

## **The Plant Resources of South-East Asia (PROSEA)**

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### **Abstract**

**The South-East Asian region is undoubtedly one of the world's major sources of useful plant resources. People living in the region have relied on indigenous vegetation for their livelihood for thousand of years. Whereby knowledge and information on useful plants have been accumulated and disseminated through the whole generations, the PROSEA programme has been undertaken with cooperation of various institutions in member countries. The purposes of the programme are to compile and disseminate the wealth of dispersed knowledge and information of some 6,200 useful plants in the region. One of the major outputs of the programme is a PROSEA data base on useful plant resources. Dissemination of information on useful plant resources is carried out through the publication of some 20 PROSEA volumes. All taxa are treated in similar manner with details on synonyms, vernacular names, distribution, uses, production, international trade, properties, botany, ecology, agronomy, breeding, prospects and literature. The PROSEA volumes which are directly related to the purpose of the congress are PROSEA 12: Medicinal and Poisonous Plants, PROSEA 13: Spices, PROSEA 16: Stimulants and PROSEA 19: Essential Oil Plants. Information of more than 500 medicinal and poisonous plants, 126 spices, 69 essential oil plants and 54 stimulant plants are available in these books.**

### **INTRODUCTION**

PROSEA, short for 'Plant Resources of South-East Asia', is an international programme focused on South-East Asia. The purpose of the programme is to make available the wealth of dispersed knowledge on plant resources for education, extension, research and industry through a computerized data bank and an illustrated multivolume handbook. A thorough knowledge of plant resources is essential for human life and plays a key role in ecologically balanced land-use systems. Extensive information on the plants growing in the region is needed to enable the plant resources of each country to be used optimally. A large international team of experts is preparing the texts on particular species and genera, which are being published in commodity groups. All taxa are treated in a similar manner with details on uses, botany, ecology, agronomy or silviculture, genetic resources, breeding, prospects and literature.

### **GROUP OF SPECIES PROCEDURES**

#### **Choice of Medicinal and Poisonous Genera**

The choice of the genera/species to be dealt with in each of the 3 subvolumes on medicinal and poisonous plants has been somewhat arbitrary. The importance attached to a given genus or species was based on existing information in handbooks on medicinal or useful plants for the South-East Asian region. In general, less information on the phytochemistry and pharmacology is available in the literature for the medicinal and poisonous plants to be covered in the present subvolume compared to those highlighted in Prosea 12(1). However, several genera/species covered in the present subvolume have a long-standing reputation in traditional medicine, such as *Alstonia*, *Alyxia*, *Capparis*, *Croton*, *Polygala* and *Quassia*. Other genera/species have been quite well investigated in the field of phytochemistry and may have prospects for the production of bioactive

intermediates. Examples include *Strophanthus* and *Cerbera* for their cardiac glycosides, *Tabernaemontana*, *Ipomoea* and *Phaeanthus* for their alkaloids and *Dioscorea* for its steroidal glycosides.

### **Choice of Spices Genera**

The spices form a large and diverse commodity group. In addition to the classifications based on taxonomic families, properties and plant parts used, many subgroups have been proposed, such as tropical spices, spice seeds, herbs, aromatic vegetables, tree spices, leafy spices, pungent spices, phenolic spices, aromatic barks, and coloured spices. However, the combination of chemistry, morphology and agronomy has so far not led to a comprehensive, satisfactory classification.

The selection of species for this volume are those species in which the direct use of the whole or ground, fresh or dried plant parts preponderates over the use of the essential oils. The 'essential-oil plants' are those species in which the extraction and use of essential oils is more important than the direct use of the plants. Spices are predominantly used in the flavour industry, whereas 'essential-oil plants' are applied in the flavour and fragrance industries.

### **Choice of Stimulant Genera**

Most of the plant resources brought together in this volume have in common that they are cultivated or collected for the stimulating properties of certain alkaloids (e.g. caffeine) and other psycho-active compounds that are present in non-toxic concentrations in the seeds, leaves or other harvested plant parts. Based on general use, three types of stimulant plants may be distinguished as follows

- (1) plants used to make beverages: hot or cold infusions are prepared, mainly from dried and processed seeds or leaves;
- (2) masticatory plants: the stimulating effect is obtained by chewing plant products;
- (3) plants whose dried and processed leaves are smoked.

### **Choice of Essential Oil Genera**

An essential oil is a mixture of fragrant, volatile compounds, named after the aromatic plant material of a single type and identity from which it has been derived by a physical process and whose odour it has. This definition indicates that a given essential oil is always derived from a single species or variety.

## **RESULTS AND CONTENTS OF PROSEA HANDBOOK**

### **PROSEA 12(1): Medicinal and Poisonous Plants**

This first volume of the medicinal and poisonous plants of South-East Asia deals with the better-known species and genera (de Padua et al., 1999). Many people in this region depend on plants for their primary health care and for use as pesticides. Interest in medicinal and poisonous plants is increasing, because plants are recognized as a vast source of novel chemical compounds, traditional systems of medicine are good starting points for drug development, synthetic drugs often produce serious side-effects, and that pesticides of plant origin are usually environmentally benign. This volume gives up-to-date information on all aspects of the plants, and where possible, couples traditional use with recent scientific findings. The volume covers about 330 species, including aloe, coca, derris, garlic, hemp, Java tea, Madagascar periwinkle, poppy, quinine, snakewood, turmeric, wormseed and wormwood. The introduction deals with general aspects of medicinal and poisonous plants. A glossary and several indices are included.

### **PROSEA 12(2): Medicinal and Poisonous Plants**

This second volume of the three planned volumes on the medicinal and poisonous plants of South-East Asia presents a mixture of species with a long-standing reputation in traditional medicine and species that have been well investigated phytochemically or

pharmacologically, but are poorly known in the South-East Asian region (van Valkenburg and Bunyaphatsara, 2001). Up-to-date information is provided concerning local knowledge as well as modern research findings, where possible. This information is important in view of the resurgence of interest in medicinal plants in South-East Asia. In general, less information on the phytochemistry and pharmacology is available for the medicinal and poisonous plants covered in the present volume compared to those highlighted in the first volume (1999). The alphabetical treatment of genera and species comprises 171 pages. Genera such as *Alstonia*, *Alyxia*, *Capparis*, *Croton*, *Polygala* and *Quassia* are well-known in traditional medicine in South-East Asia. Other genera have been quite well investigated in the field of phytochemistry and may have prospects for the production of bioactive intermediates. Examples include *Strophanthus* and *Cerbera* for their cardiac glycosides, *Tabernaemontana*, *Ipomoea* and *Phaeanthus* for their alkaloids and *Dioscorea* for its steroidal glycosides. The introduction deals with some aspects of quality control of herbal drugs. A glossary and several indices are included.

### **PROSEA 13: Spices**

This volume deals with the spices of South-East Asia. Spices are defined as those aromatic plants and plant parts, fresh or dried, whole or ground, which are primarily used to impart flavour and fragrance to foods and drinks (de Guzman and Siemonsma, 1999). The term “spices” is used in a wide sense and includes the culinary herbs. This volume complements the PROSEA volume ‘Essential-Oil Plants’ that deals with aromatic plants whose main use is for the extraction and use of essential oils.

In this volume, 61 important spices are described in 50 papers. Summary data are presented on 65 minor species. About 150 plant resources with another primary use but also used as a spice are listed, with a reference to the PROSEA volume where the plants are or will be treated in more detail.

Spices are indispensable in the culinary art, used to create dishes that reflect the history, the culture and the geography of a country. Well-known examples are curry powder, houg-liu (five-spice powder), pizza herbs and ‘fines herbes.’ Spices, spice oils and spice oleoresins are also indispensable in the food and beverage manufacturing industry, the perfumery and cosmetic industry and the pharmaceutical industry.

Some spices and derivatives possess antioxidant and antibiotic properties, which have increased interest in the commercial exploitation of aromatic plants for food preservation and crop protection. With the growing demand for natural and organic products and the increasing clamour to eliminate synthetic flavours and artificial food colouring, the future for spices seems bright.

### **PROSEA 16: Stimulants**

This volume deals with the plants of South-East Asia that are cultivated or collected from the wild for their stimulating properties (van der Vossen and Wessel, 2000). Three types of stimulant plants may be distinguished, based on their general use: plants used to make beverages, masticatory plants and plants for smoking. The beverage plants include coffee, tea, cocoa and mate: their dried or processed seeds or leaves are used to make infusions. Most people drink tea or coffee, or both, on a daily basis to banish fatigue and refresh the mind, but South-East Asians drink more tea than coffee. The masticatory plants include areca nut and kola: the stimulating effect is obtained by chewing the fresh or dried seed. These plants are primarily of regional importance and often also have cultural and social functions. Finally, there are plants for smoking, such as tobacco: the dried leaves are processed for smoking. Even though opposition to tobacco consumption is growing in Europe and North America because of the potential harm to public health, tobacco consumption is still on the increase in Asia. In this volume, 20 major stimulant species are treated in 17 papers and there are brief descriptions of 34 species of minor importance. A further 250 species with a secondary use as a stimulant or in association with stimulants are also listed.

### **PROSEA 19: Essential Oil Plants**

This volume deals with the plants of South-East Asia that produce essential oil, particularly the ones producing oils used as fragrance material (Oyen and Dung, 1999). The volume complements the PROSEA volumes on edible fruits and nuts, medicinal and poisonous plants, spices, and plants producing exudates, which include plants that produce essential oils as important by-products.

Fragrance materials play a much more important and varied role in life than is often realized. Incense is burnt in religious ceremonies all over the world. In luxury perfumery, fragrance is used to subtly please the senses of the user and those nearby. Certain body care products are equally important as perfumery products (aftershaves, antiperspirants); others have essential oils added to make their use more pleasant (creams, soaps, shampoos, deodorants). Functional perfumery covers a very wide range of products, from soaps and detergents to domestic cleaning products, although the fragrance materials used in many cosmetic and household products are now largely synthetic. Natural essential oils still play a central role in food and luxury perfumery, as the richness of their odour is unrivalled by synthetics and because the use of synthetics in food is subject to stricter government regulations.

Most of the 38 important crops covered in this volume are grown in South-East Asia, but several crops widely grown elsewhere and potentially useful in parts of South-East Asia have been included as well. A further 31 species of minor importance are treated briefly, while 400 species producing essential oils but having another primary use are listed.

## Contents in PROSEA Handbook

### Scutellaria L.

Sp. pl. 2: 598 (1753); Gen. pl. ed. 5: 260 (1754).

#### LABIATAE

$x$  = unknown; *S. discolor*:  $2n = 24, 26$

**Major species** *Scutellaria javanica*

Jungh.

**Vernacular names** Skullcap (En).

Scutellaire (Fr). Vietnam: thu[aax]n.



*Scutellaria indica* L. - 1, flowering stem; 2, opened corolla; 3, flower; 4, calyx with scutellum; 5, nutlet.

#### Origin and geographic distribution

*Scutellaria*, with 360 species, is almost cosmopolitan. Originally it was absent only from the Amazon Basin, lowland tropical Africa, South Africa, deserts of Central Asia, most of the Pacific Islands and New Zealand, and north of the Arctic circle. The centres of diversity are found in the mountain regions of Central Asia and China, which are also considered to be the regions where *Scutellaria* originated; only 3 species are native in Malesia.

**Uses** A multitude of *Scutellaria* species are used internally in the form of infusions and decoctions to alleviate stomach complaints and as a diuretic and antipyretic. Various species are used externally as a decoction or poultice to treat fungal skin infections as well as boils or scabies.

Outside the Malesian region *S. baicalensis* Georgi is an important medicinal plant, cultivated extensively for its roots in China, Korea and Japan. The roots are used in traditional Vietnamese medicine as a general tonic to balance the body, to treat bacterial infections of the respiratory and gastrointestinal tracts, and this species has been successfully grown in northern Vietnam.

**Properties** *Scutellaria* species, like many other Labiatae, contain an essential oil. The constituents of this oil are referred to as belonging to the monoterpenoids, sesquiterpenoids, phenylpropane derivatives or iridoid glycosides without further specification. *Scutellaria* species are also reported to contain diterpenes (in aerial parts e.g. of the neoclerodane type), large amounts of triterpenes, phytosterols and phenolic constituents (e.g. caffeic acid, flavonoids).

The presence and biological activities of flavonoids in *Scutellaria* have been particularly well studied. The aerial parts of *S. discolor* were found to contain chrysin, chrysin-7-O-glucuronide, apigenin, luteolin, wogonin, 5,7-dihydroxy-8,2'-dimethoxyflavone, 5,7,8-trihydroxyflavone-8-O- $\beta$ D-glucuronide, 5,7,2',6'-tetrahydroxy-8-methoxyflavone-2'O- $\beta$ D-(2-O-caffeoyl)-glucoside, 5,7-dihydroxy-8,2',6'-trimethoxyflavone and 5,7,4'-trihydroxy-8-methoxyflavone. The latter two compounds are also present in the roots of *S. discolor*, together with pinocembrin, wogonin, wogonin-7-O-glucuronide, norwogonin, norwogonin-7-O-glucuronide, 7-hydroxy-5,8-dimethoxyflavone, 7-hydroxy-5,8,2'-trimethoxyflavone, 5,7-dihydroxy-8,2'-dimethoxyflavone, 5,7,2'-trihydroxy-8-methoxyflavone, 5,7,2-trihydroxy-8,6'-dimethoxyflavone, 2(S)-5,7-dihydroxy-8,2'-dimethoxyflavanone, 2(S)-7-hydroxy-5,8,2'-trimethoxyflavanone, 5,2'-dihydroxy-7,8,6'-trimethoxyflavanone, 5,2'-dihydroxy-6,8,6'-trimethoxyflavanone and 2',4'-dihydroxy-2,3',6'-trimethoxychalcone.

The flavonoids scutellarin, found in *S. baicalensis* and *S. javanica*, and baicalein (= 5,6,7-trihydroxyflavone) inhibit the activity of partially purified rat brain protein kinase C. Various flavonoids present in *S. baicalensis* also show inhibitory effects against a considerable number of viruses: e.g. baicalin (= 5,6-dihydroxyflavone-7-O- $\beta$ D-glucuronide)

against the human T cell leukaemia virus type 1 and the human immunodeficiency virus (HIV-1), 5,7,2'-trihydroxy- and 5,7,2',3'-tetrahydroxyflavone against the Epstein-Barr virus, and 5,7,4'-trihydroxy-8-methoxyflavone against AH3N2 subtype and B-subtype of the influenza virus. 2(S)-5,7,2',6'-tetrahydroxy-flavanone showed a remarkable antibacterial activity against e.g. *Escherichia coli*, *Bacillus subtilis* and *Staphylococcus aureus*.

Furthermore, baicalein shows antiproliferative activity in cultured rabbit vascular muscle cells, and lipoxygenase-inhibitory activity. It may be useful as a template for the development of drugs to prevent the pathological changes of atherosclerosis and restenosis. The pharmacological action of baicalein may be partially attributed to its free radical scavenging activity. Other pharmacological activities of the flavonoids include: anti-inflammatory activity of baicalein in the rat adjuvant arthritis model, inhibition of LPS-induced IL-1 production by baicalin, baicalein and wogonin, and inhibition by baicalein of leukotriene C-4 biosynthesis by rat resident peritoneal macrophages. Another effect of the flavonoids is the inhibition of the release of slow reacting substances of anaphylaxis (SRS-A) from sensitized guinea pig lungs after antigen challenge.

**Description** Perennial or rarely annual herbs or small shrubs; stems prostrate to erect, often 4angled. Leaves opposite, simple, margin entire to pinnatifid, petiolate to subsessile, exstipulate. Flowers solitary, opposite or in small false whorls, in the axil of leaves or bracts, in terminal or axillary, 1-sided or all-sided racemes or spikes; calyx with a short tube, 2-lipped, the lips entire, upper lip deciduous, with a large shield- or pouch-like appendage or rarely both lips expanded to form a bladder-like structure; corolla 2-lipped, with a usually long tube which is bent upwards at base or bent distally or both, upper lip hooded, entire or notched, lower lip 3-lobed; stamens 4, inserted on the corolla tube, didynamous, anterior pair longest, anthers of the anterior pair 1-celled, those of the posterior pair 2-celled; disk tubular; ovary superior, on a short gynophore, 2-carpellate but 4 locular with a single ovule in each cell, style with a 2-fid stigma. Fruit consisting of 4 dry, ovoid to globose nutlets. Seeds without endosperm. Seedling with epigeal germination; cotyledons

free, leafy; hypocotyl elongated; all leaves opposite.

**Growth and development** Malesian *Scutellaria* species have been found flowering throughout the year. In Taiwan *S. indica* has been observed flowering and fruiting from September to May. Pollination is by insects, mainly bees. The nutlets are simply shed when the wind tosses the inflorescence to and fro, without a distinct dispersal mechanism.

**Other botanical information** *Scutellaria* takes a rather isolated position within the *Labiatae*, being the only genus of the subfamily *Scutellarioideae*. Its subdivision into subgenera and sections has been subject to much debate, but the most recent view recognizes 2 subgenera, *Scutellaria* and *Apeltanthus*, and 7 sections. All Malesian species belong to the subgenus *Scutellaria* and section *Scutellaria* which harbours about 240 species.

**Ecology** *Scutellaria* species generally occur on grassy plains, along forest tracks and streams, in forest edges, but also in open primary forest and savanna forest, in Malesia from the lowland up to 2400(-3300) m altitude.

**In vitro production of active compounds** Research on in vitro production of flavonoids in *Scutellaria* is restricted to *S. baicalensis*. Cell suspension culture as well as stem callus culture yielded a range of flavonoids, with the major constituents being baicalin and wogonin-7-O-glucuronic acid.

**Harvesting** *Scutellaria* plants are uprooted to collect the roots.

**Handling after harvest** The roots are washed and dried before being stored.

**Prospects** The flavonoids isolated from various *Scutellaria* species show a broad range of interesting pharmacological effects that merit further research, e.g. the inhibition of several pathological viruses, activities on the immune system (including inhibition of immune factors) and free radical scavenging activity.

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