Medicinal Plant Conservation


Silphion

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Chair's Note

Danna J. Leaman

Looking back

As this 13th volume of *Medicinal Plant Conservation* is prepared, I am looking back to the first volume, a slender eight pages, published in April 1995, one year after the Medicinal Plant Specialist Group was established within the IUCN Species Survival Commission. In that first volume, MPSG Co-chairs Uwe Schippmann and Tony Cunningham stated that: "in the wide range of journals dealing with medicinal plants, we believe that our newsletter is filling a gap by dealing with issues focused on the conservation of these valuable taxa – a field that has been widely neglected so far." Over the last 12 years, this newsletter has made a significant contribution to filling this gap, growing not only in size (volume 12 weighed in at 56 pages!) and distribution (the mailing list has grown from ca. 200 in 1995 to about 500 in 2007), but also in its capacity to include both short news on current topics relevant to medicinal plant conservation as well as longer reports on the results of research and action supporting medicinal plant conservation. *Medicinal Plant Conservation* has grown from a modest newsletter to a substantial journal thanks to the contributions of many contributing authors, the dedication and disciplined focus of its editor, Uwe Schippmann, the patience and diligence of production manager Natalie Hofbauer, and the ongoing generosity of its publisher, the German Federal Agency for Nature Conservation (BfN).

Volume 1 of MPC introduced the MPSG logo, which depicts the ancient Silphion plant, and included a summary by Uwe Schippmann of what was known at the time about this now-extinct medicinal plant. In the present volume, author Monika Kiehn provides new information based on her thesis research, which, in the words of Uwe Schippmann, "builds a very nice bridge into the first issue" (see page 4).

In 1995, the MPSG had a membership of 33, with the majority of members located in Europe, and Africa. The current official membership (some recent changes are not yet reflected in the 2007 membership list) has more than doubled in number, with substantial growth in South Asia and Latin America, where there are active MPSG regional sub-groups, as well as in North America, where we have been collaborating with the much-larger Medicinal Plant Working Group of the USA-based Plant Conservation Alliance. It is clear from Table 1, which summarized these changes, that if we are striving for a balanced regional membership, we need to focus our future membership-building efforts in Africa, Australia-New Zealand, the Pacific, and the Middle East.

Table 1. Changes in MPSG membership by region, 1995-2007

Region	1995	%	2007	%	% change
Africa	9	28	7	8	-20
Asia	5	15	25	29	+14
Australia-NZ	1	3	2	2	-1
Europe	10	30	19	23	-7
North America	3	9	16	18	+9
Southern America	3	9	16	18	+9
Pacific	1	3	1	1	-2
Middle-East	1	3	1	1	-2
Total	**33**		**87**		**+263**

The Present – Project Updates

International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP): The first public version (1) of the Standard was released in February 2007 in Nuremburg, Germany, during Biofach, a global organic trade fare sponsored by the International Federation of Organic Agricultural Moverments (IFOAM). The Standard is now available for application to MAP collection operations, and the ISSC-MAP Decision Board is working to develop an appropriate business model. Specific projects are being developed to test the Standard's applicability in a variety of geographic, ecologic and socioeconomic conditions of MAP collection and use. The outcomes of these projects and other experiences with using ISSC-MAP will contribute to the development of guidance, case studies, and models for good collection practice. This experience will also be used to further refine the Standard, with Version 2 planned for release in 2009. An ISSC-MAP Secretariat has been established (WWF Germany and TRAFFIC, Rebstöcker Str. 55, 60326 Frankfurt a. Main. Tel.: +49/69/79144-122, -212; Email: MAP-Standards-Criteria@wwf.de). All documents related to the ISSC-MAP, including Version 1, are available from the ISSC-MAP project website: http://www.floraweb.de/map-pro.

Revised "Guidelines on the Conservation of Medicinal Plants": a final draft of the revised "Guidelines" is proceeding through internal review and endorsement processes in the four author agencies – WHO, IUCN, WWF, and TRAFFIC. Within IUCN, this process involves review and endorsement by the Plant Conservation Sub-Committee of the Species Survival Commission (SSC), the SSC Steering Committee, various IUCN programmes, and finally the IUCN Council. We continue our efforts to raise the funds required for print/web

publication and distribution of the final guidelines, and 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. Please contact me directly (djl@green-world.org) if you wish to review this final draft.

Revision of CITES #-annotations for medicinal and aromatic plants: Revised annotations as recommended by the MPSG to the CITES Plants Committee were adopted by the 14th meeting of the Conference of the Parties to CITES in The Hague, The Netherlands, in June 2007. These new annotations entered into force on 13 September 2007, and are available on the CITES website (http://www.cites.org/eng/app/E-sep13.pdf).

New on the MPSG website: many updates and improvements can now be found on the MPSG website (http://mpsg.org), especially under the heading "MPSG Programme & Activities". This web page and associated pages now include up-to-date information about our projects and other activities, including status assessment and the IUCN Red List of Threatened Species, policy and tools for conservation and sustainable use of medicinal plants, contributions to CITES, and work towards a "Top 50" strategy for medicinal plants. Our member information still requires updating, however, and we are working to complete the posting of all back issues of *Medicinal Plant Conservation* on our newsletter web page. Future plans for our website include additional links to fact sheets on threatened species of medicinal plants, and links to MPSG regional sub-group websites as these are developed.

Looking forward

4th IUCN World Conservation Congress: Barcelona, Spain, is the venue selected for the upcoming Congress, 5-14 October 2008. As in previous years, MPSG members will be invited to participate in the Congress as members of the Species Survival Commission. The most important part of the Congress programme for SSC and other IUCN commission members will be the World Conservation Forum (6-9 October), and the events organized within the Forum's three themes: "a new climate for change", "healthy environments – healthy people", and "safeguarding the diversity of life". The first call for contributions to the Forum, which closed in July 2007, received 530 proposals, with another round of proposals expected in October. A workshop proposal co-sponsored by the MPSG, Neil's Yard Remedies (UK), The German Federal Agency for Nature Conservation (BfN), the Foundation for Revitalization of Local Health Traditions (India), and WWF Germany has been accepted by the Congress organizing committee within the "healthy environments – healthy people" theme of the Forum. With the working title "Wild and Well: Sustainable Use in the Herbal Products Industry", we will be developing a workshop event that will bring together community, industry, conservation, and government stakeholders in the sustainable use of medicinal and aromatic plants to discuss key obstacles and opportunities for collaboration. Implementation of the ISSC-MAP (see project update above) will be one focus of this discussion. Information about the Congress programme and registration is available at the IUCN Congress website (http://www.iucn.org/congress/2008/index.htm).

MPSG's role in IUCN's 2009-2012 programme: Strategic planning for the next IUCN programme period has been underway within the IUCN Secretariat, regional programmes, and commissions for some time. The central challenge for IUCN's commissions, including the SSC, is to develop a commission strategic plan that both influences and implements the broader IUCN programme. The challenge for specialist groups with the SSC, including the MPSG, is to define a realistic workplan (and find funds and other resources for its implementation) that enables members to contribute to the SSC strategic plan and the broader IUCN programme, while also supporting the priorities and needs of the specialist group and its membership. These challenges were discussed as they concern the IUCN plant network during the 14th meeting of the Plant Conservation Sub-Committee of the SSC, in September 2007, near Ottawa, Canada. The proposed frameworks for the IUCN programme and the SSC strategic plan for 2009-2012 identify several "priority" or "strategic" areas to which the MPSG is expected to contribute. These include: assessing conservation status of economically important species, including medicinal plants; creating and implementing standards and other tools for sustainable use of globally important plant resources; enabling industry to incorporate conservation values; and managing biodiversity and ecosystem resources, including medicinal plants and their habitats, to improve human health and livelihoods. The MPSG will need to develop a workplan for 2009-2012 that responds to these expectations.

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BfN Federal Agency for Nature Conservation

Silphion revisited

Monika Kiehn

Introduction

The logo of the Medicinal Plant Specialist Group shows the ancient Silphion plant, the first useful plant species said to have become extinct through over-utilization. Much has been written about this plant from the Cyrenaica in Northern Africa, starting from early sources like Herodot (5th century BC) or Theophrast (3rd century BC). SCHIPPMANN (1995) well summarized the knowledge about Silphion available at this time in his "Silphion story" in the first volume of this journal.

A closer look at the different stories about Silphion – evaluating ancient sources and combining this with a scientific botanical background – has identified a number of so called "facts" about the Cyrenaic Silphion as erroneous (KIEHN 2006). There are two main fields of confusion: utilization in ancient times (especially medicinally), and botanical characters and identification (incl. the question whether and when the species became extinct).

The aims of this paper are to identify some of the most popular misperceptions and to give more details about this enigmatic plant.

The Silphion story in short

Silphion was the main trade product of the Northern African region of the Cyrenaica (in today's Libya) for more than 200 years, after the foundation of the city of Cyrene (631 BC according to Herodot). The image of the plant is frequently found on Cyrenian coins. Subsequently, during the Ptolemaic and Roman reign, traded quantities of Cyrenaic Silphion were becoming smaller, and the original Silphion was more and more replaced by a substitute *(Ferula asafoetida)* from Persia, Syria and Media (home of the Medes, an ancient Iranian people resident from west to north of Iran). Several ancient authors like Pliny the Elder (23-79 AD) gave reasons for this successive extinction: overharvesting, trade, and profit making.

Images

Cyrenaic coins provide indicative pictures of the Silphion, showing fruits or whole plants, sometimes also with fruits and roots. In addition, plants held by small clay figurines from Apollonia possibly represent Silphion; and a stylized Silphion root is found in the Codex Vindobonensis. But none of these images gives additional botanical information about ancient Silphion.

All other reports of Silphion images do not stand a closer inspection (KIEHN 2006). This explicitly holds true for some often cited items like the capital of Al Beidha, the capital of Battos in Cyrene, a column at Delphi, a cup from Naukratis, the "goddess with Silphion" from the Louvre, Mycenaean signet-rings, Minoan letters and even famous "Arkesilas cup". In some of these cases, earlier authors already provided decisive arguments against an identification of the vegetable element as Silphion, but that did not prevent others (especially in the last decade) to repeat erroneous assumptions. As an example, already ELDERKIN (1941) showed how unlikely it is to assume that plant parts on a column at Delphi represent Silphion (and, therefore, named the column "Akanthos Column"). But, nevertheless, an identification as "Silphion column" is even found in a recent university lecture (LYKOUDIS 2006).

Figure 1. Cyrenaic tetradrachm (minted 435-375 B.C.) showing a silphion plant (Illustration taken from ROBINSON, BMC, 1927, plate IX, fig. 11).

Figure 2. Capital at the Asclepios sanctuary in Al-Beidha, Libya. The plant in the center of this relief was wrongly identified as silphion. The botanical characters fit for a member of the monocots (e.g., Liliaceae in the broad sense) and for sure not for an Umbelliferae (Photo: M. KIEHN, Libya 2001).

The probably most prominent case of a misidentification relates to the so-called "Arkesilas cup". Solely based on the spelling of the names of persons on this cup, a whole story was developed – this cup would show the survey of weighting and shipping of Silphion by a king Arkesilaos from Cyrene. Besides other possible interpretations of the spelling of the names (for details see KIEHN 2006), the most important argument against the Silphion subject on this cup relates to the traded goods, which are packed in nets – however, Theophrast and Pliny wrote that Silphion was packed in jars. And, how should a resinous substance reasonably have been packed in a net?

Not even the sticky stalks of Silphion could have been transported that way. It is much more likely that the handling and shipping of a woollen substance is shown (as already proposed by LANE 1933/34).

Medicinal uses

The multiple medicinal potentials of Cyrenaic Silphion were highly estimated in antiquity and listed by different ancient authors. Pliny the Elder called it "one of the most precious gifts of nature" (Plin. nat. XXII 101). He also reported the substitutes from Media and Syria to be weaker (Plin. nat. XIX 40: "sed multo infra Cyrenaicum"). Only two aspects of medicinal uses (birth control and aphrodisiac effects) will be dealt with here in more detail, as the recent literature about both subjects urgently deserves clarifications and corrections.

Birth control

A new interest in Silphion was created by a publication of RIDDLE (1992) entitled "Contraception and abortion from the ancient world to the renaissance". In this book and in follow-up scientific articles Riddle and co-authors argue that Cyrenaic Silphion was a powerful agent for birth control in the Roman society, and it would be evident from the ancient sources that the most prominent use of products of this plant was abortion. They also claim this use to be the reason for the high price of Cyrenaic Silphion and its final disappearance. This supposed use of Silphion and its implications have been taken up, mostly uncritical, in numerous other papers.

RIDDLE (1992) assumes that not only substances explicitly mentioned as abortive were used that way, but also others which were, i.a., reported to initiate menstruation. But his arguments are not conclusive. He, e.g., interprets Dioscorides' report of Cyrenaic Silphion to cause menstruation as an evident and intended indication of its abortive function. Such an assumption might be logical for societies tabooing contraception or abortion. However, this was not the case in the time of the Roman Empire, as Dioscorides himself names several plants with abortive effects. And, as he does not mention any such potential in his description of Silphion, this plant hardly can be considered the most effective tool for this purpose.

Regarding other ancient authors, RIDDLE (1992) quite correctly deduces from the texts of Pliny the Elder that this author disregarded all negative impacts of plants. But if the assumptions of the "birth control" effects of Silphion and its products would be correct, would Pliny have such a high opinion of Silphion, and would he not warn women to use Silphion, e.g., in cases of pregnancies?

And what about other ancient medicinal sources cited by RIDDLE (1992) to corroborate his views? No mentioning of any contraceptional or abortive effect is found in Scribonius Largus or Galen, who, similar to Dioscorides, described other plants with potential in this regard. In the texts of Hippocrates, Silphion occasionally is mentioned (together with numerous other plants) in the context of expelling a dead foetus. Again, this does not at all indicate a pronounced role of the Cyrenaic Silphion as abortive or contraceptive.

RIDDLE and co-authors do not distinguish between the effects described for true Silphion and those attributed to its substitutes. Statements, e.g., by Soranus, used by RIDDLE (1992) to underline his theories, must be regarded with care, because at the time of Soranus (who lived around 100 AD), Cyrenaic Silphion had already disappeared from the market. Thus effects attributed to the "cyrenaic juice" by Soranus either are reports from oral tradition or, if considering Soranus' texts as instructions for a daily use, they must refer to the substitutes.

While RIDDLE (1992) cites the historical sources for his ideas, other authors seem to not even have looked at these texts at all. This is the only explanation for statements now quite often found in the literature like: *"Contemporary medical authorities were universal in their praise for silphium's value as a contraceptive. … Dioscorides, … recommended silphium for contraceptive and abortive purposes."* (TSCHANZ 2003), or *"The juice appears from many descriptions in Pliny and in medical writers such as Soranus and Dioscorides to have been widely known as a contraceptice or abortifacient … Riddle has pointed to enough evidence to confirm that the contraceptive functions of laser-juice were important enough and well enough known among the learned and sophisticated élite in Rome"* (FISHER 1996).

Taking all this into account, the antique texts about medicinal uses of true Silphion and its products do not provide any proof for hypotheses about a prominent role of Cyrenaic Silphion as contraceptive or abortive agent. Just the opposite is evident – no special effect of the Cyrenaic Silphion regarding abortion or contraception is deducible from the ancient authors mentioned by RIDDLE (1992).

RIDDLE and co-authors also use the interpretation of an image on a tetradrachm from Cyrene to underline their theory of the eminent importance of Cyrenaic Silphion in the context of birth control: "… *Its connection to reproduction is suggested by the iconography used on the Cyrenian four-drachma coin: A seated woman's left hand points to her genital area, and her right hand touches a silphion plant." and state from this: "We know that silphion was valued as contraceptive from both objects and writings of the day."* (RIDDLE & WORTH ESTES 1992). The coin from the Cyrenaica is dated 570-480 BC and shows the sitting nymph Cyrene (symbolizing the city) pointing to a Silphion plant with one hand. The other hand, however, is not pointing to anywhere,

but just lies on her lap as it happens when one is sitting. Any interpretation beyond that is more than speculative as is the suggestion of a "contraceptive theme" in that coin.

Silphion – an aphrodisiac?

In recent publications (e.g., KOERPER & KOLLS 1999, KOERPER & MOERMAN 2000, KANDELER 2003) Silphion images on Cyrenaic coins are interpreted as advertisement for Silphion as compound of love potions or aphrodisiacs. KOERPER & MOERMAN (2000) write that coins from the Cyrenaica indicate *"Cyrenaic juice as an effective ingredient of love potions."* KOERPER & KOLLS (1999) re-interpret the coin with the sitting nymph Cyrene already mentioned above "... We propose that this is just as likely to have been an erotic motif whose metaphoric reference was fertility rather than the anti-fertility theme suggested by Riddle".

A symbol for love and sexuality is seen by some authors in the so-called "heart-shaped" fruit of Silphion on many coins from the Cyrenaica. FAVORITO & BATY (1995) hypothesize that the heart-symbol has survived from the antiquity through the Roman "lupercalia" (a feast celebrated during times of Roman heathenism) and the medieval age until St. Valentine's Day. They ignore the fact that the St. Valentine's type of heart as a symbol for romantic love was first used in Victorian times, and was not known in antiquity. KOERPER & KOLLS (1999) as well as KOERPER & MOERMAN (2000) doubt the "heart-shape" to be a realistic image of the Silphion fruit. KOERPER & KOLLS (1999) even go further by stating that *"…The fruits or seed pod … is testicular (realistic to cordiform) in morphology ... We do not interpret the cordiform element as naïve, but rather … it is the result of a conscious effort to mimic testicles."* and *"Such fiction was abetted by the fact that overseas consumers obtained a processed product … certain aphrodisiacs of antiquity that were prepared of plant parts resembling male genitalia."*. KOERPER & MOERMAN (2000) come to similar conclusions: *"… The seed pods – look like testicles – sometimes they look rather realistic, but sometimes more heart-shaped"*.

The real interpretation of the form of the fruits is much less poetic. First of all, the fruits are not heart-shaped, but inverted heart-shaped (some authors obviously have not even oriented the coins correctly!). And regarding the botanical facts, already OERSTED (in STRANTZ 1909, p. 176f.) correctly wrote that the coins show, quite realistically, two winged mericarps (half-fruits) of an Umbelliferae still connected at the basis, resulting in an inverted heart-shaped appearance. Such fruits do exist in several extant members of the family. Thus all the above cited speculations as well as a phallic interpretation of the Silphion plants on Cyrenaic coins found, e.g., in Koerper & Moerman (2000) *"…evoke images of an erect penis"* are obsolete in the light of the real botanical facts.

KOERPER & KOLLS (1999) as well as KOERPER & MOERMAN (2000) admit that there is not a single antique text directly mentioning Silphion as an aphrodisiac.

Finally, Silphion motifs are unlikely to have advertised an aphrodisiac in the Roman Empire three centuries after having disappeared from the Cyrenaic coins.

Wrong botanical identifications

Quite exhaustive descriptions (most importantly those of Theophrast and Pliny the Elder) and the images on the coins limit the identification of Cyrenaic Silphion to a Ferula species or a taxon nearly related to this genus from the Umbelliferae. The more surprising are other views found in recent literature. One repeatedly occurring error is the classification of Silphion into the Asteraceae, most probably caused by Linnaeus, who, in 1737, newly attributed the Latin name "Silphium" to a genus of North American Asteraceae. This Silphium has nothing to do with the Silphion of ancient times, but obviously creates confusions for non-botanists. More problematic are some chapters in the German standard literature for the etymology of plant names (GENAUST 2005). GENAUST doubts that Silphion is an Umbelliferae (i.a., because of an assumed bad taste of *Ferula asafoetida*) and associates it with the Asteraceae genus *Artemisia*. Such considerations not only contradict the information from historical texts and images. Genaust also should have noted that Theophrast (h. pl. VI 1, 6) distinguished Silphion from "abrotanum", an Artemisia species of the deserts of Libya.

All hitherto published attempts to identify Cyrenaic Silphion on species level are unsatisfying or erroneous. This refers to speculations that *Ferula asafoetida* (source of Silphion substitutes) might also have been the source of the Cyrenaic Silphion. Ideas of earlier botanists that this species could have occurred in the Cyrenaica are not shared by the most recent floristic literature for the region (JAFRI 1985). The newest reports about the rediscovery of Silphion in the Cyrenaica are all based on work of the Italian botanist ANTONIO MANUNTA from Urbino. He discovered *Cachrys ferulacea* (= *Prangos ferulacea*) in the Cyrenaica and thought it to be the Cyrenaic Silphion (MANUNTA 1996). But his arguments are not convincing: He does neither use nor cite any ancient written source; only referring to the Dioscorides-translation of Matthioli of 1568. He wrongly interprets Dioscorides' report of the distribution area of Silphion and notes the match with the distribution of *Cachrys ferulacea*. But Dioscorides did not distinguish

between the different Silphion types and his distribution data refer to all of them together. MANUNTA's comparison of botanical characters is incomplete. He only compares characters of the coins and does not consider any character mentioned in ancient written sources. He only compares to *Cachrys ferulacea* and not to any other large Umbelliferae. Including these data and taxa makes it obvious that the Silphion characters (e.g., the reported size of the ancient plant) fit much better to *Ferula* species than to *Cachrys ferulacea*. It is also interesting that MANUNTA (1996) cites GEMMILL (1966) but does not mention Gemmill's note about *Prangos ferulacea* being identical with the ancient Magydaris. Magydaris, however, was clearly distinguished from Silphion by the ancient authors. This is another strong argument against the identification of the Cyrenaic Silphion with *Cachrys ferulacea*.

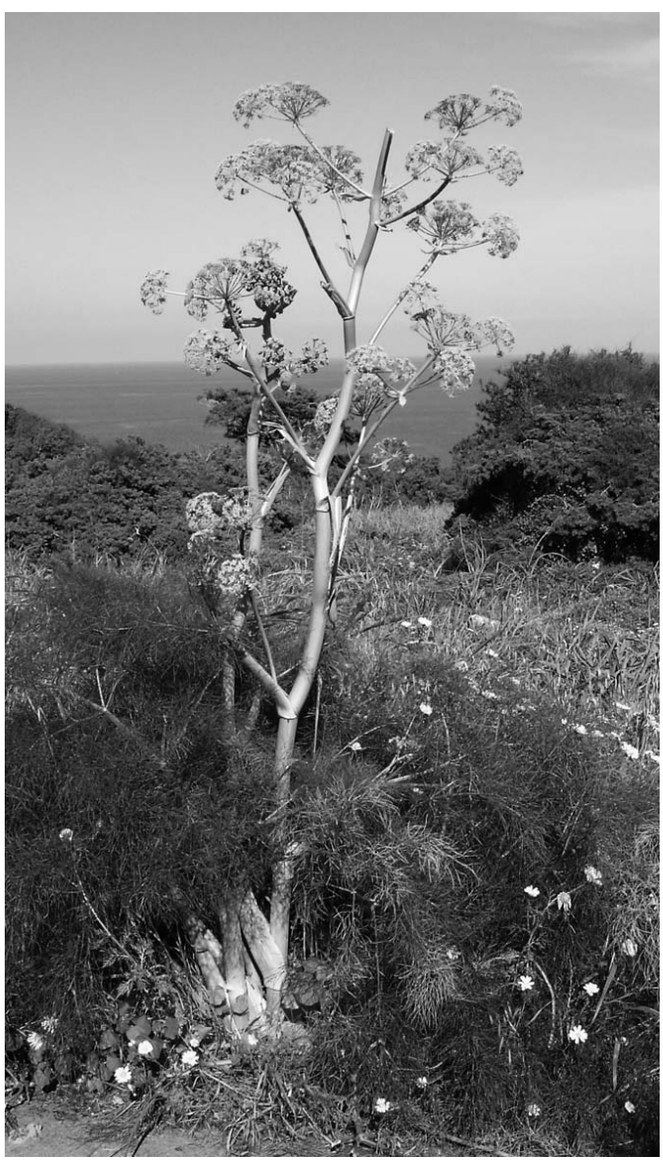

Figure 3. *Ferula communis*, a relative of Cyrenaic silphion widespread in the Mediterranean (Photo: M. KIEHN, Cyprus 2005).

Closing remarks

The present studies clearly show that many so-called facts about Silphion are the results of misinterpretations or wishful thinking rather than being based on objective evidence. This holds true for most floral ornaments brought in connection with Silphion, and also for some hypotheses, e.g. that ancient practises of birth control or moral concepts of the rising Christianity have caused its extinction. Up to now all attempts to identify a modern Umbelliferae as the Cyrenaic Silphion have failed, as there is no Umbelliferae native to Libya exhibiting all characters reported for the ancient plant. The ongoing research on this subject, however, shows that it seems difficult to accept the extinction of this enigmatic plant, a fact already indicated by Pliny the Elder nearly 2,000 years ago (Plin. nat. XIX, 39): *"It has not been found in this country for many years … as far as I remember only one plant was found and sent to Emperor Nero"*.

Thus Silphion really seems to be the first useful plant having become extinct by overharvesting, trade, and profit making – this way also being well suited as logo of the MPSG.

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Taxon File

On the history, botany, distribution, uses and conservation aspects of *Nardostachys jatamansi* in India

Niranjan Chandra Shah

Nardostachys jatamansi (D. Don) DC. is a well known medicinal plant from the Kumaon Himalayas, the Central and Eastern Himalayas, and the Sino-Indian Himalayan regions. Dealing with its systematic, WEBERLING (1975, 1978) considered all the species found in the Indian and Sino Himalayas, namely *N. grandiflora* DC., *N. chinensis* Batalin and *N. gracilis* Kitamura as morphological 'types' falling within the range of *Nardostachys jatamansi* (D. Don) DC. In this paper, we follow this view and all discussions will be made on *Nardostachys jatamansi* (D. Don) DC.

Botanical naming of *Nardostachys jatamansi* (D. Don) DC. has an interesting story worth to be reviewed. In the year 1790, Sir William Jones, the famous orientalist, discovered that 'Nardus' of the Greeks, the 'Spikenard' of the Holy Bible, 'Sumbul-e-Hind' of Persians and Arabians, and 'Balchar' of India all are 'Jatamansi' of Sanskrit. He received a specimen from Bhutan under the name 'Jatamansi'. Unfortunately, it had two portions of two different plants. The aerial portion was of *Valeriana jatamansi* Jones (= *Valeriana wallichii* DC.) and the root stock portion of *Nardostachys jatamansi* (D. Don) DC. In 1835, Jones named this specimen "*Valeriana jatamansi*". In 1795, Roxburgh added more confusion by publishing an illustration on the basis of this 'specimen' under the name *Valeriana jatamansi*. The error was detected by D. Don in 1821 who procured a specimen of true 'Jatamansi' and described it again, first as *Valeriana jatamansi* and then as *Patrinia jatamansi.* Later, in 1830 De Candolle created the new genus *Nardostachys* and classified it under the name *Nardostachys jatamansi*, he also described another species, *N. grandiflora.*

A number of authorities have considered *N. jatamansi* and *N. grandiflora* as two distinct species accounting on the difference in the infloresences. However, WEBERLING (1975) concluded that not only *N. jatamansi* but also *N. chinensis* Batalin and *N. gracilis* Kitamura fall within the range of variability of *N. grandiflora*, and suggested a study of the environmental factors in which the genus *Nardostachys* grows should be undertaken. *Hara* et al. (1978) and HARA & WILLIAMS (1979) supported this view.

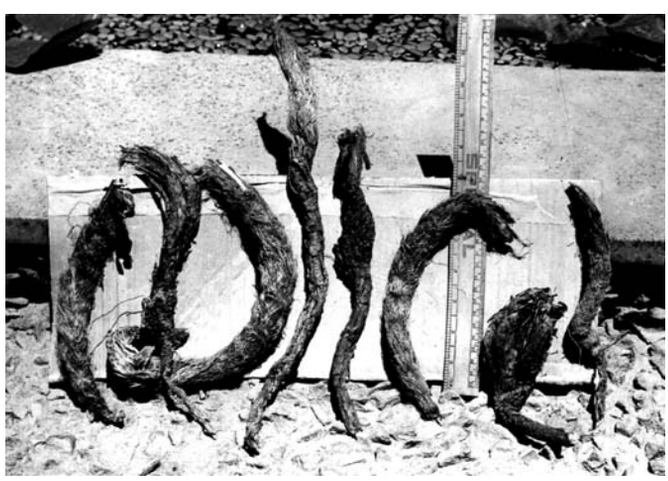

Figure 1. *Nardostachys jatamansi* rhizome with a scale to asses its size. (Photo: N.C. SHAH).

Botany of *Nardostachys jatamansi* (D.Don) DC. syn. *N. grandiflora* DC (Royle)

The morphological characters of *Nardostachys jatamansi* (D. Don) DC have been described in detail by WEBERLING & ENGEL (1975). *Nardostachys jatamansi* is a perennial herb with a stout un-branched or sparsely branched, woody, aromatic rhizome covered with reddish brown thick fibers of remnants petioles of withered radical leaves with a single long tap root with 2-7 rhi-

zomes, some time up to 12. Its thickness and numbers depend on the type and age of the plant. It is so aromatic that when up-rooted from the soil by hand its sweet fragrance is absorbed in the palm.

In nature, the plant is generally found clinging on to steep rocky cliffs and grassy slopes, somewhat lithophilous, and is also reported to be found in wet meadows and by the banks of the rivulets in the high valleys and tops ranging from 3,000 - 4,000 m. Flowering: July to August, Fruiting: September to October.

Ecoprofile and phenology in Uttarakhand: Clinging on to steep rocky cliffs and grassy slopes, occuring at altitudes from 3,000 - 4,000 m in wet alpine rocky meadows associated with *Anaphalis* sp., *Picrorhiza kurrooa, Bergenia stracheyi*, and sometimes growing in the shade of *Betula* sp.

Adulterants of Jatamansi

It is quite interesting to note that since long time adulterants of *Nardostachys jatamansi* are being sold in the crude drug market, such as the rhizomes of *Selinum vaginatum* and *S. candollei*, which very much look alike the rhizomes of *Nardostachys jatamansi* and are used knowingly or unknowingly under the name 'Bhutkeshi' or 'Nakli-Jatamansi' (False jatamansi). The adulterants are cheaper in value. In *Nardostachys jatamansi* the rhizome is covered with reddish brown fibres and has sweet aroma, while the rhizomes of *Selinum vaginatum* and *S. candollei* are covered with bristly dirty brown fibres with a pungent and unpleasing aroma. A good account of pharmacognostic (anatomical), macroscopic, and microscopic study only of *Selinum vaginatum* as an adulterant of Jatamansi, and genuine *Nardostachys jatamansi* material has been described by MEHRA & GARG (1962) and MEHRA & JOLLY (1963).

Distribution

Information about the exact locations where the species is reported to occur in wild state recorded on the herbarium specimens lodged in different herbaria (Royal Botanic Gardens Kew [U.K.]; Arnold Arboretum of Harvard University [USA]; Central Herbarium B.S.I. Howrah [Calcutta], The Botanical Survey of India, Northern Circle, [Dehradun]; Forest Research Institute Herbarium [Dehradun] and the Regional Research Institute (Ayurveda) Tarikhet [Ranikhet]) was collected by the author since 1972. Additional distribution information was taken up from UNIYAL (1977: 119), KUMAR et al. (1997: 145), and NAYAR, S.L. (1957).

The distribution within India has been collected and presented here as a synopsis. Outside the Indian territory the distribution is not presented in detail. The following number of Jatamansi locations have been identified in Central Himalayas (Nepal): 2, Eastern Himalayas (Bhutan): 7, North East Himalayas and Sino Himalayas (Tibet): 15, China: 39, and Myanmar: 2.

• Indian Himalayas

In the Himalayas it was first reported to occur above 3,300 m in Kedarkanta (Uttarkashi), Shalma (Bhutan?), and Gossainthan (Nepal). ROYLE (1839) for the first time mentioned its occurrence on the high ridges separating the Jumna valley from that of the Ganges. He reported the plant to be quite common and that it was found far above the limit of forest vegetation between 3,600 to 4,000 m. It was also quite common throughout Tehri Garhwal at suitable elevations.

However, in India it is reported from the Western Himalayas to the Kumaon Himalayas in the districts Uttarkashi, Tehri, Rudraprayag, Chamoli (in Garhwal), Bageshwar & Pithoragarh (in Kumaon); from the Eastern Himalayas in the districts Sikkim and Arunachal Pradesh (Northeast Frontier Agency – NEFA).

• Kumaon Himalayas

Uttarakhand (Garhwal): Dist. Uttarkashi: Gangotri (1897), Keshavananda (det. Weberling 1963), Damodar valley, Nilanga valley (J.F. Duthie 1883), Jadhganga valley; **Dist. Tehri:** Bhillangana valley, Pawalikanta, Tali, Kankoliakhal, Shahastratal, Khatling, Bhagirathi valley (Dyara, Gangotri), Kushkalyan; **Dist. Rudraprayag:** Kedarnath (Drummond 1881), Mandkini valley, Chorabarital (Kedarnath), Hathini, Madhyamaheshwar[1], Gangotri: Bhagirathi valley Dyara, Gangotri: Jadhganga valley; **Dist. Chamoli:** Tungnath[1], Rudranth Amrit Ganga valley, Bhuna[1], Brahmatal, Hemkund, Badrinath (Osmaston), Tungnath Chorpatangni, Ramni, Guppa Bugyal, Chorpata, Jawara, Kham area, Mannai area, Luwani, Manguchatti, Hanumanchatti, Mandal (possibly from Forest nursery), Nanda Devi Sanctuary[1], Chipla, Bhaakhan, Traindyar Amrit Ganga valley, Bhatiakhan, Niti Valley, Pindar par Reserve, Palangadh, Alaknanda valley, Hemkunda, Vasudhara, Dhauli valley, Niti pass.

Uttarakhand (Kumaon): Dist. Bageshwar: Gopain (?) (Wallich 1829), Pindari, Furkia Pindari and Pindari bugyial, Kafni and Chattaria glacier; **Dist. Pithoragarh:** Ralam (Strachey & Winterbottom), Panchachuli (J.F. Duthie 1885), Kuti valley East, Tejam, Haya, Khankhaliadhar, Ralam valley Chipla, Kuti, Yanki Valley, Byans, Patangadh (?) Balati glacier, Laspa, Balinga, Bhatiakhan.

[1] These localities have also been visited by the author who noted the occurrence or collected the specimen during the years 1967-1968, 1974, and 1982, respectively.

Sikkim: Sikkim (?) (Hooker), Le-lap-lo, Ichu-Zen (King 1877), Sikkim Alpine (Elwes 1877), Lachen, Jongri region (J.D. Hooker 1849), Jongri (C.B. Clarke 1875), Shonak (G.H. Cave 1947), Natula to Champitang, Tsomgo.

Arunachal Pradesh: No clear cut information about the locations is available from this region. However, it is reported that it is known as 'Posh' and used by the local tribal 'Monpas' as incense (Dam and Hajra 1981).

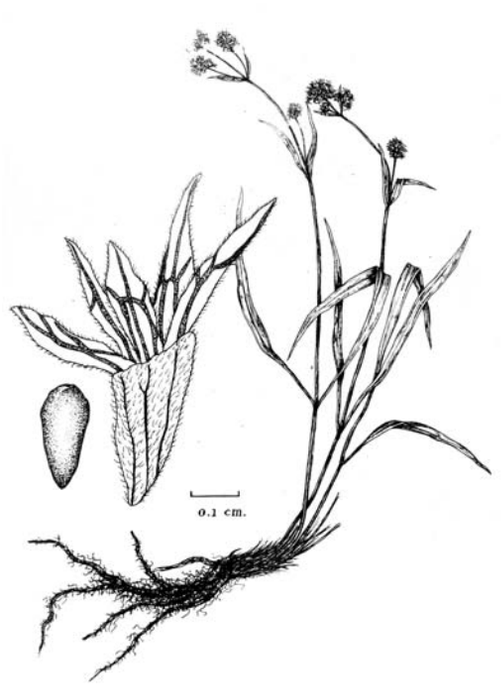

Figure 2. A sketch of seed, fruit and whole plant of *Nardostachys jatamansi* with infloresence, leaves and rhizome with root (Line drawing from Ph D.Thesis, N.C. SHAH, 1987).

Confusing reports on distribution

There is some wrong information given in an official Indian publication on the distribution of *N. jatamansi*, where it is stated to be distributed in Pakistan and Punjab (ANON. 1996). This statement is not evidenced by any documentary proof from any of the herbaria of the world, it is also not mentioned in the Annotated Catalogue of Pakistan (STEWART 1972). In the past, the species was reported as a minor forest product in Punjab Himalayas or Himachal Pradesh (H.P.), but actually, the species does not occur in H.P. However, in earlier days it was collected from the Harki-doon area of Uttarkashi (Uttarakhand), from where it was brought by traders who had crossed the river Tons. The forest officials of H.P., however, regarded it as their own minor forest product and charged the octoroi (entry tax).

Nardostachys jatamansi propagates by means of underground rhizomes for very limited distances or by the dispersal of winged fruits over long distances by winds. The fruit is winged as shown in figure 2 and matures from October to November being dispersed by high mountain winds. Topographically, the Kumaon Himalayas in Uttarakhand are separated from the Punjab Himalayas by the west defile of river Satlaj, and Himachal Pradesh is separated by the Tons river valley. These two river valleys are the main barriers in the dispersal of fruits of *Nardostachys jatamansi* towards the west of the Kumaon Himalayas (Uttarakhand). Not only because of the topographical barriers but possibly also the direction of high mountain winds blowing from west to north towards the Tibet Plateau during September to November the seeds are probably not dispersed towards the western side, i.e. Himachal Pradesh. Possibly this could be one of the reasons that *Nardostachy jatamansi* is not distributed in neighbouring Himachal Pradesh. This requires further detail study and investigation.

Present collection, trade, and conservation status

Earlier, *Nardostachys jatamansi* was reported to be very common in the Kumaon and Nepal Himalayan region, but now it has become rare due to exploitation by the local herb collectors and traders.

However, no information of its present collection and trade, availability and distribution record is available from Bhutan, Tibet, Yunnan (China), and from Myanmar.

From Uttarakhand, in the past, the plant had been so heavily exploited that its depletion and endangerment have been reported from time to time. For the first time it was cautioned for indiscriminate exploitation by SHAH (1975, 1981, 1983, 1987) and SHAH & KAPOOR (1978), TANDON (1997) and KUMAR et al. (1997). SHAH (1997b, 1998 and 1999) emphasized that *Nardostachys jatamansi* was much depleted in the Indian Himalayas and suggested its systematic cultivation. According to AIRI et al. (2000) it is a critically endangered plant species in the Kumaon region. In India it is listed as threatened species (JAIN & SASTRY 1980) and on the list of critical plants (BCPP 1996, MULLIKEN 2000, OLSEN 1999). BURFIELD (2003) has listed *N. jatamansi* in the list of unethical uses of rare and threatened plant and animal products since its essential oil and oleoresin is used.

In Nepal, a detailed study on *Nardostachys jatamansi* with accurate description of the plant, growth locations, uses, and other associated information that could help to establish permanent cultivation of the species was conducted (AMATYA & STHAPIT 1994). They expressed concern about over-exploitation of the species, calling for increased levels of cultivation and remarked that although export of the herb from Nepal itself was not allowed, there is no restriction on exporting oleoresin and essential oil, and the export volumes of these pro-

ducts are often inaccurately reported to avoid payment of Government taxes.

The trading of *N. jatamansi* reflects the high levels of commercial exploitation that also occurs with other Himalayan herbs like *Aconitum ferox, Picrorhiza kurrooa* and *Swertia chirata*. It is interesting to note that *N. grandiflora* is said to be often co-gathered with *Valeriana wallichi* (Indian Valerian) according to MULLIKEN (2000), and that published chemical compositions of essential oils from these species are similar. However, it is to note that export of *Nardostachys grandiflora (Nardostachys jatamansi)* is banned from Bhutan, Nepal and India (MULLIKEN 2000).

Legislation

Ban on collection in Uttarakhand: In 1985, a committee of experts was constituted by the Forest Department of U.P. The committee recommended the ban of 34 species for collection and marketing from Uttaranchal. *Nardostachys jatamansi* was one of the listed species under trade names 'Jatamansi' and 'Mansi', and was banned from all the Himalayan districts of Uttarakhand for a period of four years vide State Govt. Order no. 535/1-9-20 dated January 1986. This was the first serious step undertaken by any government for conservation, not only for 'Jatamansi' but also for other species, which were under threat in Uttaranchal.

Ban on export from India: In 1994, the Govt. of India, Ministry of Commerce, vide their circular Public Notice No. 47 (PN)/92-97 (Government of India 1994) prohibited the export of 56 plant species, "plant portions and their derviatives and extracts obtained from the wild". One item in the list was '*Nardostachys* species (Jatamansi)'. The list was further amended vide Notification no. 24 (RE-98)/1997-2002 (Government of India 1998). In this list only 29 plant species were prohibited for export and *Nardostachys* species was included under the name *Nardostachys grandiflora*. It creates confusion that in the first list all *Nardostachys* species were banned and in the latter list only *Nardostachys grandiflora* was banned. However, WEBERLING (1978) describes all species of *Nardostachys* as coming under *Nardostachys jatamansi*. Anyway, it was the right step though taken very late, and already the banned species are being exported under faulty export policies (SHAH 1997a).

After the ban imposed on export of *Nardostachys jatamansi* by the Government of India in the year 2002, the Government of Uttaranchal published a list of protected and banned medicinal plants (vide Government Order no. 761/van.gra.vi./2004-9(4)2001, dated 27 December 2004), in which *Nardostachys jatamansi* was also included.

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A dogmatic tradition posing threat to *Bombax ceiba* – the Indian Red Kapok tree

Vartika Jain, S.K. Verma & S.S. Katewa

Introduction

Burning of Holi – a religious tradition in India – has led to over-exploitation of *Bombax ceiba*, one of the important medicinal plant species, a member of the family Bombacaceae and a lofty, deciduous tree, found throughout India and other parts of tropical and sub-tropical Asia, Australia and Africa ascending the hills up to 1500 m. *Bombax ceiba* (Syn. *Bombax malabaricum*) is known by various names in different languages as Red kapok tree, Silk cotton tree (English), Semal (Hindi), Shalmali (Sanskrit), Bombax de Malabar (French), Indischer Seidenwollbaum (German), Mu Mien (Chinese) (CAIUS 2003, GRIN-CA Taxonomy Information). The plant is well mentioned in Ayurvedic literature for its medicinal value as well as highly reputed in ethnomedicine, used extensively both for humans and animals (JAIN 1991). It has been reported to be useful in gastrointestinal disorders, skin diseases, gynecological problems, bladder disorders, debility, diabetes, and impotence in man (GUPTA et al. 2004).

Besides being used as a medicine, it yields the vermin proof floss (Indian Kapok) which is used for stuffing life-belts, mattresses, upholstery, wadded cloth quilts, and padded surgical dressings. Timber of this plant is also used in match-industry, for planking ceilings, boats, shingles, toys, scabbards, coffins, well-curbs, brush-handles, et cetera (TARAKANADHA et al. 2006, GRIFFITHS et al. 2003).

Holi – A traditional Indian festival and the sacrifice of *Bombax ceiba*

Holi is a religiously coloured and traditionally deep-rooted festival of India. According to Narad Purana, this

day is celebrated in the memory of Prahlad's victory and the defeat of his aunt 'Holika'. The burning of Holika is celebrated as Holi or Holika-Dahan (Hindu Festival Celebration).

The myth

Hiranyakashipu, the mighty and arrogant king of demons enforced a law that everybody should worship him instead of God. But his little son Prahlad refused to accept his commands and continued to worship Lord Vishnu with complete devotion. Hiranyakashipu punished him in a variety of ways to change his devotional mind but he failed in his attempts. Frustrated by his failure, Hiranyakashipu invoked the help of his sister Holika, who had a boon that she can walk through the fire unharmed, to do away with his son. The wicked aunt agreed to the evil desire of her brother and entered the fire with her nephew Prahlad. By the grace of Lord Vishnu, the child Prahlad remained unharmed but Holika burnt and died instantly. Holi is thus celebrated to commemorate the death of the evil aunt, after whom the festival is named.

The custom of burning Holi is very old and so is employing the semal tree as the main Holi pillar. From east to west, the use of the sacred cotton tree in Holi is a must (CROOKE 1914). In north India, particularly the states of Rajasthan, Madhya Pradesh and Uttar Pradesh the whole silk cotton tree *(Bombax ceiba)* or a large branch of the tree is fixed in the ground one month before the Holi festival with dry grass tied over it. This is also a ceremonial event, when after cleaning and worshiping the land the prepared tree called Holi is grounded with sacred thread, coconut and vermilion. Once fixed, all the sacred ceremonies are restricted for the whole month till Holi is burnt.

It is interesting to note that Holi has been celebrated in the states where *Bombax ceiba* has also been found abundantly. Udaipur district, the study area under consideration, is surrounded by the Aravalli Hills. In the past, these hills were covered by dense forest, but with all the deforestation practices the hills are more or less barren now. The valleys like Chirwa, Kewada, Desuri, Ranakpur etc. near Udaipur are remaining pockets of *Bombax ceiba* with a continuously decreasing number of plants every year. To keep pace with the propagation of the tradition, every year thousands of trees are burnt in one day, which is jeopardizing the species' existence in nature.

Investigations in Udaipur (Rajasthan state) amongst people involved in Holi burning events (Figure 1) about the number of trees cut for the festival showed that in 2007 about 2000-2500 trees were cut in the city (sold at rates of 200-300 Indian rupees, i.e. 4-6 USD per plant).

The gravity of the situation can be assessed by extrapolating the number of Holi burning events in the villages of Udaipur district. There are 2393 villages in Udaipur district. If on an average in every village one Holi is burnt it may be estimated that around 2400 semal trees are sacrificed. This is just a rough estimate obtained from Udaipur district for one year only. However, taking into account that ten years ago every village had only one Holi, and that it presently increased to two- or three-fold, we can estimate a figure of around 7500 trees involved in the total villages in Udaipur division.

Presently, the number of semal trees has declined so much that people are selling other plant species such as *Ailanthus excelsa, Lannea coromandelica,* and *Nyctanthes arbor-tristis* in the name of Holi-Danda among the debarked stems of *Bombax ceiba.* Also against this background it surprises that not even the forest officials restrict cutting *B. ceiba* for the Holi tradition to help preventing this species from extinction.

Figure 1: One of the authors interacting with the person selling debarked *Bombax ceiba* stems in the city Udaipur, just one day before Holi festival (VERMA, 2007).

Impact of destruction of *Bombax ceiba*

Bombax ceiba has been the main shelter tree for honeybee colonies. Over-exploitation of this plant species for its latex has put it into an endangered species as seen in Maradavally forest area, Western Ghats, India (RAMAKRISHNAPPA 2003). This has also resulted in reduction of honeybee populations, which are the main pollinating agents in cultivated fields, and loss of pollinators has induced reduced seed set and dispersal of seeds. So, depletion of few species within a forest has caused a deleterious impact on the whole eco- and agro-ecosystems. A similar situation is being faced here in Rajasthan also because of its over-exploitation for the purpose of dragging the tradition ahead.

Bombax ceiba is an important nesting habitat of the endangered bird *Leptoptilos dubius* known as Greater Adjutant Stork, which favors this tree as its nesting habitat due to its height, canopy area, and considerable diameter at breast height. The last major reserve of *Leptoptilos dubius* lies in the town of Nagaon, near Guwahati, India, with a precious patch of Silk cotton trees. The decline of the stork population is the reflection of the continuing reduction in the availability of its nesting sites in general and over-exploitation of *Bombax ceiba* in particular, thus leading to loss of two important species, a rare stork and an important medicinal plant (SINGHA et al. 2002).

Even after banning of all kinds of clear-felling in the northeastern region of India since 1996 by the Supreme Court, the deforestation still continues as can be seen from a loss of 239 km^2 area of tropical moist deciduous forest in the Sonitpur district of Assam, India (SRIVASTAVA et al. 2002) with *Bombax ceiba* being the major plant species.

The need to conserve this plant is not limited to the Indian subcontinent but also other parts of the world. A study conducted in North Central Arnhem Land, Northern Territory of Australia has shown harvesting of *Bombax ceiba* for the artefact production. Wood carving is important for the Maningrida community, and some patches of the Maningrida region are subjected to considerable harvest impact. Developing arts and craft industries in this region may result in increased rates of *B. ceiba* harvest over time, which might threaten the future sustainability of this plant (GRIFFITHS et al. 2003).

A study from Parsa Wildlife reserve, situated in Central Nepal, revealed *Bombax ceiba* as one of the important and highly exploited species used for household purpose, subsistence income generation, and marketing within the reserve by the tribal communities (CHAUDHARY et al. 2002).

Strategies for conservation

Bombax ceiba is a multipurpose tree species which provides food, fodder, fiber, and fuel. For this reason, it is best suited for social forestry schemes and should be among those medicinally and economically important plant species to be cultivated and conserved. There is a need to create awareness among people and forest officials to avoid planting exotic ornamental species only, but start planting *B. ceiba*, the large, beautiful deciduous tree with a long life span, providing medicinal and environmental benefits for years.

The conservation strategies are directed towards strict restrictions on cutting this species for the sake of Holi burning and propagating the plant on large scale. The most important part of the conservation strategy is to make people aware about Bombax ceiba's various beneficial medicinal properties. There should be a joint venture of non-governmental organizations (NGOs), forest officials, local environmentalists, village heads, and teachers at the local school level showing the importance of the plant species, and trying to clear the dogma out of the minds of both urban and rural people. Moreover, complete involvement of all tribal communities who can be urged to replant the tree on a customary practice as their ancestors did is necessary. They should be told to harvest the plant on a sustainable basis while protecting it for the future.

In the direction of awareness, group meetings, table talks and workshops could be arranged among rural and urban people. School staff and children should be made aware of its importance during school environmental weeks by organizing various quizzes and competitions such as essay, debate, poster and slogan competition on *Bombax ceiba* etc. Every year in the month of February (before the Holi festival), a rally should be arranged in rural areas with banners and slogans depicting the importance of this plant and restricting its use during Holi festival.

People can be taught about alternative material which may be used for Holika-Dahan or else only a small twig of *Bombax ceiba* can be used symbolically conserving the tradition. Moreover, increasing numbers of burning Holi even at a very short distance should be checked by making laws to burn Holi only at some fixed places of the city and village, thus avoiding unnecessary cutting of tress in large quantities. A strict law regarding replantation or banning the cutting of *Bombax ceiba* at the occasion of Holi festival upon local people can be enforced by judiciary or local village governing bodies (panchayats). In this context, the plant has got legal protection by the Ministry of Population and Environment in Nepal by strictly banning transportation, export and felling of *B. ceiba* for commercial purpose (MOPE 2001). This is a rewarding step towards *B. ceiba* conservation strategies and the same can be enforced in India especially in the states of north, west and central India, where this traditional cutting is mostly prevalent.

Interestingly, the plant is also useful for reclamation of wastelands and mine spoils, so it can be utilized by planting in those areas to improve the barren soil and to gain economic benefits, species propagation and soil conservation (VYAS & BANSAL 2004). As the natural propagation through seeds is low and the large-scale propagule production of this plant is difficult, large scale in situ and ex situ conservation techniques should be employed for preserving this plant for the future. Efforts have already been started in the direction of ex situ conservation by the Forest Research Institute, Dehradun

(Uttaranchal) to protect the important medicinal plant species (ARYA & AGRAWAL 2006). Biotechnology should be used to propagate and conserve this species in a short time period as shown by CHAND & SINGH (1999) and VYAS & BANSAL (2004).

In a word, one should strictly restrict the illogical cutting and burning of this plant during Holi festival, and people should be made aware of its medicinal importance, ecological benefits and economical gains. The above-proposed strategies for its conservation, if strictly followed, can invariably lead to its survival and propagation thus benefiting humanity for years to come.

Acknowledgement

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Estudio de mercado y sustentabilidad de la recolección silvestre de bailahuén, una planta medicinal chilena

Hermine Vogel, Benita González, José San Martín, Iván Razmilic, Pablo Villalobos & Ernst Schneider

Introducción

Bailahuén es una planta medicinal de amplio uso en Chile. A pesar de que oficialmente corresponde a la especie *Haplopappus baylahuen,* hemos encontrado que en las diferentes regiones se recolectan y usan otras especies del mismo género, como *H. multifolius* o *H. taeda,* botánicamente descritos en REICHE (1902), HALL (1928) y MUÑOZ et al. (1981).

La producción de bailahuén se obtiene exclusivamente de material recolectado de plantas silvestres, las cuales habitan lugares específicos en la Cordillera de los Andes. Su distribución es muy limitada, por lo que se inició este estudio para desarrollar un método de producción sustentable. A pesar de ello ninguna de las especies ha sido incluida en la lista de clasificación de las especies (MUÑOZ & SERRA 2006).

En el presente trabajo se identificaron las especies ofrecidas en el mercado interno, se estimó el volumen co-

mercializado a nivel nacional en base a encuestas y se estudió las posibles aplicaciones y posibles clientes extranjeros de bailahuén. Paralelamente se estudió la existencia de poblaciones naturales y la tasa de recuperación de plantas silvestres después de la recolección.

¿Qué especies de bailahuén y cuánto de cada una se comercializan en el mercado interno de Chile?

Con el fin de estimar el volumen de bailahuén comercializado en el mercado interno se visitaron las principales comunas de las regiones III, IV, V, VIII y Metropolitana, donde se entrevistó a un total de 144 informantes calificados a nivel de ferias, mercados mayoristas, negocios establecidos, farmacias, vendedores callejeros y otros (Cuadro 1). Se consultó sobre los precios y volúmenes de venta y compra. Esta información fue difícil de obtener, ya que los entrevistados evitan darla a conocer, no la recuerdan, no la manejan o entregan información errónea. En estos últimos casos se hicieron las correcciones correspondientes, ya sea por inspección directa o por la comparación

Cuadro 1. Número de locales entrevistados por Región que venden bailahuén.

	Regiones					
Tipo de local	**III**	**VI**	**V**	**RM**	**VIII**	**Total**
Bodega	0	1	2	10	0	**13**
Botica naturista	0	1	1	1	0	**3**
Casa particular	5	6	6	2	0	**19**
Farmacia	0	2	5	1	0	**8**
Farmacia Homeopática	4	2	0	0	0	**6**
Laboratorio	0	0	1	2	0	**3**
Local ciudad	3	9	8	15	1	**36**
Puesto callejero	3	3	2	2	3	**13**
Puesto feria	6	12	0	7	18	**43**
Total	**21**	**36**	**25**	**40**	**22**	**144**

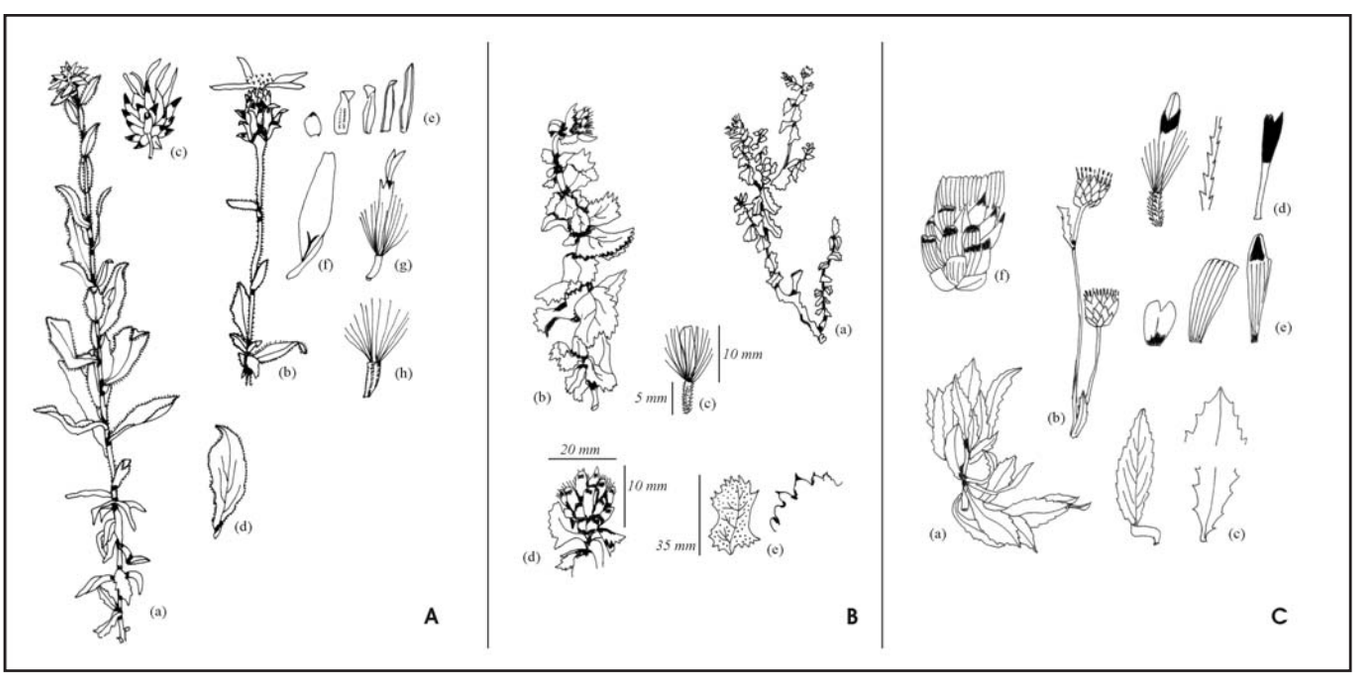

Figura 1. *Haplopappus baylahuen, H. multifolius* y *H. taeda* (dibujos J. San Martín, 2007).

A *Haplopappus baylahuen*

(a) Tallo con hojas e inflorescencia; (b) Eje floral; (c) Capítulo; (d) Hoja de la parte media del tallo; (e) Brácteas; (f) Flor ligulada; (g) Flor tubulada; (h) Aquenio.

B *Haplopappus multifolius*

(a) Forma de la ramilla; (b) Posición de las hojas en la ramilla; (c) Fruto (aquenio); (d) Inflorescencia (capítulo); (e) hoja.

C *Haplopappus taeda*

(a) Hojas basales; (b) Vara floral; (c) Hoja con detalle ápice y base; (d) Flor, vilano y corola; (e) Bráctea exterior, bráctea intermedia, bráctea interna; (f) Capítulo.

Cuadro 2. Estimación del volumen de bailahuén comercializado en el mercado interno de Chile en base a encuestas realizadas en las regiones III, IV, V, R.M. y VIII.

Tipo de local	Promedio venta mensual (kg)	Número de locales encuestados	Venta mensual por tipo de local (kg)
Bodega	74,3	13	965,9
Botica naturista	2,0	3	6,0
Farmacia	2,0	8	16,0
Farmacia	0,9	6	5,4
Laboratorio	32,9	3	98,7
Local ciudad	5,0	36	180,0
Puesto callejero	2,0	13	26,0
Puesto feria	4,1	43	176,3
Recolector a consumidor final	4,2		4,2
Recolector a intermediario	39,6		39,6
Venta mensual total en las comunas encuestadas *			1.518,1
Venta anual en comunas encuestadas			18.217,2
Estimación de consumo anual de 15 milliones de Chilenos **			**23.322,0**

* las comunas encuestadas tienen un total de 7,03 millones de habitantes
** el valor estimado corresponde al 60% del valor total, debido a que un 80% del consumo en regiones proviene de la Región Metropolitana y podría figurar en ambos registros

con los informes de los proveedores o compradores.

Un detallado análisis del volumen comercializado a nivel nacional se encuentra en el cuadro 2.

Las muestras compradas en 132 puntos de venta entre las regiones III y VIII se sometieron a un análisis de cromatografía en capa fina descrito por González (2003) y Vogel et al.(2005a) para su identificación. Los diferentes patrones de cromatogramas permiten claramente atribuir el material vegetal analizado a una de las especies descritas por la composición química de sus resinas.

El estudio del mercado nacional de bailahuén indicó que el 80 % de las muestras de bailahuén corresponden a *H. multifolius* (Figura 1). *H. baylahuen* sólo fue encontrada en muestras de las regiones III y IV y *H. taeda* en la VI Región. Esta situación se debe a que *H. multifolius* crece en la Región Metropolitana donde se encuentran las acopiadoras que distribuyen su producto a todo el país. Por otra parte, *H. baylahuen* y *H. taeda* sólo se comercializan a nivel local. En la VII región se encontró que de los 40 comerciantes encuestados que venden bailahuén sólo el 20 % recolecta la hierba personalmente mientras que el 80 % la compran (Jiménez 2004).

Figura 2. Mapa de las regiones de Chile.

Uso de bailahuén fuera de Chile

Homeopatía

En Alemania, la única aplicación conocida de *Haplopappus* es como producto homeopático. La monografía de *Haplopappus baylahuen* figura en la Farmacopea Homeopática Alemana (HAB 2006). Su aplicación está asociada a síntomas de agotamiento junto con una presión sanguínea baja (Bundesanzeiger 1988, 1989).

Una encuesta de fabricantes de fármacos homeopáticos indicó que este preparado no es de uso muy común. El único productor compra 40 kg de materia vegetal cada 10 años, lo que alcanza para elaborar un gran volumen de tintura madre, de la cual se producen principalmente diluciones D2 y D3. Esto explica la poca cantidad de *Haplopappus baylahuen* destinada a la homeopatía.

Compuestos químicos de *Haplopappus* spp. como productos naturales fisiológicamente activos

Las especies de *Haplopappus* recientemente están atrayendo el interés de los productores de cosméticos y de nutracéuticos. Este no radica en estructuras básicas para la síntesis de otros compuestos, sino en algunos compuestos menores de difícil acceso. Se trata de flavonoides estructuralmente parecidos a diosmetina y diosmina, compuestos de escasa presencia en la naturaleza (IVASHEV et al. 1995).

Diosmina se puede producir desde el compuesto hesperidina, abundante en cítricos. Sin embargo, no se trata de un compuesto natural sino semisintético, lo que, por razones de marketing, no es muy valorado.

Diosmetina se encontró en la especie chilena *Haplopappus canescens* (OKSUZ et al. 1981). En los tallos de *H. taeda* se encontró una nueva 3-acetoxyflavanona que se le parece estructuralmente (Figura 2).

Uso de diosmetina en la cosmética

En este ámbito existen patentes que mencionan plantas del género *Haplopappus*. Una de ellas indica un efecto sobre la pigmentación y, en especial, para la aplicación en caso de vitiligo, nombrando a *H. canescens* [Patente N° FR 2865132, Date 20050722, de OREAL (FR)].

Características de diosmetina y diosmina usadas en nutracéuticos

En otras patentes que describen efectos de diosmetina también se menciona a *Haplopappus* spp. Un extracto patentado de Asteridae inhibe en forma selectiva la actividad de COX-2 y/o aumenta la actividad de COX-1. Por su combinación con ácido boswellico se presume una aplicación en reumáticos [Patente WO2004052299 de SHAKLEE CORP (US)].

Otras patentes indican a diosmetina y sustancias derivadas para el tratamiento de insuficiencia venosa crónica y, junto con otros flavonoides, en caso de cáncer del colon, lo que coincide con una publicación de CIOLINO et al. (1998).

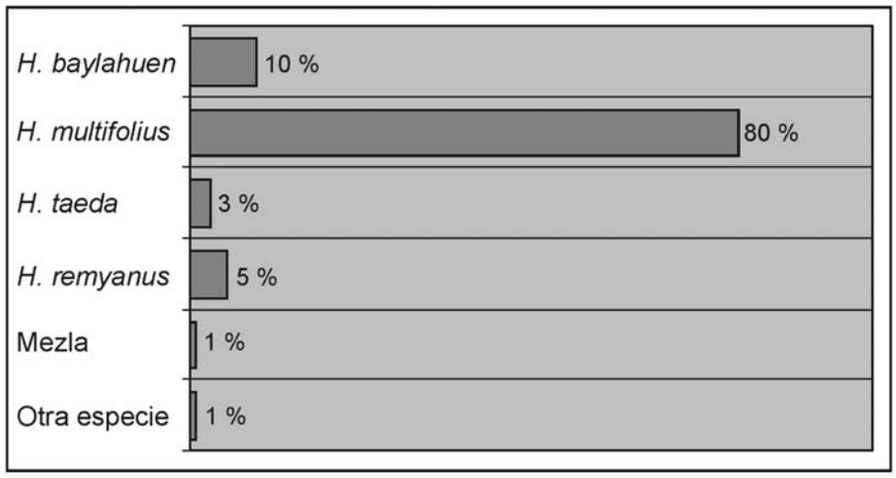

Figura 3. Identificación de las especies de *Haplopappus* comercializadas entre las regiones III y VIII como bailahuén.

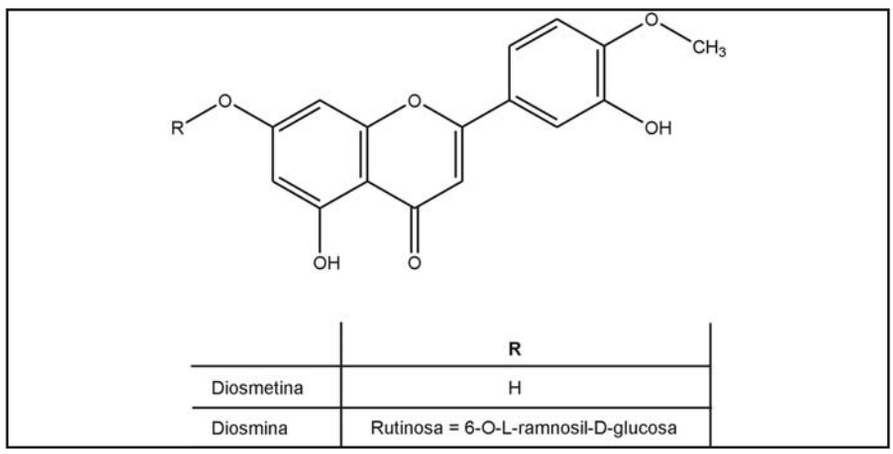

Figura 4. Comparación de las estructuras de diosmina y de su aglicón diosmetina.

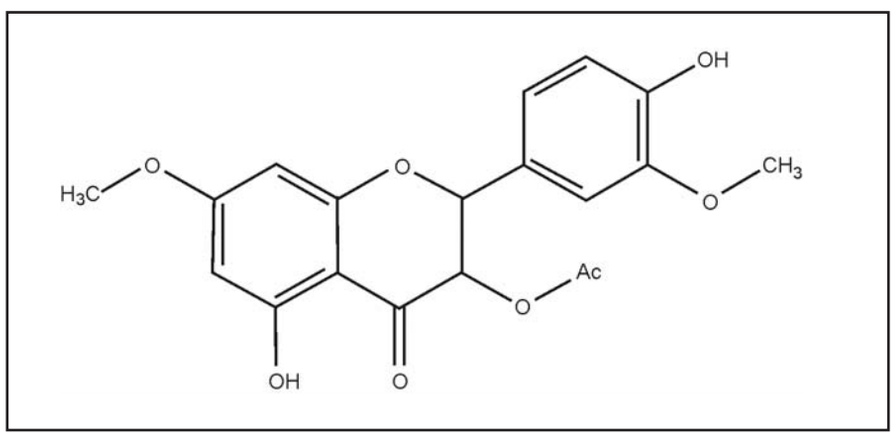

Figura 5. 3-acetoxiflavanona (MARAMBIO et al. 1989).

Además, se menciona a diosmina en el contexto de efectos fisiológicos de este grupo de flavonoides, desactivando radicales libres y actuando sobre la inflamación asociada a arteriosclerosis. Por esta razón la diosmina es el nutracéutico vascular de primera elección en el mercado estadounidense (SYMRISE 2006).

Para diosmina también están descritos efectos antiinflamatorios y protectores del cáncer de vejiga, esófago y

Cuadro 3. Ubicación geográfica, densidad poblacional y estado fenológico en las poblaciones estudiadas de tres especies de *Haplopappus.*

Especie	Lugares visitados	Regiones	N° parcelas (100 m²) estudiadas	N° plantas adultas/ha	N° plantas jóvenes	Regeneración % plantas jóvenes
H. baylahuen	10	III	60	1339	932	37 %
H. multifolius	2	V, RM	14	387	17	5 %
H. taeda	3	VI, VII	18	184	86	32 %

colon (TANAKA et al. 1997, YANG et al. 1997, CRESPO et al. 1999).

Existen fármacos registrados con diosmina que pertenecen a los fármacos vasculares por sus efectos tonificadores de venas, disminución de la permeabilidad capilar y antioxidantes (RITZMANN 2000). En Europa se comercializa una mezcla de un 90 % de diosmina y 10 % de hesperidina para esta indicación bajo el nombre DAFLON 500 mg (Servier, FR) (STRUCKMAN 1995).

El recurso: poblaciones naturales de *H. baylahuen, H. multifolius* y *H. taeda*

Para ubicar las poblaciones naturales de estas especies se recopiló información histórica sobre sitios de recolección en los Herbarios de la Universidad de Concepción y del Museo Nacional de Historia Natural de Santiago. Además, nuevos sitios fueron registrados en base a información de lugareños y en excursiones al área altoandina de Norte Chico y de Chile Central.

Las especies de *Haplopappus* usadas como bailahuén se distribuyen en la ladera occidental de la alta cordillera andina, ocupando áreas planas, laderas y en casos extremos material rocoso. La topografía modela la distribución de las poblaciones que se ubican en sitios aislados, resultando un modelo de distribución agregado y discontinuo.

Cada especie se circunscribe a un área definida del territorio (Cuadro 3).

La especie oficial, *Haplopappus baylahuen,* habita lugares de difícil acceso en la alta Cordillera de la Tercera Región de Atacama. Crece en lugares secos, pero las plantas sólo se desarrollan bien si tienen acceso al agua. Para dicha región existen quince registros en herbarios (Herbario de la Universidad de Concepción), de los cuales se revisaron ocho. En cuatro de ellos ya no se encontró la especie: Quebrada Codoceo, Quebrada de San Andrés, Camino Salar de Maricunga y Salar de Pedernales.

Haplopappus multifolius crece en la Cordillera de la V y Región Metropolitana (Santiago), entre los 1.000 y 2.500 m.s.n.m., donde es recolectada para abastecer el mercado nacional. Las poblaciones son escasas, sólo se encontraron dos sectores con presencia de *H. multifolius* que cubren sólo unas 40 ha con un número de 5.000 individuos estimados.

Haplopappus taeda crece en la Cordillera al Sur de Santiago, en la VI Región y en el límite norte de la VII. Se encontraron sólo cuatro poblaciones en áreas muy reducidas de no más de 30 ha y 22.000 individuos estimados. De ellas, las poblaciones de Termas del Flaco y Los Queñes por su cercanía geográfica, probablemente constituyan una sola.

Densidad poblacional y estado fenológico

Para estimar la densidad poblacional se aplicó el método de muestreo utilizado en estudios fitosociológicos clásicos basado en la selección de un sitio donde la población presente uniformidad fisiónomica y ecológica topográfica (KNAPP 1984). Para ello se establecieron parcelas de 100 m² (10 x 10 m) distribuidas al azar y equidistantes a una distancia mínima de 100 m. En cada parcela se contabilizaron todos los individuos.

La mayoría de las plantas estudiadas en las poblaciones naturales se encontraban en estado reproductivo. Sin embargo, en un 60 % de las poblaciones de *Haplopappus baylahuen* y en un 50 % de las de *H. multifolius* no se encontraron plantas jóvenes. Todas las poblaciones de *H. taeda* presentaron regeneración, aunque en un bajo porcentaje en el caso de Termas de Flaco, que es una población fuertemente intervenida.

Presiones

En general, las poblaciones son de difícil acceso por estar alejadas de los asentamientos humanos. Están expuestas a la influencia de ganado doméstico, como caprino y mular.

Por otra parte, en los sitios donde crece *Haplopappus baylahuen* la disponibilidad de agua está mermada debido al consumo por parte de empresas mineras y pueblos. Aún subsisten las poblaciones silvestres de esta especie, pero se observa muy poco crecimiento y un amarillamiento de las plantas, presentando sólo el 14 % de las hojas una coloración verde (Cuadro 4). Actualmente las poblaciones naturales de *H. baylahuen* son poco intervenidas por recolectores. Pero los caminos que construyen las empresas mineras, hacen cada vez más accesibles estos lugares.

H. multifolius es la principal especie comercializada en todo el país (Figura 1), tanto en puntos de venta formales como informales. Además de la sobreexplotación por parte de los recolectores, está sometida a una depredación por el pastoreo del ganado.

H. taeda es la especie de mayor volumen exportado. En el mercado nacional esta especie de bailahuén sólo se ofrece en los puestos de los hierbateros que la recolectan personalmente. En temporadas pasadas se recolectaron varias toneladas de materia seca.

En las tres especies se observa una baja producción de semillas y, en algunas poblaciones, un bajo porcentaje de reclutamiento. Una pobre regeneración y la ausencia de repoblamiento de las especies, sumados a una persistente extracción de material, hacen urgente la regulación en las colectas o una limitación de las mismas.

Cuadro 4. Biomasa media de tres especies de *Haplopappus* de recolección silvestre.

Especie	n	Peso planta entera (kg MS)	Porcentaje de hojas en la planta (%)	Hojas verdes del follaje total (%)
H. baylahuen	21	1,00 a	47 b	14,3 b
H. multifolius	10	0,28 c	46 b	51,9 a
H. taeda	8	0,59 b	83 a	47,9 a

Valores en las columnas seguidos por diferentes letras indican diferencia significativa entre las especies (Kruskal-Wallis, $p \leq 0{,}05$).

Propagación

La semilla de las especies *Haplopappus baylahuen, H. multifolius* y *H. taeda* germina sin dificultad. Sin embargo, en la naturaleza se encuentran frecuentemente frutos vanos o la parte reproductiva de las plantas consumida por el ganado. Estudios de propagación vegetativa mostraron un bajo porcentaje de enraizamiento de estacas (Vogel et al. 2005b).

El rendimiento de las especies por planta y el crecimiento anual que se refleja en el porcentaje de hojas verdes están descritos en el cuadro 4. Un ensayo de intensidad de intervención en la colecta reveló que la colecta total de la planta (poda al ras) conlleva a la muerte de un 60 % de plantas y, en los sobrevivientes, pérdida de la mitad de los brotes al cabo de un año y cerca del 12 % después de dos temporadas. Si se colecta solamente la parte apical de un 80 % de los brotes, la pérdida se reduce a un 36 % y 31 % después de uno y dos años, respectivamente. En cambio, al despuntar sólo la mitad de los brotes de la planta, la pérdida al año fue similar a la del testigo sin podar. Sin embargo, en ninguno de los tratamientos se recuperó el número de brotes durante los dos años después de la colecta.

El método recomendado para una recolección silvestre es la cosecha de la mitad de los brotes verdes en cada uno de los individuos. De esta manera, durante el año siguiente, se permite la floración y producción de semillas de la otra mitad de la planta que posteriormente puede ser cosechada, mientras que se recupera la parte cosechada el año anterior.

Por el alto nivel de consumo de estas especies silvestres (Cuadro 5) y por razones de la conservación del recurso se iniciaron estudios y actividades de capacitación de recolectores para el cultivo in situ con el fin de hacer de la recolección de bailahuén una actividad sustentable. De esta manera se dispondrá de una alternativa al cultivo ex situ para valorar y conservar la actividad tradicional de los recolectores y de las comunidades aledañas.

Cuadro 5. Estimación de plantas requeridas para satisfacer el mercado de bailahuén.

Especie	Porcentaje de bailahuén comercializado	Estimación volumen comercializado (kg)		Biomasa/Planta	N° de plantas
		en Chile	exportación		
H. baylahuen	10 %	2.332		1,00	2.332
H. multifolius	80 %	18.658		0,28	66.636
H. taeda	3 %	700	15.000	0,59	26.610

Colecta

La producción de bailahuén se basa exclusivamente en la colecta de plantas silvestres.

Para la estimación de biomasa por individuo se recolectaron cinco individuos de cada población en verano de 2005. El material vegetal fue deshidratado a temperatura ambiente bajo sombra.

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Conferences and Meetings

Coming up

Natalie Hofbauer

All websites viewed 13 November 2007.

↳ **Fourth meeting of the Conference of the Parties serving as the Meeting of the Parties to the Cartagena Protocol on Biosafety (COP/MOP-4).** 12-16 May 2008, Bonn, Germany.

and

↳ **Ninth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP-9).** 19-30 May 2008, Bonn, Germany.

Contact: Secretariat of the Convention on Biological Diversity • 413, Saint Jacques Street, suite 800 • Montreal QC H2Y 1N9 • Canada • E-Mail: secretariat@cbd.int • Website: www.cbd.int.

In Germany: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety • Robert-Schuman-Platz 3 • 53175 Bonn • Germany • Website: http://www.bmu.de/english/nature/un_conference_on_biological_diversity_2008/general_information/doc/39656.php.

↳ **Medicines from the Earth Herb Symposium.** 31 May - 2 June 2008, Black Mountain, North Carolina, USA.

Contact: Herbal Educational Services • PO Box 3427 • Ashland OR 97520 • USA • Tel. ++1/800/252-0688 • Website: http://www.botanicalmedicine.org/conferences/index.htm.

↳ **4th World Conservation Congress.** 5-14 October 2008, Barcelona, Spain.

Contact: IUCN • Rue Mauverney 28 • 1196 Gland • Switzerland • Tel. ++41/22/999-0000 • Fax ++41/22/999-0002 • E-mail: congress@iucn.org • Website: http://www.iucn.org/congress/2008.

CITES News

Uwe Schippmann

All websites in this article: viewed 30 November 2007.

Conference of the Parties

The 14th meeting of the Conference of the Parties (CoP14) was held 3-15 June 2007 in The Hague (Netherlands). It is interesting to note that, unlike CoP13 (see *MPC* 11: 38ff), only very few proposals for new inclusions into the Appendices had been put forward by member states. The majority of plant proposals that the CoP had to consider dealt with enforcement related changes of existing CITES species. This is also true for the medicinal plant issues that had to be dealt with at CoP14. A list of all amendments of Appendices I and II agreed at CoP14 is available at www.cites.org/eng/notif/2007/E022.pdf.

• Criteria for non-detriment findings

Upon export of CITES species, member states have to make a so-called "non-detriment finding" (article IV2a of the Convention), in other words, they have to assess whether the intended export is within sustainability limits. A scientific basis for making these findings still does not exist in detail. CoP14 has now asked the Plants Committee to develop principles, criteria and indicators for the making of non-detriment findings for wild specimens of high-priority taxa such as timber species, *Prunus africana* and other medicinal plants. To this end, a workshop on non-detriment findings is planned for 2008 which will be organised by the Mexican CITES authorities. The funding of this workshop is, however, not yet secured (see also www.cites.org/eng/dec/valid14/14_135-136.shtml).

• Agarwood-producing taxa

At CoP13 in 2004, the two genera *Aquilaria* (ca. 24 species) and *Gyrinops* (ca. 7 species) have been included in CITES Appendix II. The implementation of trade controls for these commodities poses a challenge for CITES authorities. CoP14 has now decided upon the following measures: (i) Member states involved in trade in agarwood should produce identification materials for all forms of traded products under CITES control. (ii) They should agree on which agarwood products should be exempted from CITES controls. Once agreed, a proposal for amendment of the current annotation for agarwood-producing species should be put forward to CoP15. (iii) A set of principles, criteria and indicators for the formulation of non-detriment findings for agarwood-producing species should be developed. (iv) A workshop aimed at strengthening the capacity of member states to implement agarwood-related decisions should be held before CoP15 (see also www.cites.org/eng/dec/valid14/14_137-144.shtml).

• *Taxus cuspidata*

At CoP13 in 2004, *Taxus chinensis, Taxus cuspidata, Taxus fuana*, and *Taxus sumatrana* were included in Appendix II based on evidence that the species were at risk of being over-harvested in the wild for the purpose of extraction of chemical derivatives used in the production of anti-cancer drugs (i.e., paclitaxel). Enforcement problems arose after this inclusion, because artificially propagated hybrids and cultivars of *T. cuspidata* are commonly used as landscape plants in North America and Europe, and constitute the vast majority of horticultural trade in *Taxus* specimens, e.g. the man-made hybrid *Taxus x media.* Under CITES, hybrids are subject to the provisions of the Convention even though not specifically included in the Appendices if one or both parents are included in the Appendices.

However, trade in such specimens has no effect on wild species and the use of artificially propagated hybrids, particularly for the production of paclitaxel, may even alleviate harvest pressure on wild species. Furthermore, trade in man-made hybrids places an unnecessary regu-

latory burden on CITES authorities and commercial plant producers and exporters. It was therefore proposed by the USA to exempt hybrids and cultivars of *T. cuspidata,* which occur almost exclusively as artificially propagated specimens. Since no agreement was reached, the issue was deferred to the Plants Committee which will discuss hybrids and cultivars and provide recommendations to CoP15 regarding their treatment under the Convention (see also www.cites.org/eng/dec/valid14/14_147.shtml).

• Trade review of seven Asian CITES medicinal species

Please refer to *MPC* 11: 38ff. for background information on this topic. It relates to the BfN funded TRAFFIC review on the status, use, trade, and trade controls for seven Asian medicinal plant species – *Cistanche deserticola, Dioscorea deltoidea, Nardostachys grandiflora, Picrorhiza kurrooa, Pterocarpus santalinus, Rauvolfia serpentina*, and *Taxus wallichiana.* Based on earlier reports by Germany (www.cites.org/eng/com/PC/16/E-PC16-10-05.pdf) which were endorsed by the Plants Committee, CoP 14 decided that the range states of these species should ensure the implementation of regionally coordinated actions to improve the management of and prevent illegal trade in the seven species, including, inter alia, measures to combat illegal trade, regional capacity-building workshops and the harmonization of regulations and legislation. Progress reports have to be submitted at the 17th and 18th meetings of the Plants Committee (see also www.cites.org/eng/dec/valid14/14_20.shtml).

• Annotations of medicinal plants in Appendix II

Please refer to *MPC* 11: 38ff. for background information on this topic. A review of the current Annotations for CITES listed medicinal plant species has been undertaken by the Plants Committee for several years. The MPSG has assisted greatly in this progress. At CoP14, a proposal to amend the annotations for medicinal plant species on Appendices II and III was tabled and accepted by concensus (www.cites.org/eng/cop/14/prop/E14-P27.pdf).

CITES medicinal plant species in Asia – treasured past, threatened future?

Teresa Mulliken & Uwe Schippmann

Introduction

Wild plant species form the foundation of healthcare practices throughout much of Asia. This is particularly true in the case of traditional medicine practices, including codified systems such as traditional Chinese medicine, Ayurveda, Siddha, Unani and Tibetan medicines, and more localised healthcare traditions. Asia's wild plants also form a critical component of 'modern' healthcare practices. Compounds such as reserpine from Snakeroot *Rauvolfia serpentina* and paclitaxel from Himalayan Yew *Taxus wallichiana* have important pharmaceutical uses in Europe, North America and more widely. Some medicinal species are also in demand for their aromatic properties, the use of the oil of Jatamansi *Nardostachys grandiflora,* for example, appearing in written texts dating back over a thousand years. Still others, including Red Sanders *Pterocarpus santalinus,* are also valued for their timber.

Wild plant species also form an important component of livelihood strategies in Asia, with wild collection of medicinal and aromatic plants providing a critical source of income in many areas. This is particularly true in areas such as the high alpine regions of the Himalayas, where agricultural outputs are low and there are few other opportunities for income generation.

The combined and in many cases increasing demand for Asia's medicinal plants and the consequent increase in the rate of collection are having a negative impact on the wild populations of many species, to the point that some species are now considered to be threatened with extinction. National governments throughout the region have responded by establishing various systems of collection and trade controls to bring wild collection within sustainable levels. Governments, non-governmental organisations and in some cases the private sector have also begun investing in cultivation of certain species to meet demand. In order to help ensure that international trade was both sustainable and in accordance with national legislation, member countries of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) have also established international trade controls for some Asian medicinal species.

Earlier reviews of the status, wild collection and trade of a number of CITES-listed medicinal plant species, including those mentioned above, found that implementation of collection and trade controls was generally low, and in some cases nearly non-existent. Not surprisingly, there were also indications of continuing declines in wild populations despite these regulatory efforts. In order to support efforts to improve the management and conservation of medicinal plant species in trade, in 2004, the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) contracted TRAFFIC to undertake a study of the status, use, trade and trade controls for seven Asian species (Table 1). Four of the seven, Elephant's Foot *Dioscorea deltoidea, Pterocarpus santalinus, Rauvolfia serpentina* and *Taxus wallichiana,* had already been reviewed by BfN as a contribution to the CITES Significant Trade Review

Table 1. CITES-listed medicinal plant species included in this review.

Taxa/life form	Distribution/habitat	Main part(s) used medicinally	Entry into effect of CITES listing; annotation at time of writing*
Cistanche deserticola Desert Cistanche (perennial parasitic herb)	China, Mongolia	Stems	19 July 2000 Annotation #1
Dioscorea deltoidea Elephant's Foot (deciduous perennial with annual climbing stem)	Afghanistan, Bhutan, Cambodia, China, India, Lao PDR, Nepal, Pakistan, Thailand, Viet Nam	Rhizomes	01 July 1975 Annotation #1
Nardostachys grandiflora Jatamansi (perennial herb)	Afghanistan (?), China, Bhutan, India, Myanmar (?), Nepal, Pakistan (?)	Rhizomes	18 September 1997 Annotation #3
Picrorhiza kurrooa Kutki (perennial herb)	India and Pakistan	Rhizomes	18 September 1997 Annotation #3
Pterocarpus santalinus Red Sanders (tree)	China (?), India, Pakistan (?), Philippines (?), Sri Lanka (?), Taiwan (?)	Wood	16 February 1995 Annotation #7
Rauvolfia serpentina Snakeroot (small, evergreen perennial, semi-shrub)	Bangladesh, Bhutan, China, Indonesia, India, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan (?), Sri Lanka, Thailand, Viet Nam	Roots	18 January 1990 Annotation #2
Taxus wallichiana Himalayan Yew (small evergreen tree or shrub)	Afghanistan, Bhutan, China, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, and Viet Nam	Bark and leaves	16 February 1995 Annotation #10

Annotation #1 designates "all parts and derivatives, except: a) seeds, spores and pollen (including pollinia); b) seedling or tissue cultures obtained in vitro, in solid or liquid media, transported in sterile containers; and c) cut flowers of artificially propagated plants".

Annotation #2 designates "all parts and derivatives, except a) seeds and pollen; b) seedlings or tissue cultures obtained in vitro, in solid or liquid media, transported in sterile containers; c) cut flowers of artificially propagated plants; and d) chemical derivatives and finished pharmaceuticals".

Annotation #7 designates "logs, wood-chips and unprocessed broken material".

Annotation #10 designates "all parts and derivatives except: a) seeds and pollen; and b) finished pharmaceutical products".

***** A proposal to amend the CITES annotations for these species was accepted by the 14th meeting of the Conference of the Parties to CITES (June 2007). As of 13 September 2007, the annotation for *Cistanche deserticola, Nardostachys grandiflora, Picrorhiza kurrooa, Rauvolfia serpentina* and *Taxus wallichiana* will be: "Designates all parts and derivatives except: a) seeds and pollen; and b) finished products packaged and ready for retail trade". The annotation for *Dioscorea deltoidea* will be "Designates all parts and derivatives, except: a) seeds, spores and pollen (including pollinia); b) seedling or tissue cultures obtained in vitro, in solid or liquid media, transported in sterile containers; c) cut flowers of artificially propagated plants; and d) fruits and parts and derivatives thereof of artificially propagated plants of the genus *Vanilla*." The annotation for *Pterocarpus santalinus* will be "Designates logs, wood-chips, powder and extracts."

process (SCHIPPMANN 2001). A further two, the Himalayan species *Nardostachys grandiflora* and Kutki *Picrorhiza kurrooa,* were previously reviewed by TRAFFIC under contract to the CITES Secretariat, also as part of the CITES Significant Trade Review Process (MULLIKEN 2000). That study also reviewed the trade in *Neopicrorhiza scrophulariiflora,* closely related and similar to *Picrorhiza kurrooa* and also referred to and traded as Kutki. The seventh, Desert Cistanche *Cistanche deserticola,* was listed in CITES Appendix II in 2000 and has not been the subject of a previous review.

The present study was led by TRAFFIC, working with the Species Programme of IUCN – The World Conservation Union. Research support was provided by TRAFFIC offices in East Asia and Southeast Asia, IUCN offices in Nepal and Pakistan, and independent consultants. Members of the IUCN/SSC Medicinal Plant Specialist Group and other experts generously contributed information. The texts of MULLIKEN (2000) and SCHIPPMANN (2001) were used as the starting point for the study, with researchers seeking to augment and update this information through a combination of literature reviews and web-based information searches, expert interviews and compilation and analysis of CITES annual report and Customs data. The resulting document, "Review of the Status, Harvest, Trade and Management of Seven Asian CITES-listed Medicinal and Aromatic Plant Species" (MULLIKEN & CROFTON, in press) is published by BfN as part of the BfN Skripten series and available in hard copy from BfN and electronically from the BfN and TRAFFIC websites.

Although the number of species studied was small, their diversity in terms of life forms, use and trade provides a useful basis from which to consider issues associated with Asia's medicinal plant trade more broadly. The following presents some of the overall findings based on a comparison of information available for the various species. Recommendations for addressing what appear to be generic problems associated with management of medicinal plant collection and trade, particularly in South Asia, are also provided.

Key findings

There is a growing body of work related to the use and trade of medicinal plants in Asia, with numerous NGOs, academics, government and intergovernmental agencies supporting and/or undertaking research. However, wider understanding of the domestic and international trade continues to rely primarily on the results of studies by NGOs and academics, with much of the work being very site specific. As a result, the information on both the species and trade is patchy. Research efforts appear to have been greatest in Nepal and India, with less work identified in other countries.

Status and threats

Somewhat surprisingly given their commercial importance and concerns regarding population declines, information on the status of the species throughout their range was generally limited. Information on declines and rarity appeared to be based largely on expert opinion, sometimes developed via Conservation Assessment and Management Plan (CAMP) workshops organised by members of the IUCN/SSC Medicinal Plant Specialist Group. Population surveys appeared to be limited to a small number of sites, with little evidence of more widespread surveys to determine the status of the species at either the country or the global level. This situation can be explained in part by the vast size and remoteness of the species' habitats. For example, the appropriately named *Cistanche deserticola* is found in arid areas in China and Mongolia, while *Nardostachys grandiflora, Picrorhiza kurrooa* and *Neopicrorhiza scrophulariiflora* occur across large areas of the alpine Himalaya.

Based on the information that is available, it appears that all seven species have declined in the wild owing to over-collection to supply domestic and foreign medicinal markets. As a result, all are also considered to be threatened with extinction in at least parts of their range, although only one, the tree species *Pterocarpus santalinus,* has thus far been reviewed and classified as globally threatened (Endangered) in the IUCN Red List. In some cases, *P. santalinus* being one example, the threat of harvest for medicinal use appears to be secondary to that of harvest for other uses, e.g. timber and dyes. In only one case, that of *Cistanche deserticola,* a parasitic plant, was collection from the wild not considered the primary threat; here, the main threat was use of the host species, the trees *Haloxylon ammodendron* and *H. persicum,* for timber, fuelwood and fodder.

Medicinal and other uses

All seven species are used in traditional medicines domestically and to some extent regionally. Several species are used in more than one traditional medicine system. Kutki, for example, is listed in the Hamdard Pharmacopoeia of Eastern Medicine (Qarabadain-e-Hamdard), is used in Ayurveydic preparations, traditional Chinese medicine, and traditional Tibetan medicine. Three species are also used in western pharmaceutical products. *Dioscorea deltoidea* and *Taxus wallichiana* are exploited as a source of compounds first identified and extracted from other species in the two genera. Paclitaxel, more widely known by the trade name Taxol®, was first extracted from the North American species Pacific Yew *Taxus brevifolia.* The compound, used in treating cancer, was subsequently identified in

T. wallichiana prompting a rapid increase in wild collection of the needles and bark of this Himalayan species for paclitaxel extraction. Similarly, diosgenin, which is extracted from *Dioscorea deltoidea,* was first discovered and extracted from Mexican *Dioscorea* species, one of the major uses of this compound being for the production of oral contraceptives. By contrast, *Rauvolfia serpentina* appears to have been the main initial source of the alkaloid reserpine, a compound used to treat hypertension among other ailments, and which is now also extracted from other *Rauvolfia* species, e.g. the African species *R. vomitoria.* It is possible that extracts from *Picrorhiza kurrooa* will soon join the list of medicinal plant-based pharmaceuticals, with phase three clinical trials underway in India for treatment of liver disorders.

All but one of the species *(Cistanche deserticola)* have multiple uses. The two tree species are valued for their timber, *Taxus wallichiana* for its resistance to rot, and *Pterocarpus santalinus* for its deep red colour and sometimes 'wavy' grain. The timber of *P. santalinus* is also used in powder and extract form as a dye, and that of *Taxus wallichiana* as a source of fuelwood, with *T. wallichiana* leaves also providing a source of fodder. In Miandam Valley of Pakistan's North-West Frontier Province, *T. wallichiana* is one of the most valued species for timber and fuelwood, with collection from the wild considered to be causing rapid population declines and to threaten the forest habitat upon which other medicinal plants depend (ADNAN et al. 2006).

While not a tree species itself, the reliance of *Cistanche deserticola* on its host species means that it is also impacted by harvest for timber, fuelwood and fodder. *Nardostachys grandiflora, Picrorhiza kurrooa* and *Pterocarpus santalinus* are all used in incense. In the case of *Nardostachys grandiflora,* this may be the main use, contrasting with *Pterocarpus santalinus,* where at present use in incense appears to be low, though identified as having growth potential. The tubers of *Dioscorea deltoidea* are eaten as food (although this requires repeated washing and boiling to remove toxins), and used in the western Himalayas to wash wool owing to their high saponin content. Only a single non-medicinal use was identified for *Rauvolfia serpentina* during this study – the species is planted in gardens in the Nepali Terai in the belief that this will ward off snakes.

Wild collection and trade

Similar to the information on status, information on wild collection and trade of these and other Asian medicinal species is patchy at best. Wild collection and trade in Nepal appears to be the most well-documented, with corresponding information for India being less comprehensive, although numerous site-specific studies have been undertaken. This may be explained in part by the much larger size of the country, and the greater complexity of manufacturing and trading structures.

Wild collection typically involves the rural poor. *Neopicrorhiza scrophulariiflora* and *Nardostachys grandiflora* provide almost 50 % of the total annual income from alpine medicinal plant collection in Nepal, with alpine collection of medicinal plants believed to form an integral part of the livelihood strategies of 7-10 % of Nepal's mountain regions (considered a conservative estimate), or approximately 25 000-35 000 people (*Olsen & Larsen* 2003). In India, according to one estimate, collection and processing of medicinal plants contribute at least 35 million workdays per year to the "poor and underemployed workforce" (ANON. 2001). Collection of medicinal plants also makes an important contribution to rural household incomes in parts of India, with *Picrorhiza kurrooa* collection considered particularly important in the tribal areas of Himachal Pradesh studied by NEGI & BHALLA (2002), who noted that most collectors were "small and marginal farmers". *Rauvolfia serpentina* collection from the wild in Thailand and Myanmar was said to be undertaken on an opportunistic basis by local people, often at the same time they are collecting other forest products. Information indicating a large-scale trade in *R. serpentina* from Myanmar to India, and an increase in processing within Myanmar in the mid-1990s, suggests that targeted collecting may also be taking place. In Pakistan, where *Dioscorea deltoidea* was said to be one of the main medicinal species collected in the mid-1990s, collection also involves the rural poor.

Although all of the species are collected for local use, in many areas the main reason to collect the species is to provide cash income and supply demand that may be hundreds to thousands of kilometres away from collection areas: in the case of *Taxus wallichiana* the distance is potentially 10 000 km or more. The path from wild collection to end market generally involves a complex trade chain, a typology of which has been proposed by OLSEN & BHATTARAI (2005) for trade from Nepal to India. The journey often begins with one or more days of walking from the site of collection to village, and then again from village to the nearest roadhead. Based on available information, with regard to Himalayan species, most though not all roads lead to India, which is both a major manufacturing centre and end consumer market. This is particularly true of trade from Nepal, which is fed by hundreds of thousands of medicinal plant collectors supplying raw materials through a multi-tiered system of middlemen leading to large-scale wholesalers in Nepal and India (OLSEN & BHATTARAI 2005). Raw materials are often transported on to large wholesale markets,

e.g. in Delhi, Amritsar and Kolkata (Calcutta) for onward sale. Alternatively, traders may work directly with pharmaceutical companies, providing them samples for product testing in advance of sales, for example in the trade of *Dioscorea deltoidea* in India.

Those collecting for onward sale typically undertake little value added processing beyond cleaning and air drying. In the case of *Dioscorea deltoidea*, collectors in India may chop the tubers into smaller pieces to aid drying before onward sale. There has been investment in promoting essential oil extraction, including of *Nardostachys grandiflora*, for export from Nepal.

India at the centre. . .

As indicated above, available information indicates that India is a major destination for trade in the raw medicinal plant materials, and apparently the major destination for all but two of the seven species in this study; *Cistanche deserticola*, native to and primarily used in China, and possibly *Taxus wallichiana*, trade patterns for which have changed in recent years.

India's long and rich history of traditional medicine practices such as Ayurveda and highly developed herbal and pharmaceutical products manufacturing industry combine with a potential domestic market of over one billion consumers to drive the wild collection, import and export of thousands of tonnes of medicinal plants and products each year. Both finished products and extracts for production of pharmaceuticals are manufactured in India. Ayurvedic products produced in India are sold both in that country and around the world, as are extracts such as reserpine and other *Rauvolfia* alkaloids, with exports of over 200 t recorded in India's Customs data for the years 1999/2000 - 2003/2004.

A significant segment of India's consumer and industrial demand continues to be met by national supplies delivered both via and outside of a complex system of wild collection, transport and trade controls. All supplies of *Pterocarpus santalinus*, native to India and, according to some authors, Sri Lanka, originate from India, the proportion used within the country relative to exported being unknown. However, as noted above, there is also a tremendous flow of raw materials to Indian markets from other Himalayan countries, particularly Nepal, with imports also recorded from Southeast Asia. This includes hundreds of tonnes of *Neopicrorhiza scrophulariiflora* and *Nardostachys grandiflora* rhizomes from Nepal and over 150 t of "serpentina roots" (most likely *Rauvolfia serpentina*) from Myanmar. Annual trade from Nepal to India of *Dioscorea deltoidea* has declined to less than ten tonnes in recent years, apparently as a result of increased diosgenin production within and outside of India from other sources of raw materials. The flow of *Taxus wallichiana* from Nepal to India similarly seems to have declined, reflecting in part increased extraction capacity within Nepal, but potentially also increased competition from taxane production in China and elsewhere.

. . . but China increasing in market share?

China is a major and growing manufacturing centre for medicinal extracts and finished products, including taxanes. Until recently, China's manufacture of taxanes was based on *Taxus wallichiana* and several other Asian yew species native to China. However, all wild harvest of native yew species for taxane extraction in China was banned in 2003, with a consequent need to import increasing amounts of material from other countries. CITES annual report data for China show major imports from Myanmar in 2003, however this trade was not recorded in corresponding records for Myanmar. Increased emphasis within China on cultivation, including of non-native species e.g. the hybrid *Taxus x media* (a hybrid of *T. cuspidata* and *T. baccata*) from Canada, may decrease raw material trade flows to this country in future. There are indications that sales of *Dioscorea* spp. and production of diosgenin within India may be suffering from import competition from China, and it does not seem unlikely that similar competition could emerge for the reserpine extraction industry. Bearing in mind its use in traditional Chinese medicine, it is not inconceivable that in future the flow of *Picrorhiza/Neopicrorhiza* supplies could shift to the north, particularly if the efficacy of *Picrorhiza kurrooa* in the treatment of liver disease is confirmed.

Wild collection versus cultivation

Cultivation is routinely promoted as the preferred (and sometimes the only) solution to the problem of dwindling supplies and over-collection of wild medicinal plant populations, with investment into research and/or associated cultivation efforts documented for all seven species covered by this study. Much less emphasis is being put on development and promotion of sustainable wild collection practices (SCHIPPMANN et al. 2006). Given the interest in cultivation, and the relative ease of collecting information on cultivation versus wild collection, which is by nature more widely distributed, it might be expected that information on the scale of cultivation of medicinal plant species would be readily accessible. This is not the case, however, the information is similarly scattered, site specific, and relatively inconclusive.

Cultivation is contributing an increasing share – possibly the majority – of pharmaceutical compounds extracted from *Taxus*, *Dioscorea* and *Rauvolfia* species; however, it appears that cultivation mainly involves species other than those covered by this study. As noted above, for

example, diosgenin can be extracted from a number of *Dioscorea* species. In the case of *Dioscorea deltoidea*, for example, there is conflicting information regarding the scale of cultivation; although it appears to be relatively easy to cultivate, cultivation was said to be unprofitable for farmers owing to the long growing time (several years) between planting and commercial harvest. At least one pharmaceutical company was said to be growing this species, but also several non-native *Dioscorea* species, on a commercial basis in India. Cultivation within India, and possibly imports of diosgenin from *Dioscorea* cultivated in China and Mexico, seems likely to be linked to reduced demand for wild-collected *D. deltoidea* from Nepal.

It seems likely that the role of cultivation in meeting pharmaceutical demand will continue to expand in future, including through the selection of cultivars producing higher concentrations of the target compounds. Other technologies, e.g. plant cell fermentation technology, which is being used to produce paclitaxel, are also likely to replace wild collection as a source of pharmaceutical products.

Cultivation is also increasing for species used primarily in traditional medicine. Although it was considered difficult to cultivate until recently, owing to its life history strategy (being a parasitic species), an estimated 60-70 % of *Cistanche deserticola* is now said to come from the wild, with cultivation increasing rapidly and considered as likely to overtake wild collection. Efforts to cultivate *Pterocarpus santalinus* have been underway since at least the mid-1960s, however information varies with regard to whether cultivation efforts have been successful, and it appears that the majority of trade is still met from wild-collected materials. Further clarification is required on this point. Cultivation is in the early stages of development for *Picrorhiza kurrooa* and *Nardostachys grandiflora*, although it appears to hold strong promise for *Picrorhiza kurrooa*, which propagates well from root cuttings.

Wild collection and trade controls

Although the characteristics of wild collection, use and trade vary significantly among the seven species covered by this study, characteristics of collection and trade controls appear to be relatively universal. Wild collection for commercial trade, whether domestic or international, is highly regulated, generally involving a series of collection and transport permits. However, implementation of collection and trade controls is generally ineffective. It appears to be minimal and/or ineffective in Nepal, more active in India, though illegal collection is believed to be widespread, and appears to be increasing in China. Exports are also highly regulated and frequently banned, particularly of materials in unprocessed form. International trade controls by both exporting and importing countries are also required through the species' listing in CITES Appendix II. All but *Cistanche deserticola* and *Dioscorea deltoidea* were included in Appendix II at the request of the Government of India out of concern for the threat to its domestic populations. Thus far, CITES controls have had little impact on the trade, both because the main products in trade for some species, e.g. extracts, are not currently covered by the Convention, and because implementation effort has been low more generally. Of particular concern is the apparent lack of CITES implementation for imports into India, a key consumer, with imports apparently not required to be accompanied by CITES export permits or recorded in India's CITES annual reports. The February 2006 decision by the Government of India to implement import controls for *Rauvolfia* spp. and several other species, including agarwood *Aquilaria* spp. and cacti, indicates a shift towards more comprehensive CITES implementation in that country. The only major evidence of successful CITES enforcement action relates to the trade in *Pterocarpus santalinus* timber, with numerous seizures reported within India and in destination countries.

The failure to implement either wild collection or trade controls seems likely to reflect the sheer enormity and complexity of the medicinal plant collection and trade throughout the region, and the lower importance given to addressing issues of illegal or unsustainable collection of plants relative to animal species, particularly charismatic species such as Tigers. This pattern is repeated in the case of international trade, which takes place across long and porous borders with few staff resources to police them. The low level of awareness among enforcement staff of trade controls for plant species, particularly plant species traded as parts and derivatives, is a further contributing factor.

Discussion

Asia's wild medicinal plant populations continue to play a central role in human healthcare. This is true within Asia and more widely, within both rural and urban settings, and within traditional as well as modern healthcare practices. In some areas, Asia's medicinal plants also play a central role in income generation. It is therefore both surprising and worrying that the status and trade of medicinal plants is so poorly studied, particularly in light of concerns that wild populations are declining as a result of increased demand and unsustainable collection.

Though not well understood, wild collection and trade of Asia's medicinal plants are nevertheless highly regulated, with various government permissions and docu-

ments required for collection, transit and export. The often low level of regulatory implementation helps explain the low availability of wild collection and trade information – no permits issued and/or checked means no corresponding data collected.

The information that is available is nevertheless sufficient to conclude that traditional medicine, which consumes the majority of species in trade, relies on whole plant parts rather than single compounds and will continue to do so for the foreseeable future. For the majority of species, these plant parts are collected from the wild. Further research is required to identify whether traditional medicine practitioners and/or manufacturers have an established preference for wild-collected specimens of selected species, or whether cultivated specimens would be considered equally acceptable or preferable if they were available independent of the species concerned. Such information would be critical to informing investment in longer term species management and rural development efforts.

While the total number of species involved is much lower, pharmaceutical production is consuming a greater share of medicinal plant harvest from the wild for some species. Cultivation of these species is increasing, and increasingly likely to be preferred over wild collection for production of plant compounds used in pharmaceutical products. However, commercial cultivation may not be possible or may be more expensive in the short term, with the result that pharmaceutical production, like traditional medicine, will continue to depend on wild collection for many species.

Thus far the main management response to concerns about dwindling medicinal plant populations and supplies has been to increase regulation and/or cultivation. This includes at the international level, e.g. listings of species in the CITES Appendices and development agency investment in cultivation projects. Relatively little effort has been made to identify and promote sustainable collection practices, or to increase the economic incentives to use such practices. Where cultivation is being promoted, it is not clear whether and how the needs of those engaged in wild collection are taken into account, a problem noted for non-wood forest products more generally over a decade ago by Nair (1995), or what the consequent impacts have been on collection rates.

A common response to this situation for other wildlife commodities is to invest more resources in enforcing existing laws. However, consideration needs to be given to the effects of any such 'crackdown' on unlicensed collection or trade, particularly where this takes place in only part of a species' range. Increased enforcement in one location/country may simply shift collection to other locations/countries. Further, rural communities dependent on wild collection for income may have little choice but to continue to collect medicinal species and risk detection, and so be at risk of increased "rent capture" by government personnel charged with enforcement, and lower prices from those traders willing to circumvent existing controls. The recent trend in some South Asian countries toward granting greater community rights over natural resources, particularly forest resources, should be considered in conjunction with regulatory approaches for managing wild collection.

Summary and recommendations

Throughout much of human history, Asia's medicinal plant species have simultaneously been treasured and taken for granted. They have been available and used to treat the ills of countless generations, originally within Asia, and more recently throughout much of the rest of the world. Changes in current collection and trade practices will be required if these plants are to survive in the wild and continue to be available for use by future generations. Numerous authors and organisations with direct experience concerning medicinal plant collection, use, trade and conservation in Asia have provided recommendations for promoting such changes (e.g. see Bhattarai 1997, Karki 2006, Kinhal et al. 2006, Olsen 2005, Olsen & Larsen 2003, Pei Shengji 2001 and many others). Hopefully the suggestions below will serve to reinforce their recommendations and encourage support for their and others' efforts.

Given that many Asian species in trade both occur and are used in more than one country, a collaborative, multi-country approach is likely to be both more efficient and more effective at achieving increased knowledge, conservation and sustainable use of these and other species in the longer term. Equally, given the importance of medicinal plants in the context of conservation, development (including healthcare and income generation), and manufacturing, a collaborative, multi-stakeholder approach is likely to be more effective and efficient than isolated efforts by different stakeholder groups.

All stakeholders with an interest in medicinal plant conservation, use and/or trade should work together through, for example, the Medicinal and Aromatic Plants Programme in Asia (MAPPA), to share and increase collective knowledge of:

• the species, origin and quantity of medicinal plant materials traded;

• market trends, including with respect to the preferred source (wild, cultivated) of specimens in trade;

• the current population status of traded species nationally and globally, and observed or suspected population trends;

• current wild collection practices (all uses), including extraction methods and intensity, and their impacts, including with respect to re-generation rates;

• the actors in the trade, building on the work of Olsen & Bhattarai (2003) to develop a typology of economic agents for trade from Nepal to India;

• the contribution of medicinal plants to healthcare and incomes along the trade chain from collector to end consumer, differentiating with respect to, e.g. gender, age and socio-economic status; and

• successful mechanisms to increase the value of medicinal plant collection to the rural and urban poor.

Government agencies, IGOs, NGOs and medicinal manufacturers and associations should promote conservation of wild populations and sustainable sourcing by:

• adopting and adhering to codes of practice for sustainable sourcing of wild medicinal plants, including CITES and the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) (MPSG 2007)

• undertaking resource mapping to underpin development of site-based management plans;

• developing, with collectors, training materials and programmes appropriate for spreading of knowledge of sustainable collection techniques;

• exploring the potential for increasing production in situ, e.g. via enrichment planting; and

• when developing cultivation programmes, taking into account the potential for and reducing the possibility of hybridization of cultivated specimens with wild plants.

Governments should seek to increase collaboration in the enforcement of controls on international trade, including through:

• increased information exchange concerning national level trade restrictions, including through joint capacity building programmes and provision of copies of any documents required to accompany shipments exported;

• increased investment in CITES implementation for CITES-listed medicinal species;

• ensuring that any bilateral trade agreements, such as the Indo-Nepal treaty, are consistent with other international obligations, e.g. CITES, with respect to international trade controls; and

• developing more detailed Customs codes for species traded in large quantities, including, within India, the re-adoption of codes previously used for *Pterocarpus santalinus* chips and timber and *Rauvolfia serpentina* formulations.

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Reviews and Notices of Publication

Uwe Schippmann

ALBRECHT, M.A. & MCCARTHY, B.C. (2006): Comparative analysis of goldenseal (*Hydrastis canadensis* L.) population re-growth following human harvest. Implications for conservation. – American Midland Naturalist 156 (2): 229-236.

> "Goldenseal is an uncommon woodland herb whose rhizomes are widely harvested for their medicinal properties. Goldenseal populations regenerate from vegetative propagules that are broken-off from the primary rhizome during harvesting activities. While previous studies reported significant variability in re-growth among harvested populations, it is not entirely clear what drives differences in population re-growth. One hypothesis is that goldenseal populations re-grow at greater rates when harvested during the fall compared to mid-summer. Over a 4 y period, we biennially censused the re-growth of a goldenseal population that was wild-harvested during the fall 2001 from the Wayne National Forest in southern Ohio. Data were compared to previous studies that quantified the re-growth of a goldenseal population wild-harvested during the fall in West Virginia and to goldenseal populations (n=3) experimentally harvested during mid-summer." (from CABI-RAMP, 20063225697)

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> "American ginseng (*Panax quinquefolius* L.) is a native North American forest herb whose roots have been collected for their reputed medicinal properties and exported to international markets for nearly 300 years. Numerous anecdotal reports suggest declining abundance throughout its range, and the species is currently listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. This study examines the putative decline of American ginseng over the last 150 years in 19 US states by using data from herbarium specimens. For successive time intervals, we calculate the numbers of American ginseng specimens in addition to the numbers of specimens of related taxa that are not commercially harvested. The proportions of American ginseng specimens from adjacent time intervals are then examined for significant changes. An additional analysis evaluates the potential for species overrepresentation in the database due to species collection bias. Despite evidence of preferential collection of American ginseng, the proportion of American ginseng specimens declined significantly through time for six northern states. This result is consistent with a long and intense history of harvest, extensive deforestation in northern regions of the United States, and slow regeneration of American ginseng." (from CABI-RAMP, 20073016459).

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> "Replicate harvest simulations were conducted in a large natural population of *Panax quinquefolius* L. (Araliaceae) to determine the selective effects of harvest. We investigated how minimum size requirements and the influence of size on apparency to human harvesters could result in preferential removal of large plants. To determine which plants were encountered in the large population, harvesters were tracked using GPS as they searched for every legally harvestable, adult plant they could find. Plants were assigned stage-specific fitness measures based on their contributions to population growth rate (λ) under three demographically based harvest regimes: no harvest, harvest and harvest removing seeds. Plant size was codified into a size-index equal to the product of total leaf area and stem height. Heterogeneity of slopes was tested to determine if the selection gradients (ß) describing the relationship between fitness and size varied among the three harvest regimes. Harvest differentially reduced the fitness of larger plants in one of four individual harvest simulations. The combined harvest simulation significantly altered the selection regime for size in the population of juvenile and adult (harvestable) plants. Seed removal by harvesters intensified fitness declines for larger plants. Because larger plants contribute most to population growth, the selective effects of harvest could result in a shift in the evolutionary dynamics of this species with significant conservation implications." (from CABI-RAMP, 20073037178).

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> "As part of a national programme focusing on developing sustainable usage of medicinal plants in five biogeographically representative Medicinal Plant Conservation Areas (MPCAs) in Sri Lanka, we describe the rapid appraisal methodology developed for, and substantive results derived from, a resource inventory undertaken at respective MPCAs to provide: (a) baseline assessment of the distributions, associated population structures and densities, and ecological requirements of medicinal plant species; and (b) an informed basis for ongoing in situ conservation, management, and harvest sustainability of defined priority medicinal plant species. The applied methodology comprised: (a) quantitative assessment of medicinal plant populations and habitat features at 898 inventory plots, located using a strict hierarchical stratification; (b) standard numerical classificatory procedures to define major habitat types; and (c) areal estimates of habitats based on available fine-scale topographic mapping, augmented with refined mapping derived from Landsat TM imagery. Over 1400 medicinal plant species (ca. 40 % of the national flora) were sampled during the inventory." (from CABI-RAMP, 20063194897).

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List of MPSG Members

The following list of members is as of 1 December 2007. Please look through it and advise the editor on all errors and missing information (e.g. e-mail addresses).

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