



SPECIES IN DANGER

MEDICINAL PLANTS AND PLANT EXTRACTS

A REVIEW OF THEIR
IMPORTATION INTO EUROPE

Anna Lewington

A TRAFFIC NETWORK REPORT

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OF MEDICINAL PLANTS AND
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by the WWF International Plant Programme

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PREFACE

Many plants are essential in human health care, both in self-medication and in national health services. Ironically, many plants that save lives are themselves in need of saving, not from diseases but from an ever-expanding human population whose growth and consumption of natural resources are threatening plant diversity in most parts of the world.

The use of wild plant material in the pharmaceutical trade is enormous even if difficult to quantify. While regulation of harvest at the national level exist for some species, control is difficult and ineffective. Very few species of medicinal importance are subject to international trade regulations, despite the fact that they are traded in large volumes, and very little is known about the biological impact of such trade. Many of the most important species in trade are threatened by habitat destruction and unsustainable harvest. The international trade in medicinal plant material, however, is often dwarfed by the internal trade. In the United States, for example, imports represent only a small percentage of the value of internal trade in medicinal plants. As an example, in 1980, imports to this country were valued at US\$44.6 million compared to an internal trade in medicinals and botanicals estimated at US\$3.9 billion (Akerle 1991).

In 1988, at an international consultation in Chiang Mai, Thailand, on the conservation of medicinal plants, a joint initiative of WHO, IUCN and WWF, health professionals and conservation specialists met for the first time ever to discuss the consequences of the loss of plant diversity. The participants in this consultation viewed with grave concern the fact that many plants that provide traditional and modern drugs are threatened with extinction. In the so-called Chiang Mai Declaration (see Akerle *et al.* 1991), which summarised the conclusions of the consultation, the participants drew the attention of the international community to:

- the vital importance of medicinal plants in health care;
- the increasing and unacceptable loss of these medicinal plants due to habitat destruction and unsustainable harvesting practices;
- the fact that plant resources in one country are often of critical importance to other countries;
- the significant economic value of the medicinal plants used today and the great potential of the plant kingdom to provide new drugs;
- the continuing disruption and loss of indigenous cultures, which often hold the key to finding new medicinal plants that may benefit the global community;
- the urgent need for international cooperation and coordination to establish programmes for conservation of medicinal plants to ensure that adequate quantities are available for future generations.

Today, five years later, these considerations are more valid than ever.

The present report on the importance of the European market for medicinal plants will supplement TRAFFIC's report from 1991 on the US medicinal plant trade (Fuller 1991). Together, these reports attest to the fact that the use of plant-based medicine is not a phenomenon which is restricted to the developing world, but that it is an integral part of people's lives everywhere.

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INTRODUCTION

Recent research has begun to reveal impressive facts about the scale of the developed world's dependence upon medicinal plants, and the monetary and social values that this usage represents (Farnsworth and Soejarto 1991). The statistic that 1/4 of all prescriptions dispensed in the USA are likely to contain one or more ingredients derived from higher plants is now commonly quoted (Farnsworth and Soejarto 1985). The global monetary value of plant-based pharmaceuticals in OECD countries by the year 2,000 is estimated to reach \$500 billion (Principe 1991).

It appears, however, that this dependence upon medicinal plants is still not widely acknowledged by the general public or endorsed by the medical profession at large, and the view prevails that medicinal plants are at best marginal to mainstream medicine - an image that pharmaceutical companies have done little to dispel. The fact remains that medicinal plants are in demand in two main areas: for modern allopathic medicine and for herbal remedies or phytomedicine.

In allopathic medicine active ingredients from plants are used in the following main ways: directly as drugs or therapeutic agents (that is both in highly purified and in extract form); as starting materials for the synthesis of other drugs; as models for new synthetic drugs; and as tools in drug development and testing. Many of our most valuable plant-derived drugs used to treat specific conditions, such as digitoxin and tubocurarine are still unsurpassed in their respective fields and cannot be synthesized. Some 95 plant species have been listed as the source of 121 clinically useful prescription drugs derived from higher plants (Farnsworth *et al.* 1985), but a far higher number are contained in the great variety of medicines that can be bought over-the-counter.

A very large trade also exists in plants used for the preparation of phytomedicines or 'herbal remedies', as used by homoeopaths and herbalists, and which can be purchased in health food shops, supermarkets and pharmacies. Within this category are many preparations, including 'herbal teas' and 'food supplements' which, in the UK, for example, have not been given product licenses allowing them to be sold as medicines. The situation regarding the marketing of these products within Europe as a whole is very complex and differs from country to country. Germany and France, for example, have a far greater official acceptance of herbal treatments and a proportionately larger trade.

An International Trade Centre (ITC) report (quoting figures from the World Drug Market Manual 1982/83) indicates that, in 1980, Western European countries accounted for the largest single share of the world demand for pharmaceuticals (31%) (ITC 1982). In 1979, the former F.R. Germany imported over 28,000 tonnes of medicinal plants, worth US\$ 56.8 million, according to the ITC report. Within Western Europe, in 1984, F.R. Germany, France and Italy were the biggest individual consumers of prescription drugs using plant extracts (Principe 1991).

Given the fact that serious over-collection of many medicinal plants has already occurred (for example *Rauwolfia* and *Dioscorea* species) due to the pressures of international trade,

much for European markets, serious questions are now raised for medicinal plant conservation in general: which are the species involved, and where do they originate? Are they being collected from the wild, and in what quantities? Who is involved in the trade and what regulations exist to control it? What are the effects of this trade and which species are now in need of conservation action?

It is widely acknowledged that very little detailed data exists on the trade in medicinal plants in general and that this information is not easily acquired (ITC 1982, Farnsworth *et al.* 1985, Farnsworth and Soejarto 1991, Principe 1991). Within this context, this study is able only to give an overview of the situation and to make general recommendations for future conservation action.

RESEARCH FOR THE REVIEW



Europe was interpreted as referring to those countries which have traditionally constituted 'Western Europe', that is: Austria, Belgium, Denmark, Finland, France, Greece, Italy, Luxembourg, the Netherlands, Norway, Portugal, the Republic of Ireland, Spain, Sweden, Switzerland, the United Kingdom, and F.R. Germany. However, the volume of medicinal plant imports and the complexity of the situation with regard to making an accurate assessment of this trade as it effects each of the countries individually merits studies which far exceed the limits governing the present one, in terms of both time and financial resources available. For this reason, it was decided to focus in any detail on only two countries: Germany — the largest importer of medicinal plants in Europe — and the UK.

Perhaps the primary and most logical avenue to pursue in search of detailed import information — Customs and Excise records — proves to be of little help. In practise one finds that the categories under which the majority of medicinal plants are listed are so broad as to make the information almost useless. Only those plants entering a country in very large quantities are listed individually, but complicating the matter to a much greater extent is the fact that both those plants listed individually (and which do have some medicinal use) and those grouped together, may also be used for several other purposes — perhaps as foods or flavourings, or for cosmetics — which are not distinguished. Two examples of this are liquorice (*Glycyrrhiza* spp.) and papaya (*Carica papaya*). Liquorice is well documented as being used as an expectorant and anti-inflammatory, but it has a multitude of other uses from flavouring for chocolate, beer, tobacco and toothpaste to stabilising the foam in fire extinguishers. In the case of papaya, the extract papain is the most common proteolytic enzyme used in medicine, used for example in the treatment of dyspepsia, intestinal and gastric disorders and for blood clots, but it is also widely used in the food industry as a tenderiser.

In the absence of detailed official statistics, interviews with traders would seem to be the best avenue to pursue. However, here one finds that the complexity of the trading network and the levels of secrecy (or confidentiality) are such that very little can be ascertained in as restricted a study as this one. This study found a general reticence and nervousness amongst those dealing in any way with medicinal plants (either using, buying or brokering) to reveal the names, numbers or quantities of those involved, and most significantly, the precise sources of these plants.

An examination of trade catalogues provided the only relatively detailed information as to the number and names of plants entering Europe (Germany and the UK specifically), though it has not been possible to supply information relating to the serious matter of origin —

whether wild or cultivated — or therefore an accurate assessment of the need for conservation action for particular species, from this source.

The methods of research adopted for this study included:

- a) a literature review;
- b) analysis of UK Customs and Excise data;
- c) correspondence with and (in the UK) visits to companies and individuals in the UK and Germany using or trading in medicinal plants;
- d) examination of trade catalogues;
- e) discussions with members of the British Herbal Medicines Association.

The information which follows summarises the importation of medicinal plants into Europe as it appears from the above sources, and emphasises the markets of Germany and the UK.

MEDICINAL PLANTS: DEFINITIONS AND USES



What is a medicinal plant?

A useful interpretation of the term 'medicinal plant' — as used in its traditional sense — has been given by Fellows (1991):

'The term 'medicinal' as applied to a plant indicates that it contains a substance or substances which modulate beneficially the physiology of sick mammals, and that it has been used by man for that purpose'.

Farnsworth and Soejarto (1991) refer to medicinal plants as:

'all higher plants that have been alleged to have medicinal properties, i.e. effects that relate to health, or which have been proven to be useful as drugs by Western standards, or which contain constituents that are used as drugs'.

What can be shown or proven, in modern Western 'scientific' terms to 'modulate beneficially the physiology of sick mammals', that is, to have 'medicinal properties', has been at the centre of a division that has developed generally between the advocates of modern allopathic and 'traditional' or 'herbal' medicine. Today's allopathic medicine is in fact highly dependent upon a range of substances produced by plants, but the fact that clinically useful chemicals are now being obtained from plants that have not been classified before as having 'medicinal' properties, is changing the parameters of what a medicinal plant can be said to be. The result is potentially a great increase in the number of plants which can be regarded as medicinal.

As far as we can tell, plants have been by far the most important source of medicines for all mankind throughout our evolutionary history. For the majority of the world's population today this is still the case. In 1985, WHO estimated that 'perhaps 80 per cent of the more than 4,000 million inhabitants of the world rely chiefly on traditional medicines for their primary health care needs' (Farnsworth *et al.* 1985). Farnsworth and Soejarto (1991) and Hamann (1988) have qualified this statement to indicate 'people in developing countries' and 'rural people' respectively, rather than referring to 'inhabitants' in general and further specify 'herbal medicines' or 'medicines involving the use of plant extracts or their active principles' rather than 'traditional medicines'.

In modern China alone, some 800 million people are said to use around 5,000 plants medicinally (Farnsworth and Soejarto 1991). According to Shan-an and Zhong-ming (1991), 'The total number of taxa used exceeds 10,000 in number'. The Chinese system of medicine, which derives 80 per cent of its medicaments from higher plants (Hussain 1991) is also popular in Asian countries such as Hong Kong, Japan, Korea and Malaysia. A similar situation exists in India, Pakistan, Bangladesh, Sri Lanka and Nepal, where highly developed

traditional systems of Ayurveda, Siddha and Unani are practised, and all of these are mainly based on drugs derived from plants (Hussain 1991).

Taking these and other factors into account, such as a similarly widespread traditional use of plants by the indigenous peoples of Africa and Latin America, Farnsworth and Soejarto (1991) have estimated that 35-70,000 species have at one time or another been used in some culture for medicinal purposes.

In October 1978, WHO published a list of 212 plants as the 'Priority List of the World's Most Widely Used Medicinal Plants'. In May 1978, a Resolution was adopted by the 31st World Health Assembly, requesting WHO to compile an inventory of all the medicinal plants used in the countries of the world, also to standardize botanical nomenclature and to compile a therapeutic classification of the most widely used medicinal plants (Penso 1978). A provisional list of more than 20,000 had already been compiled, covering the use of medicinal plants in 73 countries, but it was found that it contained many replicates and was subsequently reduced to around 10,000. Referring to her definition of 'medicinal plant', Fellows (1991) states that surveys suggest that over 10,000 species of higher plants have been used in this way.

The uses of medicinal plants in Europe

In most 'developed' European countries (as in other parts of the world), the full picture of medicinal plant usage overall has become somewhat complicated by the developments of synthetic chemistry. In the UK, for example, these developments helped to form certain attitudes within the medical profession and pharmaceutical industries (which have only recently begun to change), which have themselves helped foster misunderstandings on the part of the general public as to our actual use of, and need for, substances produced by plants.

An apt observation was made by Huxley (1984) when he described plants as 'extraordinary chemical factories'. All plants produce chemical substances for a range of different purposes, and most of those whose structure is most complex are produced, it is thought, for self-defence. Fellows (1991) notes: 'The chemicals in today's wild plants have, we believe, arisen in response to pressures from pathogens and predators, and reflect the end product of almost 300 million years of selection for what are essentially plant protection agents ... All wild plants are potential sources of biologically active molecules'.

These biologically active compounds, which help protect plants against predators and other damage, but which it is believed, are not directly essential to growth, are generally known as secondary chemical compounds or metabolites. They include alkaloids and glycosides as well as fungicidal and bactericidal resins.

Until World War II, roughly speaking, it was raw plant material or active ingredients extracted from plants that formed the mainstay of medications used. Once it became possible to isolate and then copy (synthesize) in the laboratory the plant chemicals believed or known to be responsible for certain medical effects, and furthermore to sell these in the form of patented or brand-named products, a whole new industry was born.

With the rise of the synthetics industry in the late 1940s and the new emphasis on patents, the laws governing the use of medicinal plants changed. The former usage of large numbers of plants was rejected because, in their natural state, their active ingredients were not patentable. By 1950, the majority of companies manufacturing what would henceforward acquire the somewhat pejorative label of 'herbal remedies' had changed over to synthesis and were only interested in a plant if its active principles could be extracted and copied (H.W. Mitchell pers. comm.).

The commercial interests of the developing pharmaceutical companies came to predominate. Within the field of modern drug development then, a considerable emphasis arose on the identification, extraction and synthesis of single active substances to which particular actions could be attributed — laying the foundations for today's enormous market for proprietary medicines.

Today, other financial considerations can further promote the prominence of such medicines (whether or not based on, or including, as many do, substances derived from plants). For example, in the UK, there are no financial subsidies given under the National Health Service for products considered or classified as purely 'herbal remedies'. This, in the view of Hugh Mitchell, President of the British Herbal Medicine Association (BHMA), is because the medical establishment as represented by the British Medical Association is 'hooked on synthetics'.

Alongside these developments, a set of attitudes has prevailed in professional medical and commercial quarters in which plants have been seen largely as primitive and outmoded adjuncts to 'modern medicine', a view still held by a good proportion of the UK's medical profession today. Broadly speaking, two main camps have formed, comprising:

- Proponents of allopathic medicine and its conventions who have tended to be dismissive of the value of plants even though many of the most common and most specialized treatments depend on them.
- Proponents to what is broadly described as 'herbal medicine', into which a far larger number of plants are admitted, and which embraces in principle all plants with a medicinal or therapeutic value.

Medicinal plants in allopathic medicine

At the present time, substances from plants are used in the following main ways in modern medical treatment:

- Directly as pharmaceuticals — either as single purified drugs, for example, morphine (extracted from the opium poppy *Papaver somniferum*) and vincristine (extracted from the rosy periwinkle *Catharanthus roseus*) or in advanced extract form often in admixtures with other ingredients, for example, oil of evening primrose *Oenothera* spp. or senna extract from *Cassia senna*. The latter category includes the enormous range of plant extracts used in common medications such as cough and cold treatments and laxatives.

- As building blocks or starting materials for the production of semi-synthetic drugs, for example plant saponins which can be extracted and altered chemically to produce sapogenins for the manufacture of steroidal drugs. An enormous number of products are made by the chemical alteration of plant material — a problem (in terms of recognition of our reliance on the plant world) being that the end-product often appears, because of its name, quite unrelated to plants. An example of this is Trimethoprim (a urinary antibacterial drug) made from 3,4,5, trimethoxybenzaldehyde, itself produced by the chemical or enzymatic hydrolysis of gallic acid, taken from the South American tree *Caesalpinia spinosa* (commonly known as 'tara' in Peru)(M.B. Burbage *in litt.* 1985).
- As blue-prints for the manufacture of synthetic drugs of a similar structure, for example the plant alkaloid cocaine extracted from *Erythroxylum coca* which has provided the chemical structure for the synthesis of procaine and other related anaesthetics.
- As tools to help us understand physiological and pharmacological mechanisms, especially in drug development and testing.

Attempts have been made to assess the importance and usefulness of medicinal plants in Western medicines according to various criteria. Perhaps the most often quoted statistic refers to the proportion of prescription drugs which contain ingredients from plants. According to data first published by Farnsworth and Morris (1976), approximately one-fourth of all prescriptions dispensed from community pharmacies in the United States contain one or more ingredients derived from higher plants. Up-dating this information in a paper published in 1985, Farnsworth *et al.* (1985) reported that 25 per cent of all prescriptions dispensed from community pharmacies from 1959 to 1980 contained plant extracts or active principles prepared from higher plants.

It appears that this statistic is broadly applicable to prescription drugs in Europe too. Fellows (1991), for example, drawing on a paper by Principe (1989), notes that today 25 per cent of prescription drugs contain a plant-derived chemical or derivative, a figure which has remained constant for 30 years.

With regard not just to prescription drugs but other medicines, Huxley (1984) reported that about 30 per cent of modern packaged medicines are based on plant products while 80 per cent or more were plant-based at some time. Although it has not been possible to find a current figure which quantifies the number of plants used in such medicines, it can be estimated that the number is significant, simply from an observation of the frequency with which plant extracts are mentioned as ingredients in the commonest treatments, from cough syrups to laxatives (for example, eucalyptus, thyme, mint and castor oils, cascara, liquorice, plantain, ipecacuanha, etc.). Plant-based laxatives represent a substantial part of the retail market for some 1,000 proprietary laxative preparations worldwide, valued in 1982 at \$500 million (ITC 1992).

More attention, however, appears to have been given to calculations of the number of different chemical substances derived from plants. For example, Farnsworth *et al.* (1985)

referred to the existence of 'at least 119 distinct chemical substances derived from plants that can be considered as important drugs currently in use in one or more countries ... Altogether about 62 therapeutic categories can be distinguished ... it can be seen that these drugs are primarily obtained from only about 91 species of plants'. Farnsworth and Soejarto (1991) subsequently indicate, 'at least 121 chemical substances of known structure ... extracted from plants, ... are useful as drugs throughout the world'. According to Oldfield (1984, in Fuller 1991), about half the world's pharmaceutical compounds are derived from plants.

As Principe (1991) noted, 'the inability of the pharmaceutical industry to synthesize commercially the vast majority of the plant-derived drugs currently in use' and 'of the 76 different chemical compounds used in prescriptions in 1973, only 7 can be commercially produced by synthesis: emetine, caffeine, theobromine, theophylline, pseudoephedrine, ephedrine and papaverine. Important drugs such as morphine, codeine, atropine, digoxin and digitoxin cannot be commercially synthesized.'

The reasons for this are either that the sheer complexity of the chemical structure defies the process or because it would simply be too expensive to do so. An example of this is provided by reserpine, which could be obtained from *Rauwolfia* spp. for approximately US\$ 0.75 per gram or synthesized for US\$ 1.25 per gram. The cost of synthesis can apparently be ten times as much as that of direct extraction from plants (Principe 1991).

This brings us to one other major focus of attention in the assessment of the importance of medicinal plants in allopathic medicine and their economic value. In countries belonging to the Organization for Economic Cooperation and Development (OECD), the retail market for plant-based prescription and over-the-counter medicines was calculated to be US\$ 43 billion in 1985. The monetary value of plant-based pharmaceuticals (rather than plant-based medicines) in OECD countries may reach US\$ 500 billion by the year 2,000 (Principe 1991).

The interest shown by pharmaceutical companies in the development of drugs from plants has fluctuated over the years. According to Fellows (1991), after an initial flourish in the 1940s and 1950s leading, for example, to the 'launch' of reserpine from *Rauwolfia* spp. and diosgenin from *Dioscorea* spp. in the 1950s, very little interest was shown after 1960. 'By 1974, only one US company ... was investigating plant-derived drugs ... By 1980, no US company was working on higher plants' (Farnsworth and Soejarto 1985).

With the new analytical techniques that are now available however, and encouraged by the commercial success of plant-derived drugs (such as vincristine and vinblastine), in the light of promising new trials on others (such as taxol from the Pacific yew *Taxus brevifolia* and with various plant compounds demonstrating an activity against the HIV virus, the last few years have seen a renewed interest in plants as sources of new commercial drugs.

In 1985, 2,618 new structures were isolated 'most beyond the imagination of the most inventive chemist' and, by 1990, 223 companies worldwide were investigating plants as a source of new leads, with clinical trials for eight conditions already in progress (Fellows 1991).

According to Fellows (1991) the search is now on for new active chemical groups in plants which may not necessarily have been classified before as 'medicinal'. (This was the case, for example, with *Dioscorea* spp., which were the starting point for approximately 40 steroid drugs). To date, fewer than five per cent of the approximately 250,000 species of higher plants have been subject to any kind of chemical study.

From the conservation point of view, as new 'medicinal plants' are identified, even greater vigilance will be required to ensure that these are not endangered by commercial exploitation.

Medicinal plants in 'herbal medicines'

Any definition of the term 'herbal medicine' must be linked to an interpretation of the term 'medicine' itself. In modern Western allopathic medicine, generally speaking, treatment is reductionist, that is prescribed to deal with a particular symptom or individual 'disease' once it has occurred, by the use of substances that can be said to be inimical to it.

In the longer established systems of traditional medicine (for example Ayurveda and Chinese medicine) as in those 'alternative' systems found also in European countries, 'herbal' treatment is given as part of a comprehensive approach to preventative medicine, in which maladies are seen in the context of the body as a whole. As part of this approach, rather than prescribe individual (purified) drugs to deal with symptoms, a great many factors may be taken into consideration in trying to assess (or, where possible, prevent) the cause. Such treatment may involve the use of many different plants or substances, at different times, not to replace the body's defence mechanisms (as in Western medicine generally) but to stimulate them into action. As Akerele (1988) noted: 'An important feature of traditional Chinese therapy is the preference of practitioners for compound prescriptions over single substances, it being held that some constituents are effective only in the presence of others. This renders assessment of efficacy and, eventually, identification of active principles much more difficult than for simple preparations'.

Fellows (1991) confirmed that the 'cocktail of chemicals' found in plants 'does not necessarily serve the interests of today's commercial companies which aim to detect, purify and synthesise a single active molecule and its derivatives ... *in vivo* and *in vitro* activity may be due to complex synergism'. Fuller (1991) added: 'Herbal remedies differ from the highly purified pharmaceutical compounds in that they contain a complex variety of active inert ingredients ... By using herbs in their raw or semi-processed form, herbal practitioners help to ensure that ancillary compounds, which are believed to enhance synergistic action, remain intact. Some herbalists even claim that the use of whole plants somehow captures a 'vital' force, which is necessary to ensure full efficacy'.

To adherents of such holistic systems, or those simply disenchanted with Western allopathic medicine therefore, a 'medicinal plant' or 'herb', may refer in its widest sense, to any plant believed or 'proven' to promote well-being overall. This category can also include what might otherwise be labelled simply as 'foods' or 'food plants' and, as Fuller (1991) has further pointed out, 'In the view of most herbalists, there is little difference between regular

intake of mild herbal remedies and the daily consumption of healthful food — both prevent sickness by strengthening the immune response’.

Within the UK certainly, the term ‘herbal remedy’ has come to be used very loosely to cover an enormous range of preparations — not normally prescribed as part of allopathic practise — from capsules containing pure plant powders (referred to as the ‘totum’ in herbalists’ terms) to ‘herbal teas’, now widely available in pharmacists, supermarkets and health food shops. Herbal teas may now account for the vast majority of those plants traded in Europe as ‘medicinal’.

According to EEC Directives 65/65 and 75/319, a herbal medicine is: ‘a medicinal product containing as active ingredients exclusively plant material and/or vegetable drug preparations’. But medicines containing a mixture of herbs (vegetable drugs) and isolated constituents of other active compounds such as vitamins or trace minerals, do not fall into the EEC classification of herbal remedy and have to be treated as other licensed medicines, requiring detailed efficacy and safety data to support a normal product license application (Anon. 1990).

During the period of major development of the pharmaceutical industry and its promotion of ‘synthetic’ drugs (over the last 30 years or so) the term ‘herbal remedy’ has acquired a stigma which proponents of traditional medicine — in the UK at least — have been anxious to dispel. The efforts of bodies such as BHMA and their counterparts in other European countries (backed up by organisations such as the WHO and EEC) has led to the development of scientific standards for plant-based preparations aimed at distinguishing what are or may become licensed ‘phytomedicines’ from the ever-growing volume of ‘herbal remedies’ (which may include products which make false claims or are even dangerous), in order to enhance the professional reputation and acceptance of herbal medicines as a whole.

For the public at large, such important distinctions and considerations (that is, in terms of what is or is not a *bona fide* ‘medicine’) are perhaps as yet unclear. What can be definitely noted, however, is that while the pharmaceutical industry in Western countries has been moving towards synthetics and biotechnology in their research, the consumer is expressing a greater and greater interest in natural products, fuelled partially by a growing awareness of the risks of using synthetic compounds, which works in tandem with the growing concern about environmental degradation and the loss of physical and spiritual contact with the natural environment (Principe 1991). As Akerele (1991) observed: ‘in recent years there has been a great surge of public interest in the use of herbs and plants’. By some this has been viewed as a ‘herbal renaissance’.

Comparing acceptance of medicinal herbs in the United States (which has itself witnessed a ‘renaissance’ in their use) with Europe, Fuller (1991) described ‘The western European herb market [as] among the most advanced, with herbs making up a significant source of over-the-counter remedies’. He adds: ‘The growth of the western European herb market is evidenced by the doubling of medicinal plant consumption there over the past decade’.

This interest has not, however, restricted itself to the realms of medicine only: 'Overall, the trade in botanicals has increased following their increased use in the health food and cosmetics industries' (ITC 1982). The multiple uses of plants for foods and, more recently, cosmetics considerably complicates the task of assessing the importation of purely 'medicinal' plants and extracts into Europe.

REGULATIONS GOVERNING THE USE OF MEDICINAL PLANTS

Alongside the varying degrees of professional medical acceptance of the value of medicinal plants and 'herbal remedies', the rules and regulations governing their use (and/or acceptance) within individual European countries vary considerably. Generally speaking, countries such as Germany and France have shown and continue to show a much greater acceptance of the intrinsic value of medicinal plants than the UK.

European regulations

As previously mentioned, in the UK there has been considerable resistance by the practitioners of allopathic medicine to allow 'herbal' treatments to assume an equal footing with products created and marketed by the powerful pharmaceuticals industry. One of the central arguments put forward has been the lack of acceptable 'scientific' evidence of efficacy and potency standards. The debate over what is 'acceptable' appears to have been a long and bitter one, with representatives of the herbal medicine industry believing, for example, that the criteria set for clinical trials have of necessity suited the powerful producers of synthetic drugs, and that considerations important to an assessment of the efficacy of herbal medicines, such as diet and environment, have been ignored.

In Europe, the various standards applying to the use of all legally accepted drugs and medicines are listed in the pharmacopoeias of individual countries. According to ITC (1982), there are at least 14 different pharmacopoeias in use in Europe (ITC 1982). In the British Pharmacopoeia, for example, under a generic term such as 'Aspirin tablets B.P.', all the criteria which aspirin tablets must meet are presented. The Council of the European Communities publishes the European Pharmacopoeia — an attempt to unify national standards. This document is legally binding even when it refers to products included in the individual national pharmacopoeias.

The different pharmacopoeias contain quite different numbers of plant-based drugs or preparations. The British Pharmacopoeia — which is revised every 5 years — contains between 50 and 70. It is interesting to note that 'not all medicinal plants are included in the various pharmacopoeias. For example, ... plants such as *Catharanthus* used exclusively for the extraction of active substances, are not specified, but the pharmaceutical company that uses the plants will have laid down its own specifications' (ITC 1982).

For the majority of plant-based preparations excluded from the British Pharmacopoeia, the Government has, according to Hugh Mitchell (pers. comm.), consistently side-stepped the issue of their serious acceptance and promotion by obliging use of the wording 'traditional herbal remedy for the symptomatic treatment of ...'. To the BHMA this exemplifies the

dismissive attitude towards phytomedicines (as they would rather they were called) adopted by the UK Department of Health.

In contrast to the British Government's lack of interest, members of the BHMA point to the examples of the German, French and Belgian governments. The German government for example, has prepared monographs (which define quality standards and tests for potency) for over 250 single plant drugs; the French government is responsible for the publication of a document which currently lists more than 170 medicinal plants which are officially recognised, and gives specifications concerning marketing authorization (Anon. 1990b). A complication arises in the fact that these plants are not necessarily listed in the French Pharmacopoeia.

According to J.T. Hampson (Director and Co-Chairman of the Natural Medicines Group and Committee Member of the Natural Medicines Society; 1988), in the UK the Natural Medicines Group represents the major commercial producers of medicines containing herbal ingredients in the UK. With its sister charity, the Natural Medicines Society, it is 'dedicated to the informed use of herbs based on realistic levels of scientific knowledge within a workable form of governmental control, which ensures safe products and good quality to GMP standards'. These organisations, which 'represent the public interest in natural medicines' are concerned to 'balance the overwhelming lobby of the allopathic interest ... to ... achieve an equal and complimentary role for Herbal Medicines'. They are concerned to set 'reasonable standards for the quality control of herbal products' particularly in view of 'a large and increasing number of pseudo medicines, sold as foods but held up for sale as medicinal products by use of P.R. and innuendo. These food products carry none of the overheads of licensed medicine manufacture. They require only rudimentary quality assurance'.

In Britain, it has fallen to the BHMA to produce scientific monographs for the vast majority of medicinal plants. This organisation is currently in the process of up-dating the 232 individual plant monographs first published in 1983 in the British Herbal Pharmacopoeia (BHP). A review compendium of 84 plants was published in 1990 and reviews for another 84 plants are in preparation. In its final version, the BHP will list the constituents, therapeutics, regulatory status and scientific references for more than 200 medicinal plants used in Britain. The BHMA is hoping to get this volume accepted by the British Government as a specified publication under the Medicines Act and therefore of equal status and value to the medical profession as the British Pharmacopoeia.

In the UK, the national laws governing the use of herbal or phytomedicines which have evolved during the last 40 years, have of necessity been influenced by the edicts issued by the EEC. After the medical disasters with synthetic drugs, such as thalidomide in the 1960s, the British Medicines Act of 1968 laid down strict standards to which all medicines must henceforward conform. By 1970, every factory had to be inspected by Medicines Inspectors acting under the Medicines Commission of the Department of Health and, by 1972, every producer of a product had to apply for a Product License of Right (PLR). The Medicines Commission then became the responsibility of the new Medicines Control Agency.

In Europe things were also changing. In 1965, a new European Medicines Act came into force through EEC Directive 65/65 and, subsequently, in 1975, the required standards for quality, safety and efficacy of plant-based proprietary medicinal products were laid out in EEC Directive 75/318. After the UK joined the EEC in 1973, the regulations governing British Medicines receded in status as those issued by the EEC grew. Dates were set by the Commission of the European Communities for the review of all medicines on the market concerning quality standards (Anon. 1990c).

The latest of such dates was May 1990: by this time the medicines produced by all herbal medicines manufacturers in each country had to be reviewed or they would not be acceptable for use. In the UK, where manufacturers generally took this ruling very seriously this review was carried out by the Medicines Control Agency. The UK was, in fact, according to the BHMA, the only country in the EEC to have completed the review of herbal medicines by the specified date, whilst Germany had barely begun its review by this time. This has left the curious position of the majority of German herbal medicines being now unlicensed according to the rules of the Commission of the European Communities. As an example of the more successful results in this respect in the UK, one major manufacturer, Potters (Herbal Supplies) Ltd., had 148 out of 150 products submitted passed according to the European standards. Despite this apparent success, one of the directors of this company, J.T. Hampson, laments the continuing resistance of the medical establishment at large to accept his medicines. Despite the fact that he has product licenses, the *Monthly Index of Medical Specialities* (MIMS) — the journal sent free to medical practitioners every month and which lists all proprietary medicines available — still refuses to list his products. According to Hampson (pers. comm.), fewer than 1,000 herbal medicines have licenses in the UK, in contrast to some 29,000 'non-herbal items' that do.

In preparation for the new single European market, a set of guidelines will be prepared to allow herbal medicines to be traded across Europe. The next review date set by the Commission of the European Communities is for 1st June 1993 and at this time all medicines will have to be assessed and meet the revised set of standards agreed by the Committee on Proprietary Medicinal Products (CPMP), which operates within DGIII of the Commission, based in Brussels.

European Scientific Co-operative for Phytotherapy (ESCOP)

A measure of the seriousness with which the trade associations of various European countries have viewed the confused status of herbal medicine is evidenced by the formation of ESCOP (the European Scientific Cooperative for Phytotherapy), set up under the auspices of the EEC to advance the status of herbal medicine in Europe and assist with regulatory status.

One of ESCOP's main goals is the publication of 200 plant species monographs that will detail the therapeutics (the pharmacology and preparation of) medicinal plants in a proposed standard format for application to the EEC for marketing authorization. The monographs are being prepared as proposed models such that official drug regulation policy can be standard-

ised throughout the EEC, forming the basis of a common review procedure for herbal medicines in the single market.

Fifteen of these monographs have already been published — the first five in 1990, and a further 10 at the ESCOP meeting held in Milan in 1992. A further 10 are in progress and ESCOP is now waiting for the CPMP's views on those already prepared. ESCOP is also recommending that all herbal medicines should be classified as conventional medicinal products and that users of such medicines should be reimbursed by health care systems for the cost of herbal remedies (Fuller 1991).

World Health Organisation (WHO)

As part of a Resolution adopted by the 31st World Health Assembly in 1978, WHO was requested to: 'develop international standards and specifications of identity, purity and strength for [the most widely used medicinal plants] and their galenical preparations' (Penso 1978).

Since that date, a number of conferences, workshops and meetings have been held to further this Resolution. As a result of the 4th and 5th International Conferences of Drug Regulatory Authorities (in 1986 and 1989), it was concluded that WHO should consider preparing 'model guidelines' containing the basic elements of legislation designed to assist countries wishing to develop appropriate registration and legislation (Anon. 1991a). The objective of these guidelines, then, is to define the criteria for the evaluation of safety, efficacy and quality standards for the global trade in herbal medicines.

The finalised 'Guidelines for the Assessment of Herbal Medicines' were presented at the 6th International Conference of Drug Regulatory Authorities held in Ottawa in 1991 and are now published.

IMPORTATION OF MEDICINAL PLANTS INTO EUROPE



General assessment of imports

In their summary of the study to evaluate the market for selected medicinal plants and their derivatives, the authors of the 1982 ITC report remarked: 'It is not possible to assess the volume or value of the trade in all botanicals that are used medicinally because trade statistics do not identify all the plants individually and of those listed, the statistics do not identify medicinal and other uses separately'. They added: 'products reported as medicinal plants often include gums, medicinal species and plants used in the food industry; certain plant products include those used for teas and infusions; large volumes of plants such as pyrethrum are used in the manufacture of insecticides; plants used by the cosmetics industries are also included'. Furthermore: 'While hundreds of medicinal plants are items of commerce, details of the volumes traded in most of these will only be obtained from individual traders and users; details

of trade in the majority of individual medicinal plants do not appear in any published statistics' and, where 'key end-users of large quantities of selected medicinal plants have already invested in plantations in both developing and industrialized countries or have made long-term contracts with suppliers in Eastern European countries ... the transactions are not recorded in international trade statistics'.

As has already been noted, this situation was found to be true during the present study and the estimates of the numbers of medicinal plants imported and used in the two European countries selected have been arrived at largely through an examination of trade catalogues. However, it has been impossible to reach any accurate up-to-date or independent figure for the number of plants entering Europe overall or the volumes of plants currently traded because of the lack of published information and the need for detailed discussions with a large number of traders which has been impossible in so short a time.

In the circumstances, the overview presented here has relied to a large extent on the findings of the 1982 ITC study. According to this, the nine countries which at that time belonged to the EEC (F.R. Germany, France, Italy, the Netherlands, UK, Belgium, Luxembourg, Ireland and Denmark) imported 80,738 tonnes of 'vegetable plant materials used in pharmacy' in 1980; out of this total, F.R. Germany imported 31,452 tonnes. The second largest importer after F.R. Germany, France, imported less than half this quantity.

The report stated that at that time 'over 400 botanicals' were used commercially in Western Europe. It was acknowledged, however, that the prevailing economic recession had forced many traders and end-users to cut their inventories to an absolute minimum.

It seems likely that the figures quoted above are now somewhat higher. Based on an

examination of UK and German trade catalogues, particularly that currently published by the largest German importer, Heinrich Ambrosius, the number of medicinal plants traded via Hamburg (the centre of European trade) is nearer 500 and possibly as high as 600 (considering the figure given by the BHMA for the UK). The quantities of individual plants imported vary from several hundred kilogrammes to several hundred tonnes, with only relatively few botanicals imported in quantities of thousands of tonnes or more.

In 1980, because of the unfavourable economic situation, many traders had ceased to carry their own stocks, but ordered supplies from Hamburg against their own confirmed orders. Normally, specialized traders based in Hamburg 'act as both importers, and distributors and in some cases, stockists ... In Europe, a series of brokers and agents often act between the traders and the end-users' (ITC 1982), while companies requiring large volumes of plants import direct from suppliers or set up joint ventures in source countries.

The ITC study found that the supply of 'botanicals' from developing countries fluctuated considerably and that there were frequent complaints from users concerning the quality of the plant material they received, much of it not corresponding to the samples on the basis of which the contract had originally been made. It was noted that the main end-users in the pharmaceutical industry found it advantageous to develop contractual relationships with established 'growers' in developing countries when the required volume of a particular plant was sufficiently large to make this economically viable. It was also noted that in general, medicinal plants are traded without any tariff restrictions, as most plants and crude drugs are exempt from duty.

With regard to prices, it was found that they tend to vary in a cyclical manner and are often difficult to determine. Price cycles of six to seven years are apparently common as the availability of many plants goes from over-supply to scarcity very quickly and then takes several years to return to normal. The prices of those plants traded in the largest volumes, in co-operation with or under contract from the user companies, are not published. The prices of most medicinal plants traded within Western Europe appear to be based on those prevailing in Hamburg at the time.

According to management consultants McAlpine, Thorpe and Warrior Ltd., there are over 2,000 companies in Europe in the herbal medicines sector (Anon. 1990a). Of these, some 30 per cent are said to have a turn-over in excess of £ 20 million per annum, and over 90 per cent are privately owned.

With regard to the final use of the medicinal plant material traded, ITC (1982) found that a large quantity was used in the preparation of herbal and medicinal teas. It was also noted that botanical suppliers and traders have greatly extended their potential markets by supplying plant extracts and medicinal herbs and spices to the food, flavour, fragrance and cosmetic industries. At the time of the ITC study, pharmaceutical applications represented less than 20 per cent of the total market for botanical products.

While India was the individual country supplying the overwhelming majority of medicinal

plants (10,055 out of a total 80,738 tonnes imported into the nine European countries surveyed), the ITC survey noted that Eastern Europe remained a major source of medicinal plants. Indeed, according to Peter Bradley (pers. comm.) of the BHMA, large numbers of medicinal plants are currently supplied by Poland, Bulgaria and former Yugoslavia. The last country appears to have been producing at least 150 different species of medicinal plant — many of these from wild sources (Anon. undated). Other important producing countries within Europe include Greece, France, Italy, the Netherlands, Czechoslovakia, Hungary and Albania.

The German market

Germany has a far greater use and official acceptance of medicinal plants in general than the UK. Indeed, herbal medicines enjoy a similar status to conventional drugs. According to Reithmeier (in Anon. 1991b), a survey of the attitude of the German population towards natural medicines showed that nine out of 10 patients considered them 'as good or even better than chemical medicines'. It is interesting to note also that a product from *Gingko biloba* is the most widely used of all medicines in former F.R. Germany, accounting, in 1989, for over 5 million prescriptions, many for the treatment of tinnitus (H.W. Mitchell pers. comm.).

With manufacturers able to make much stronger claims about the benefits of their herbal remedies than in most other European countries and with doctors reimbursed for their use, Germany has become the largest importer of medicinal plants in Europe and is now the acknowledged centre of the trade. Hamburg is the focus of this activity (claimed by ITC in fact to be the centre of world trade in medicinal plants) and a large number of dealers are based here.

Traders in Hamburg supply not only German pharmaceutical and herbal medicine companies (some of the largest of which include Schwabe, Madaus, Nattermann and Scheiffer, Lichtwer and Schaper and Bruemmer), but companies in many other parts of Europe too. Germany (and Switzerland) are also major suppliers of finished plant-based pharmaceutical products to other countries. The size of the German herbal product market in 1989 was estimated by McAlpine, Thorpe and Warrior to be US\$ 1.7 billion (accounting for 70 per cent of the European market).

ITC (1982) noted that in 1980, F.R. Germany imported 31,452 tonnes of medicinal plants and 805 tonnes of alkaloids, of which 6,473 tonnes of plants and 7,222 tonnes of alkaloids (some of these, however, from synthetic sources) were re-exported. Durbeck and Wildner (1991) have estimated that in 1987 the value of plant alkaloids, glycosides and their derivatives in F.R. Germany was DM 262 million; they also give the value of plant and extracts in general as DM 390 million and of homoeopathic preparations as DM 110 million.

Schumacher (1991) estimated that some 75 different plant-derived secondary metabolites are used in Germany, currently representing five per cent of all medicines. Crude plant drugs are said to represent about 15 per cent of all medicines on the German market. Of these, plant

drugs, according to Schumacher, account for some 25 per cent of all available anti-hypertension and anti-tussive medicines, up to 30 per cent of available hypnotic and tranquillizing medicines, and up to 50 per cent of laxatives. For anti-tussive and heart therapy medicines, he reports that 'nearly no preparation can be found which does not contain either crude [plant] drugs or chemically defined substances'.

The 1982 ITC report stated that while 'there is no large production of medicinal plants in the Federal Republic ... there is some cultivation of *Valeriana officinalis*'. In addition, small quantities (under 500 tonnes) of some of the plants sold in herbal medicines and infusions by the various traders are also produced domestically.

Of the 31,452 tonnes of plants imported into F.R. Germany in 1980, figures quoted by ITC (1982), but which are taken from the Analytical Tables of Foreign Trade from the European Communities Statistical Office (Luxembourg), give the most important of the 53 supplying countries as follows: India (6,929 t); Argentina (3,383 t); Yugoslavia (1,902 t); Greece (1,061 t); China (1,051 t); Poland (1,036 t); Egypt (931 t); Hungary (916 t); Czechoslovakia (801 t); Zaire (702 t); Albania (680 t); the Netherlands (671 t) and France (456 t). It is interesting to note, however, that countries of origin of 4,813 tonnes of plants are listed as 'not disclosed'.

With reference to the 805 tonnes of alkaloids and their derivatives imported, most were obtained from China (261 t), then France (212 t) followed by Zaire (88 t).

As already mentioned, the major stockists in Hamburg appeared to have stocks of about 400 plants before the 'recession' of 1980. Research for this study indicates that currently 500 plants are available, if not always in stock. To verify this figure, however, one would need to contact the importers directly, since, as Dr. Uwe Schippmann reported (*in litt.* 1992), 'official trade statistics ... are of no help for gathering trade data on medicinal plants. Therefore, the records of the importers themselves are of potential value'.

The F.R. Germany was, in 1980, a growing market for medicinal infusions, mostly marketed through pharmacies as 'teas' and commonly drunk to alleviate ailments of the bowel and bladder. ITC (1982) noted that since the volume of these infusions traded is between 4,000 and 5,000 tonnes a year, 'it is difficult to differentiate between the use of say, senna, as an infusion and senna as an extractive raw material'. A separate ITC study of herbal infusions showed that in 1979 the consumption of plants for such purposes was somewhere between 11,500 and 12,500 tonnes (ITC 1980). Whilst some 7,500 tonnes were sold mainly at general food outlets, some 4-5,000 tonnes consisted of 'medical infusions sold at pharmacies'. The complication is that of those sold at food outlets (90 per cent of which comprised lime tree blossom, peppermint, vervain, camomile, hibiscus and rose hips), some are also used as medicinal infusions. The ITC report concluded that the bulk of the plant material used for medicinal infusions originated from about 500 species.

With regard to the future of the trade in Germany, it appears that medicinal plants will not lose their popularity and that trade is likely to expand. One indication of this is a current

initiative backed by the Government which is aimed to increase trade with the producers of medicinal plants for Germany, through an initiative known as PROTRADE.

The UK market

Drawing on the ITC report (1982) and noting its statement that 'there are few import statistics on imports of medicinal plants for the United Kingdom', it appears that, according to figures from the EEC Statistical Office, the UK imported 2,824 tonnes of 'vegetable materials used in pharmacy' in 1980 (Anon. 1980). According to the Department of Trade's 'Overseas Trade Statistics of the United Kingdom', however, some 3,813 tonnes of 'medicinal plants' were imported into the UK in the same year, valued at US\$ 4,630.

While it was reported that belladonna and liquorice were cultivated in the UK alongside small quantities of other temperate medicinal plants, the biggest suppliers to the UK were: India (806 t); Sudan (251 t); USSR (243 t); the Netherlands (232 t); Italy (205 t); Yugoslavia (167 t); Egypt (157 t); France (148 t) and F.R. Germany (138 t).

Although it is listed as having supplied only 18 tonnes in 1980, Fuller (1991) reported that the UK imported 250 tonnes (5.5 per cent of total UK herbal imports) from the US in 1988-89. This apparently represented the highest relative per centage imported by any European country, followed by the F.R. Germany and Switzerland. Still, with regard to imports into the UK, Fuller (1991) stated that a far larger per centage came from developing nations such as India and Brazil, rather than from the US.

According to ITC (1982), some 357 tonnes of vegetable alkaloids and their derivatives were imported in 1980, but the source of 326 of these tonnes was not disclosed for commercial or military reasons. The largest quantity listed, 12 tonnes, came from Switzerland, nine from F.R. Germany, five from France and three from Indonesia, with India and the Netherlands supplying one tonne each.

ITC (1982) noted that the annual imports of plant materials into the UK had ranged between 3,500 and 4,500 tonnes for the last eight years, but that with the reduction of inventories imports had declined considerably in the previous two years and was expected to diminish in the foreseeable future. The report continued: 'Even prior to 1980, the larger manufacturers tended to buy their principal raw materials direct, sometimes on contract, in an endeavour to guarantee supplies and a reliable quality. This had led to a contraction in the number of dealers in medicinal plants and by 1978 there were only two importers of crude plant materials for the herbal trade who kept plants in stock for "on demand" sales. Only a small proportion of these materials however had much of a turnover'. The report singled out only very few plant materials for individual attention in this regard. It mentioned that in 1981 and 1982, 'ipecacuanha was often unquoted and expensive when it became available' and that 'ginseng imports amounted to 25 tons in 1980 ... No details about imports of *Datura* species, *Dioscorea* or *Rauwolfia* species could be found; any major groups trading these items would probably purchase them from Hamburg against specific orders'.

According to ITC, despite the fact that the British pharmaceutical industry 'has always

sought reliable sources of supply and has shown a preference for materials that are synthesized ... the recent trend towards natural remedies and health foods has led to the development of a market for herbal and health foods that is valued at £ 200 million per year. Dietary supplements such as vitamins and trace elements account for the bulk of sales, but sales of herbal products and herbal cosmetics are increasing. New products are introduced onto the market each year: 1982 saw the introduction of new ginseng products, a pure valerian tablet and various other herbal remedies ... new products can be marketed without a license provided that there is no claim on the label about the therapeutic properties of the product'.

As part of the exercise of gaining an overall picture of the imports of medicinal plants into the UK, correspondence was entered into and visits were made to members of the BHMA. Hugh Mitchell, its President, and Director of his own company Mitchfield Botanics (which imports medicinal plants into the UK), implied that while a great deal is known about the trade in medicinal plants and the sources of the plants, information pertaining to wild collection was 'commercially sensitive' and no offer was made to disclose it. He did, however, suggest that as many as 600 plants were probably used in the UK medicinally, from a total of 6,000 currently traded worldwide. (Interestingly, Fuller (1991) reported that 'According to Steven Foster, a noted expert on American herbs, some 600 medicinal herb species are commonly traded in the US market').

One of the UK's major suppliers of herbal extracts, elixirs, infusions, syrups and tinctures to the pharmaceutical, food and cosmetics industries, William Ransom and Son was also visited. Dr. Sheila Drew (Deputy Head, Technical Services Department), who kindly organised an extensive tour of the factory in Hitchin, did not appear to know a great deal about which of the materials they used were collected from the wild. She was, however, able to reveal the names of about 20 suppliers of plant material to the company and implied that, whilst the company would not be prepared to take any direct action to curtail the use of plants from the wild, she thought it possible that it would be able to write letters to its suppliers stating that they were concerned about the situation and did not wish to jeopardise future supplies.

Suppliers included: in the UK — Mitchfield Botanics, Wilfred Smith, Charles Clemenson and Co. and Brome and Schimmer; in Germany — Heinrich Ambrosius, Alfred Golk, Techow, Joseph Flach, Paul Muggenburg, Madaus, Walter Bolke, Cornehl and Bosse, Caeser and Loretz, and Siber Hegner; in Belgium — Meyskens; in Holland — V.N.K.; in South Africa — Gerber Goldschmidt Group and, Meihuizen Freight and Exporters Ltd.

From the study of the William Ransom catalogues and promotional material, it appears that the company is using about 200 different plants. A current brochure mentions the company's need to obtain 'several hundred different raw materials of vegetable origin' to make its full range of products and states: 'though some materials are fairly difficult to obtain, the company has secured more than one source for each material. Owing to its considerable expertise in the purchasing of materials, the company is usually able to buy when supplies are plentiful and prices low. Adequate stocks are held to guard against future shortages'.

Another company contacted, Potters (Herbal Supplies) Ltd., also offered a visit to their factory (in Wigan). The number of plants they are using has not been calculated, though their 'Potter's New Cyclopaedia of Botanical Drugs and Preparations' lists approximately 600 medicinal plants (see Wren 1988).

English Grains (said to be one of the biggest retailers of products involving medicinal plants in the country) stated in a letter: 'We do indeed use many different varieties of plant powders and extracts in our tablets, but many we feel would not be of interest to you as regards a full survey for their survival'. The company did disclose, however, the names of its principal suppliers in England and Germany. From England: Brome and Schimmer, Slater and Frith, and Brightstern Ltd.; from Germany: Heinrich Ambrosius and H. Finzelberg Nachfolger.

According to management consultants McAlpine, Thorpe and Warrior, the following UK companies are thought to rank among the most profitable 10 per cent of herbal medicine companies in Europe, with annual sales of £ 5 million or more: English Grains, Potters (Herbal Supplies) Ltd., G.R. Lanes, Gerard House, and Seven Seas. Whilst the UK market for 'herbal remedies' was estimated at £ 65 million in 1989, the total, including dietary supplements, was £ 225 million.

Future trends in trade

In the fields of both allopathic and herbal or traditional medicine, it appears that globally the use of medicinal plants will rise appreciably in future years. First, considering herbal medicine, predictions of increase in the global human population (projected to rise to 10 billion by 2050) especially in developing countries (where traditional medicine is most widely used), cannot but place a huge extra burden on wild populations of medicinal plants, unless effective conservation measures are adopted fast. Indeed, ITC (1982) predicted that 'The major growth markets for medicinal plants cultivated or collected in developing countries and for their extracts may well be in the geographical regions in which the producing countries are located, rather than the established markets of Europe, North America or Japan'.

As far as European trade is concerned, it appears that imports and usage are also likely to rise because of the following factors: i) consumer interest: McAlpine, Thorpe and Warrior predict that 'the growing trend of herbal medicine sales through pharmacies will increase in stature among consumers who are looking for natural-based, environmentally-friendly products' and that although 'the ethical drugs market dominates the pharmaceutical industry, in all countries there is a trend towards more self-medication in the West, due to governments wanting to reduce the costs of subsidized health care and by consumers taking up responsibility for their health'; ii) EEC legislation improving the status of the herbal medicine industry — with efforts being made to set workable standards for the use of medicinal plants across Europe; and iii) aggressive marketing moves and strategies which seem likely to prevail in the next few years.

According to McAlpine, Thorpe and Warrior: 'The UK market is growing and will continue to do so more rapidly in the future'. Beyond the UK meanwhile: 'The market for herbal

medicines in the European Community is a buoyant, prosperous one that continues to grow at a rapid pace, offering excellent opportunities for investment in both the less developed markets and the more sophisticated ones'. According to James Middleton (*in litt.* 1992) of the same company: 'the prospect of a single market in the EEC has focused many minds on the business opportunities that will be created ... Many companies will ... be looking at the advantage of supplying or procuring herbal products on a pan-European basis'. McAlpine, Thorpe and Warrior predict that annual sales of natural (herbal) medicines in the US and Western Europe could grow to US\$ 4.9 billion by the late 1990s (compared with US\$ 2.1 billion in 1986) and to US\$ 47 billion by the turn of the century. This company appears to have been playing or attempting to play an important catalytic role in the encouragement of trade in medicinal plants, with the specific aim of increasing market opportunities for companies in Europe and developing countries by means of licensing or joint-venture agreements. Their publication 'EEC Market for Herbal Medicines 1990-1994' identifies major products and trends in the introduction of new products and gives data on market size and growth rates for different production sectors, with a section on the future of herbal medicine in the EEC and suggested tactics for allowing new products to pass more quickly through the licensing system.

In addition to efforts such as these, according to Chadha (1990): 'the new interest in medicinal plants has prompted some UN development agencies to stimulate research in this field in the developing countries. UNIDO has been assisting in the development of pharmaceutical industries based on medicinal plants on scientific lines. UNESCO has sponsored two regional networks for promoting co-operation among research institutions concerned with the chemistry of medicinal and aromatic plants in South Asia and South East Asia. More recently, it has launched the Asian and Pacific Information Network on Medicinal and Aromatic Plants (APINMAP) ... WHO is encouraging developing countries to intensify research on medicinal plants so that traditional and new herbal medicines could be put to better use'. Together, UNIDO, UNESCO and WHO are promoting the establishment of national information systems and regional information networks for the benefit of pharmaceutical industries, with particular attention to medicinal and aromatic plants.

In an assessment of likely future trends, it should not be forgotten that it is generally expected that many plants currently traded as 'medicinal' may be used extensively in the cosmetics, toiletries and food industries and that these sectors are likely to account for a proportionately far larger growth than the medicinal sector alone.

Despite the prediction made in 1982 by the ITC that 'the use of medicinal plants and derivatives ... in purely allopathic medicinal applications will generally decline in most industrialized countries', and the warning that uncertain supplies from developing countries can result in the development of synthetics with companies rarely returning to the plants themselves, a number of factors point to an increased use of plants in mainstream medicine:

- The renewed interest of pharmaceutical companies in isolating useful compounds from plants.

- The fact that useful clinical substances are now being extracted from plants not previously used medicinally. As Fellows (1991) has pointed out, we should remember that 26 per cent of today's plant-based commercial drugs were found serendipitously in plants with no previous history of use as medicines — suggesting that the screening of all wild plants is likely to yield information of value to the pharmaceutical industry.
- The numbers and types of diseases or symptoms for which satisfactory cures still remain to be found or developed, for example: viral diseases, arthritis, cancers, diabetes, asthma, heart disease, ulcers, rheumatism, genetic diseases, such as cystic fibrosis, and AIDS. For a number of these, particularly long-term, chronic disease, it has been suggested that herbal medicines — even if they cannot cure the problem entirely — may at least offer some assistance that is complimentary to allopathic drugs.
- Recent discoveries of useful plant-derived compounds with activity, for example, as anti-implantation agents, anti-malarial agents, immunostimulants, cardioactive and anti-viral agents, all from tropical rainforest species (Farnsworth and Soejarto 1991).

Apart from any increased flow of raw medicinal plants into Europe for these purposes, according to Principe (1991): 'many pharmaceutical companies have begun major licensing programmes with pharmaceutical companies in other countries. [since] Licensing another company's drugs yields healthy profits'.

Some large multi-national companies in Europe, such as Fisons, are also setting up herbal-based product subsidiaries, and the largest pharmaceutical businesses are said to be monitoring carefully the development of the herbal medicine industry and may consider entering the market in the near future (Anon. 1990d). According to the same source, many large German and Swiss companies are taking time to research the European market for herbal remedies, suggesting that the industry is anticipating a sharp rise in the importance of this product category in the future.

IMPLICATIONS FOR MEDICINAL PLANT CONSERVATION



Wild or cultivated plants in trade?

As has already been observed in this report, the precise origin of the medicinal plants currently imported into Europe is extremely difficult to ascertain. Users and traders alike are reluctant to reveal their exact sources — traders especially apparently fearing that this may allow others to undercut them.

From the research carried out during this study it would seem that relatively few plants are actually being cultivated at present, though the information is at best confusing and contradictory. A complicating factor appears to be that a number of those plants that are definitely cultivated are also harvested from the wild (often in large quantities, as with certain *Gentiana* species from which some 1,500 tonnes of roots are apparently taken and exported through China every year) (Franz 1991). This makes the exact picture very difficult to establish.

For example, at least one user in the UK appears from catalogue evidence to be using a minimum 35 of the 71 species of native North American medicinal plant reported by Fuller (1991) as being primarily wild-harvested and traded in significant volumes. Yet a number of these, including *Echinacea purpurea* (purple coneflower) also appear to be cultivated. Fuller, who compiled the North American list from various sources, states in fact that *E.purpurea* (used in Germany to bolster the immune system and to fight chronic infections and inflammations) is cultivated 'in mass quantities'. American ginseng (*Panax quinquefolius*) is another plant that is both cultivated commercially on a large scale and yet still apparently collected from the wild.

- Examples of species that appear to be both collected from the wild and cultivated for trade include:

Atropa belladonna and *A. acuminata*

Cassia acutifolia and *C. senna*

Cephaelis ipecacuanha (though most appears to come from the wild in Brazil)

Datura metel and *D. stramonium*

Discorea spp.

Eleutherococcus senticosus

Glycyrrhiza glabra

Hyoscyamus muticus and *H. niger*

Panax ginseng and *P. quinquefolius*

Rauwolfia serpentina (grown on the Indian subcontinent, while other species of *Rauwolfia* are collected from the wild in Zaire, Mozambique and Rwanda)

Valeriana officinalis

- Examples which appear to be only cultivated include:

Catharanthus roseus

Chamomilla recutita

Cinchona spp.

Digitalis lanata and *D. purpurea*

Duboisia spp.

Mentha piperata

Papaver somniferum

Plantago ovata

Puzzlingly, Farnsworth and Soejarto (1991) noted, with reference to the global use of medicinal plants: 'Currently one can document that at least 137 species of plants are collected from the wild *or* are cultivated in ton quantities. Most of these are produced from cultivated plants; little is known about the natural abundance of those few major species that are collected from wild-growing plants' [emphasis added]. Unfortunately, the authors do not identify which of these plants are definitely and solely cultivated or those which come from the wild. For example, in their table of 'Major Medicinal Plants Entering World Trade', drawn from data presented in ITC (1982), the authors list only 74 plant species and of these only approximately half are indicated to be cultivated at all. Because of this anomaly, and on the basis of research for the present review, it appears that only a very small per centage of those plants entering European trade as a whole for herbal and allopathic medicines are solely cultivated. This question urgently needs to be investigated.

In apparent contradiction to Farnsworth and Soejarto (1991), Schumacher (1991) estimates that two thirds of the species used in Germany as sources of important crude drugs are collected from the wild. Durbeck and Wildner (1991) state that: '*most* medicinal plants entering Germany are from the wild' [emphasis added]. And as Franz (1991) noted: 'Only a very small number of species whose products are required in large quantities are systematically cultivated'. Similarly, according to Palevitch (1991): 'Only a small portion of the raw material is produced under cultivation'. Bonati (1991) on the other hand, has declared that today a very large proportion of the medicinal plants used comes from cultivation: the plants used are usually grown in their natural habitat where organisations have been set up to cultivate, collect and dry large quantities of these plant materials.

The overall situation as regards sources of plants then, appears to be very confusing. It seems that the very largest end-users definitely have their own plantations for the cultivation of some of those plants most frequently used for the manufacture of drugs for allopathic medicines, but the picture is very unclear as regards the rest.

Attempts have certainly been made in a number of developing countries to begin cultivation and research programmes, yet where these are not backed up by big-business, including powerful multi-national companies, they appear to be generally on a small scale. Nepal, for example, having witnessed indiscriminate exploitation of plants such as *Swertia chirata*, as well as *Orchis* and *Valeriana* species in recent years, is now growing a number of oil-

producing plants (such as *Citronella* and *Mentha* species) but certainly not many of those that are most threatened through over-harvesting (Amatya and Sthapit 1991).

In China, meanwhile, several hundred species appear to be grown in botanic gardens, with an unspecified number located in 'about 300,000 ha ... devoted to medicinal plant cultivation' (Shan-an and Zhong-ming 1991). In Brazil and Guatemala research programmes have also been initiated aimed at the evaluation, screening and cultivation of medicinal plants, and in Thailand, where there has been encouragement of extensive cultivation of medicinal plants by villagers as a means of improving and extending primary healthcare, 48 medicinal plants are systematically being grown in 1,000 villages (Anon. 1991, Caceres 1991, Desawadi 1991).

In many other countries, however, no attempt at all appears to have been made at cultivation. In Pakistan, for example: 'All the plants are growing wild and no systematic attempt has been made at cultivating herbs in a proper and planned way' (Ikram and Hussain 1978).

Within Europe, the picture seems to be slightly more encouraging, yet still unclear. Italy, for example, apparently cultivates some 47 species and in Greece, where 'it is estimated that the aromatic and pharmaceutical plants growing over the country amount to 600 [species] or so', an unspecified number are also cultivated (ITC 1990, ITC 1977).

Former Yugoslavia is a very important source of many plants — some 150 species or so seem to have been exported from the country — but though some have definitely been cultivated, a large number are almost certainly collected from the wild.

Wild collection as a marketing strategy

One major problem as regards implications for plant conservation is the belief — held in tandem with the notion that 'natural is better' — that a plant collected from the wild is generally more efficacious than a cultivated one. Fuller (1991) observed: 'herbalists tend to believe that wild harvested plants are somehow superior to cultivated or artificially propagated ones', and in the UK, at least, this point is used as a marketing strategy.

A good example of this is devil's claw *Harpagophytum procumbens* as marketed by the company Arkopharma, in the form of 'Arkocaps' — capsules which contain pure plant powder — since the packet announces the wild origin of the plant material as the highest recommendation of its efficacy.

The secondary roots or rhizomes of *Harpagophytum*, which is indigenous to the Kalahari desert, are used in anti-rheumatic treatment, amongst other things. According to Peter Bradley (pers. comm.) of the BHMA, this plant is 'definitely harvested from the wild and there's not much of it about'.

Paradoxically, the marketing allure of a wild grown plant — which is likely to have borne few overheads in its collection — enables producers to charge high prices. In noting that consumer preference for wild collected herbs extends well beyond the confines of the US

market, Fuller (1991) found 'perhaps the most dramatic example being the willingness of Asian consumers to pay three times as much for wild American ginseng *Panax quinquefolius* as for cultivated varieties'.

Fuller (1991) felt — with regard to the American trade at any rate — that although some herb companies are 'cautioning the public about unethical collecting practises ... conservation-minded herbalists are caught in the seemingly contradictory position of promoting the use of wild plants and advocating their simultaneous protection'.

The traders' point of view

The point of view of UK traders appears to be that any conservation considerations (specifically, cultivation as opposed to wild harvesting) are largely an unaffordable luxury at the moment. This view is set in the context of the British manufacturers' struggle to: i) get the usage of medicinal plants officially recognised and accepted in the face of stiff opposition from the medical profession at large (seen as in league with the pharmaceutical industry); and ii) the activities of 'cowboys' within the trade who are able to bring the whole industry into disrepute by either making spurious claims, or using plant materials in their products other than the ones advertised, thus not adhering to correct standards and therefore undercutting the prices of *bona fide* licensed products.

According to J.T. Hampson (pers. comm.) of Potters (Herbal Supplies) Ltd., it is the activities of such 'cowboys' in particular which should be outlawed, to enable sufficient revenue to be made by licensed manufacturers to allow them to invest the money in cultivation. At the moment, it appears that profits are insufficient and trade too uncertain for this to happen. Hampson quotes the example of the recent wave of interest in feverfew *Tanacetum parthenium* as a case in point. His company, he says, had expended considerable time and effort in cultivating the plant in Jersey (having had their material checked by The Royal Botanical Gardens, Kew, in the process). By the time their licensed product reached the market, however, another company was able to undercut their price, using, as it later transpired, a chamomile species instead of feverfew.

For the British traders then, conservation — as they see it — depends firstly on increased revenue: more plant material must be sold to pay for these activities. According to Hampson (*in litt.*), to enable this to happen, the current 'legislative unfairness' must be resolved. Speaking at the Chiang Mai conference on conservation of medicinal plants in 1988, he said: 'Most Western nations still have legislation which strongly acts against a stable market and seem intent on destroying or at least severely restricting the use of herbal medicines in the West'. His point was that this has created a commercial uncertainty which precludes a strong regrowth of commercial farming. Hampson stated that the first target should therefore be to 'create a commercial environment with a strong growth to satisfy the already existent, justifiably buoyant consumer demand. This in turn will create a commercial viability and wealth which, if supported by academic interest, will provide the money and knowledge needed to restore commercial plantations and farming. This will lead naturally to revenue-earning crops in many parts of the world'. Alongside this and to eliminate the 'cowboys', reasonable standards for the quality control of herbal products should be set.

In the view of Hugh Mitchell (pers. comm.), those really threatening wild plant populations are 'the big boys', the large international drug companies working across boundaries and continents and able to do roughly as they please. According to Mitchell, companies such as his own (which has been importing medicinal plants since 1952) represent only a small part of the industry.

Interestingly, according to A. Bonati of Indena (pers. comm.), which claims to be the 'largest producer of plant derivatives in the world' and which also claims to cultivate a large part of the material they use, 'cultivated plants are usually no more expensive than wild-collected ones'.

Institutional conservation efforts

As has already been noted, guidelines are now being developed to set standards regarding the use of medicinal plants across Europe. These efforts appear to be much more concerned with the interests of increasing trade, marketing and consumer safety than with conservation. Indeed, it is difficult to find any evidence of practical legislation being used or drawn up to ensure that conservation considerations are adequately addressed as regards the importation of medicinal plants into Europe as a whole.

While ESCOP is busy preparing proposals for European monographs which will 'legitimize' the use of some 200 plants as ingredients for phytomedicines, there is no apparent mention of conservation criteria or any consideration of the effects of current usage, let alone of increased demand on wild plant populations.

According to Peter Bradley (pers. comm.) of the BHMA, the Commission of the European Communities has recently been discussing *Harpagophytum procumbens* for inclusion in the European Pharmacopoeia (it is currently only listed in the French Pharmacopoeia), yet, as we have seen, this plant is definitely being harvested from the wild, perhaps at unsustainable levels.

World Health Organisation (WHO)

In its promotion of traditional medicine and its stated aim of 'Health for All by the Year 2,000', many Resolutions have been passed by WHO since 1976 to further the usage of medicinal plants. At the 40th World Health Assembly in 1987, for example, points were made reaffirming some of those stated at the Alma Ata Conference in 1979 and member states were urged to: 'initiate comprehensive programmes for the identification, evaluation, preparation, cultivation and conservation of medicinal plants used in traditional medicine' (Akerele 1988).

An important part of WHO's Global Medium-Term Programme (for 1990-1995) is the: 'study, evaluation, utilization and conservation' of medicinal plants (Akerele 1991). At the 1988 Chiang Mai conference on conservation of medicinal plants, O. Akerele (WHO's Programme Manager for Traditional Medicine) stated: 'the importance of conservation is recognized by WHO and its Member States and is considered to be an essential feature of national programmes on traditional medicine' (Akerele 1991). In drawing attention to the

serious problems of the over-exploitation of medicinal plants in the past, such as *Rauwolfia serpentina* in India and *Coptis teeta*, Akerele declared: 'logically, the investigation, utilization and exploitation of medicinal plants by a country should also include measures for their conservation'.

In the Resolution of the 44th World Health Assembly (May 1992), it is recognised that 'many species of medicinal plants are threatened by ecological and environmental changes', but no mention is made of the threats posed by over-collection or of practical measures that can be adopted to overcome them.

Indeed, a considerable focus of WHO activity appears to be commercialization in the first instance: 'Technical links are maintained with UNIDO, UNDP, UNESCO and the World Bank, as these agencies and other funding and development bodies are financing traditional medicine activities at country level. A recent link has been forged with the World Federation of Proprietary Medicines Manufacturers (WFPMM), a non-governmental organization in official relations with WHO' (WHO 1991).

IUCN and WWF

At the Chiang Mai conference on conservation of medicinal plants, IUCN, WWF and WHO declared jointly that they viewed 'with grave concern the fact that many of the plants that provide traditional and modern drugs are threatened' and therefore 'The urgent need for international cooperation and coordination to establish programmes for conservation of medicinal plants to ensure that adequate quantities are available for future generations' (Akerele *et al.* 1991).

As summarised by Hamann (1991): 'The joint IUCN/WWF Plants Conservation Programme is emphasizing medicinal plants as a major, but neglected group of plants for which conservation is a priority' and, as part of this Programme, a number of useful initiatives have been started involving, for example, centres of plant diversity, the role of botanic gardens and wild plants of economic value. However, Hamann acknowledged: 'so far there has been little coordinated action on an international scale to ensure the sustainable utilization and conservation of medicinal plants. The present [conference] is therefore a historic event, in bringing together the conservation and health care professionals ... with the intention of producing a set of guidelines for countries wishing to make the best possible use of their medicinal plant resources and to conserve them for the future'.

CITES

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) provides at present the only international instrument for listing species of plants and animals whose numbers are considered to be endangered to the extent that commercial trade must either be monitored and controlled or prohibited. Very few medicinal plants are listed on Appendix I (which prohibits commercial trade) or Appendix II: *Saussurea lappa* is on Appendix I while *Dioscorea deltoidea* and *Panax quinquefolius* are on Appendix II.

Fuller (1991) believed that to redress the lack of data on international commerce in medicinal plants 'evidence of international trade should be sought and, for those species traded internationally, CITES Appendix II proposals should be prepared. Meaningful quantitative data on international trade at the species level are often hard to come by; a CITES listing would greatly improve the quantity and quality of data for such heavily exploited taxa as *Hydrastis canadensis*, *Sanguinaria canadensis*, *Echinacea* species, and *Rhamnus purshiana*, among others'. All of these plants are currently used in Europe.

Considerations concerning wild collection and cultivation

The over-collection of many medicinal plants from the wild stems often from local poverty which is itself a direct result of the particular socio-economic situation that many rural inhabitants find themselves. The activities of governments as well as large multi-national companies and banks are likely to have caused the most serious of these problems, which most rural people are quite unable to overcome in the normal course of events.

The prices paid for the collection of medicinal plants by large companies are often so low as to act as a stimulus to over-collection. As Fuller (1991) found in the US, prices are kept artificially low by a small number of wholesale distributors with monopoly control over prices and, by doing this, wholesale distributors may in fact be forcing plant harvesters to over-collect in order to obtain a reasonable return. However, even when higher prices are paid, this will not necessarily solve the over-collection problem on its own. For example with *Panax quinquefolius* in the US, 'because ginseng root is valuable, many overzealous collectors dig all the plants from wild populations. They often fail to reseed and as a consequence, there is serious concern about the survival of American ginseng in the forest ecosystem' (Fuller 1991). Where the whole plant is not taken, of very serious concern is the removal of perennial parts of plants, such as bark, roots and rhizomes, in which secondary compounds are often located (Fuller 1991). Rather than ban wild collection it seems sensible to encourage prudent (sustainable) harvesting, along with propagation and cultivation where possible.

The question of cultivation needs to be approached with care, since it appears to bring its own risks — the most serious being the abandonment of wild populations to their fate. Whilst *Cinchona* trees are cited as good examples of medicinal plants that have been successfully cultivated, this activity does not appear to have done anything to safeguard wild relatives. Indeed, of the 40 species known to exist in the wild, only four (and their hybrids) have acquired commercial significance. As McHale (1986) noted: 'There is a real danger that ruthless selection and exploitation of the commercially valuable species of *Cinchona* will lead to the extinction of less favourable genetic stock ... the genetic base of cultivated *Cinchona* is already restricted since the original seed collected by Ledger represented only a limited sample of the total *Cinchona ledgeriana* population of South America. The introduction of propagation *in vitro* for *Cinchona* at the expense of seed-derived plantations could lead to further genetic loss if large areas are planted with an even more restricted range of genotypes. Recognition of the vulnerability of the genetic base has led certain workers to look seriously at the question of conservation ... wild stands of *Cinchona* in South America

are potentially the most valuable from the long-term point of view and serious attempts at their conservation would be wise'.

This somewhat ingenuous last remark is, lamentably, indicative of the general lack of awareness concerning the problems facing wild medicinal plants and the tardiness with which the imperative of *in situ* conservation has generally been viewed.

As with other plants of major economic importance — for example, rubber, *Hevea brasiliensis* — no sense of ethical responsibility or even 'wise house-keeping' has ever prompted those who benefit most from their exploitation to take anything but the cheapest and most expedient measures to conserve wild relatives, generally through the collection of germplasm from the wild — an activity which could be construed as stealing.

It is because of this widespread, manifest refusal to initiate or become involved in meaningful efforts at *in situ* conservation on the part of commercial users generally, that it seems unfair to blame local people for the excesses of the trade, and that one approach to the problem is to help empower rather than incentivate (since most people have at least a shrewd idea of the causes of their predicament) them to protect their local plants.

Most land — and the plants on it — is the traditional territory of some or other local or indigenous group or other. The strength of Western economies has depended in part on the successive plundering of natural resources (often plants) from other peoples' lands. For this reason and the fact that millions of people in developing countries have become impoverished as a direct result of Western economic activities, it seems imperative that local people be assisted wherever possible to become, once more, the guardians of the plants that they may well have nurtured in the past.

RECOMMENDATIONS FOR CONSERVATION ACTION

It has become very apparent during this review, that any meaningful assessment of the importation of medicinal plants into Europe requires a much longer time period for research, and strong support from the industry.

Because of the size and complexity of the trade, it is recommended that:

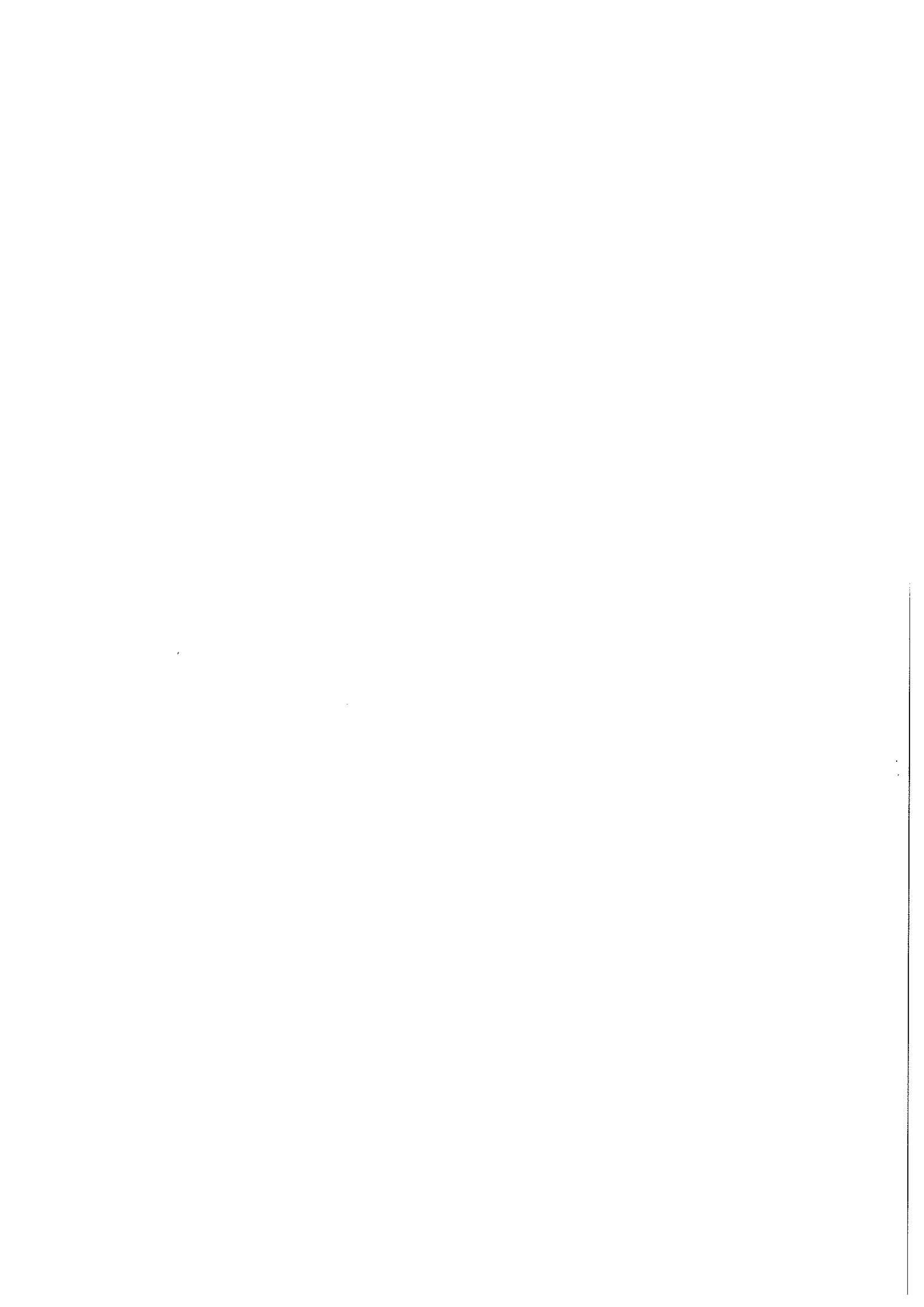
- Trade researchers carry out detailed studies, working very closely with the trade, and actually based in the European countries in question. If no more than one country can be studied this should be Germany; in order to assess:
 - a) the precise numbers of species entering the country or countries and in what quantities;
 - b) the origin of these plants — whether wild or cultivated;
 - c) if from the wild, their status in terms of rarity;
 - d) the extent of confusion of species in trade (i.e. 'rare' taxa being mistaken for more common members of a species).
- On the basis of the above research, an accurate list of all the medicinal plants entering each country or, at a minimum, entering Germany should be compiled, indicating their status and conservation problems faced, such that individual plants can then be singled out for conservation action. Following this:
 - a) traders and end-users should be alerted and encouraged to initiate or collaborate in conservation activities, with the desired goal of cultivation and/or adequate and achievable sustainable harvesting practises; the governments of the countries where the plants concerned occur should be alerted and involved in measures to control trade;
 - b) detailed ecological assessments should be made for individual plants, involving: distribution, growth rates, effects of harvesting and the capacity for regrowth/reproduction, etc., and genetic variation;
 - c) social studies should be conducted to ascertain, for example, who uses the plants currently, to what degree, how important are they to local people's income/well-being? Are they being harvested from land that actually belongs to them?
 - d) optimum rules, guidelines or quotas for sustainable harvesting should ideally be drawn up firstly by local people, such that they have greater control over the processes that may have obliged them to over-exploit their wild resources in the first place, and, secondly, for and involving large commercial companies, whose operations can perhaps be relocated or modified along sustainable lines.
- An awareness campaign should be initiated to alert:
 - a) governments;
 - b) traders and industry;
 - c) the general public to the problems now facing medicinal plants in view of the current effective lack of conservation measures.

- A commitment should ideally be elicited on the part of:
 - a) governments, specifically involving improved official monitoring (strongly recommended) with greater clarification of and access to Customs and Excise records;
 - b) the traders and companies using medicinal plant products: there should be far greater transparency in trading practises and an admission of responsibility in this regard. Companies in particular should be encouraged to make a commitment to place trade on a sustainable basis and recognise that part of the profits generated by their trade should be used for conservation of the resources which these commercial activities may directly undermine. Companies may indeed respond to this approach and take action, for fear, if nothing else, of adverse publicity.

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