
– 226 024 U.P. • India
Tel.: 0091/522/2326489
Fax: 0091/522/2326489
E-mail: drnshah@sancharnet.in

Patricia SHANLEY
Center for International Forestry Re-
search (CIFOR) • P.O. Box 6596,
JKPWB • Jakarta, 10065 • Indonesia
Tel.: 0062/251/622-622
Fax: 0062/251/622-100
E-mail: p.shanley@cgiar.org

Dr. Zabta SHINWARI
COMSTECH • 3-Constitution Avenue
• Islamabad – 44000 • Pakistan
Tel.: 0092/51/9201242-3
Fax: 0092/51/9211115
E-mail: Shinwari2002@yahoo.com

Dr. Ernest SMALL
Agriculture and Agri-Food Canada
(ECORC) • Saunders Building (#49),
Central Experimental Farm • Ottawa,
Ontario K1A 0C6 • Canada
Tel.: 001/613/759-1370
Fax: 001/613/759-1599
E-mail: smalle@agr.gc.ca

Viviane STERN DA FONSECA-
KRUEL
Etnobotânica - Programa Conservação
- DIPEQ, Instituto de Pesquisas Jardim
Botânico do Rio de Janeiro • Rua
Pacheco Leao 915 • CEP 22460-040
Rio de Janeiro - RJ - Brazil • Brazil
Tel.: 0055/21/2294-8696
Fax: 0055/21/2294-8696
E-mail: vfonseca@jbrj.gov.br

Bhishma P. SUBEDI
Asia Network for Small Scale Biore-
sources (ANSAB) • P.O. Box 11035,
Min Bhawan • Kathmandu • Nepal
Tel.: 00977/1/497547, 476586
Fax: 00977/1/487916
E-mail: ansab@mos.com.np

Vinay TANDON
Winrock International India • 1, Nav-
jeevan Vihar • New Delhi – 110 017 •
India
Tel.: 0091/11/5569-5219
Fax: 0091/11/2669-3881
E-mail: vtandy@gmail.com

Jongthap TSHITILA
Ministry of Agriculture • Dept. of Ag-
riculture • P.O. Box 212 • Thimphu •
Bhutan
Tel.: 00975/2/333852
Fax: 00975/2/333853
E-mail: tshitila@druknet.net.bt

Paul VANTOMME
FAO, Wood and Non-Wood Utilization
Branch, FOPW, Forest Products and
Economics Division, Forestry Depart-
ment • Viale delle Terme di Caracalla •
00100 Roma • Italy
Tel.: 0039/06/570-54064
Fax: 0039/06/570-55618
E-mail: paul.vantomme@fao.org

Devendra Kumar VED
Foundation for the Revitalisation of
Local Health Traditions (FRLHT) •
No.74/2, Jarakbande Kaval, Post: Attur,
Via Yelahanka • Bangalore - 560 064 •
India
Tel.: 0091/80/856-8000, 8001
Fax: 0091/80/856-5873
E-mail: dk.ved@frlht.org.in

Dr. Vivienne WILLIAMS
PO Box 375 • P.O. Wits 2050 Johan-
nesburg • South Africa
Tel.: 0027/11/346-0942
Fax: 0027/11/346-0942
E-mail: vivwill@planetac.co.za

Asst. Prof. Dr. ZHAO De-Xiu
Institute of Botany, Academia Sinica •
20 Nanxincun, Xiangshan, Haidian
District • Beijing 100093 • China
Tel.: 0086/10/6259-1431 x 6201
Fax: 0086/10/6259-0833
E-mail: zhaodx@ns.ibcas.ac.cn

Medicinal Plant Conservation is edited and produced by:

Bundesamt für Naturschutz • Uwe Schippmann • Konstantinstrasse 110 • 53179 Bonn •
Germany • E-mail: uwe.schippmann@bfn.de.

Contributions for the next issue of *Medicinal Plant Conservation* are most welcome and
should be sent to Natalie Hofbauer (E-mail: natalie.hofbauer@bfn.de, mailing address
as above) as word processing files.

The Medicinal Plant Specialist Group is chaired by:

Danna J. Leaman • 98 Russel Avenue • Ottawa, Ontario K1N 7X1 • Canada • Tel.
++1/61/235-7213 • Fax ++1/61/235-9622 • E-mail: djl@green-world.org.