

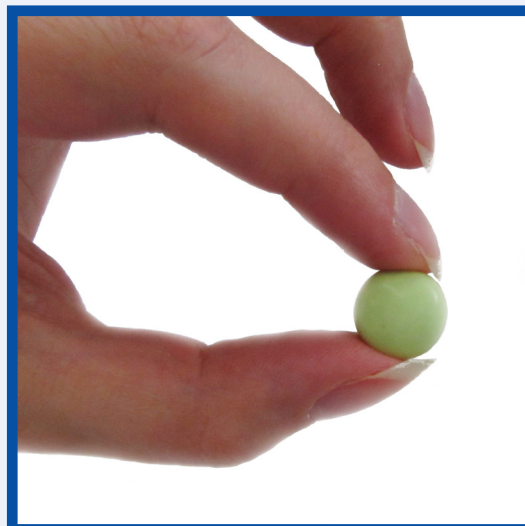
# E/S/C/O/P MONOGRAPHS

ONLINE  
SERIES

*The Scientific Foundation for Herbal Medicinal Products*

**Sambuci flos**  
Elder flower

2013



**E/S/C/O/P**  
EUROPEAN SCIENTIFIC COOPERATIVE  
ON PHYTOTHERAPY

[www.escop.com](http://www.escop.com)

**E/S/C/O/P**  
**MONOGRAPHS**

*The Scientific Foundation for*  
**Herbal Medicinal Products**

**SAMBUCI FLOS**  
**Elder Flower**

**2013**

**E/S/C/O/P**  
EUROPEAN SCIENTIFIC COOPERATIVE  
ON PHYTOTHERAPY

ESCOP Monographs were first published in loose-leaf form progressively  
from 1996 to 1999 as Fascicules 1-6, each of 10 monographs  
© ESCOP 1996, 1997, 1999

Second Edition, completely revised and expanded  
© ESCOP 2003

Second Edition, Supplement 2009  
© ESCOP 2009

## ONLINE SERIES

ISBN 978-1-901964-11-0

### **Sambuci flos - Elder Flower**

© ESCOP 2013

Published by the European Scientific Cooperative on Phytotherapy (ESCOP)  
Notaries House, Chapel Street, Exeter EX1 1EZ, United Kingdom  
[www.escop.com](http://www.escop.com)

All rights reserved

Except for the purposes of private study, research, criticism or review no part of this text  
may be reproduced, stored in a retrieval system or transmitted, in any form  
or by any means, without the written permission of the publisher.

**Important Note:** Medical knowledge is ever-changing. As new research and clinical experience broaden our knowledge, changes in treatment may be required. In their efforts to provide information on the efficacy and safety of herbal drugs and herbal preparations, presented as a substantial overview together with summaries of relevant data, the authors of the material herein have consulted comprehensive sources believed to be reliable. However, in view of the possibility of human error by the authors or publisher of the work herein, or changes in medical knowledge, neither the authors nor the publisher, nor any other party involved in the preparation of this work, warrants that the information contained herein is in every respect accurate or complete, and they are not responsible for any errors or omissions or for results obtained by the use of such information. Readers are advised to check the product information included in the package of each medicinal preparation they intend to use, to be certain that the information contained in this publication is accurate and that changes have not been made in the recommended dose or in the contraindications for administration.

Edited by Simon Mills and Roberta Hutchins  
Cover photograph by Simon Mills (*Sambucus nigra*)  
Cover and text design by Martin Willoughby  
Typeset in Optima by Roberta Hutchins

Plant illustrated on the cover: *Sambucus nigra*

## FOREWORD

It is a great pleasure for me to introduce the online era of ESCOP Monographs. Interest in herbal medicinal products continues to stimulate research on herbal substances and the body of knowledge in this field is steadily growing. ESCOP takes account of this by preparing new monographs and - as the only organisation in the field at the moment - particularly through regular revision of our published monographs. In order to provide readers and authorities with balanced compilations of scientific data as rapidly as possible, ESCOP Monographs will be published online from now on. This contemporary way of publishing adds further momentum to ESCOP's endeavours in the harmonization of European standards for herbal medicinal products.

The Board of ESCOP wishes to express its sincere gratitude to the members of the Scientific Committee, external experts and supervising editors, and to Peter Bradley, the final editor of every monograph published up to March 2011. All have voluntarily contributed their time and scientific expertise to ensure the high standard of the monographs.

**Liselotte Krenn**

*Chair of the Board of ESCOP*

## PREFACE

Over the 15 years since ESCOP published its first monographs, initially as loose-leaf documents then as two hardback books, ESCOP Monographs have achieved a reputation for well-researched, comprehensive yet concise summaries of available scientific data pertaining to the efficacy and safety of herbal medicinal products. The Second Edition, published in 2003 with a Supplement in 2009, covered a total of 107 herbal substances.

The monograph texts are prepared in the demanding format of the Summary of Product Characteristics (SPC), a standard document required in every application to market a medicinal product for human use within the European Union and ultimately providing information for prescribers and users of individual products.

As a change in style, literature references are now denoted by the name of the first author and year of publication instead of reference numbers; consequently, citations at the end of a monograph are now in alphabetical order. This is intended to give the reader a little more information and perspective when reading the text.

Detailed work in studying the pertinent scientific literature and compiling draft monographs relies to a large extent on the knowledge, skills and dedication of individual project leaders within ESCOP Scientific Committee, as well as invited experts. After discussion and provisional acceptance by the Committee, draft monographs are appraised by an eminent Board of Supervising Editors and all comments are taken into account before final editing and approval. In this way a wide degree of consensus is achieved, but it is a time-consuming process.

To accelerate the publication of new and revised monographs ESCOP has therefore decided to publish them as an online series only, commencing in 2011. We trust that rapid online access will prove helpful and convenient to all users of ESCOP Monographs.

As always, ESCOP is indebted to the many contributors involved in the preparation of monographs, as well as to those who provide administrative assistance and hospitality to keep the enterprise running smoothly; our grateful thanks to them all.

## NOTES FOR THE READER

From 2011 new and revised *ESCOP Monographs* are published as an online series only. Earlier monographs are available in two books, *ESCOP Monographs Second Edition (2003)* and the *Second Edition Supplement 2009*, but are not available online for copyright reasons.

After purchase of a single monograph, the specific items to be downloaded are:

- Front cover
- Title page
- Verso
- Foreword and Preface
- Notes for the Reader
- Abbreviations
- The monograph text
- Back cover

Information on the member organizations and people involved in ESCOP's activities can be found on the website ([www.escop.com](http://www.escop.com)):

- Members of ESCOP
- Board of Supervising Editors
- ESCOP Scientific Committee
- Board of Directors of ESCOP

## ABBREVIATIONS used in ESCOP monographs

AA	arachidonic acid
ABTS	2,2'-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid)
ACE	angiotensin converting enzyme
ADP	adenosine diphosphate
ALAT or ALT	alanine aminotransferase (= SGPT or GPT)
ALP	alkaline phosphatase
anti-IgE	anti-immunoglobulin E
ASA	acetylsalicylic acid
ASAT or AST	aspartate aminotransferase (= SGOT or GOT)
ATP	adenosine triphosphate
AUC	area under the concentration-time curve
BMI	body mass index
BPH	benign prostatic hyperplasia
b.w.	body weight
cAMP	cyclic adenosine monophosphate
CI	confidence interval
C <sub>max</sub>	maximum concentration of a substance in serum
CNS	central nervous system
CoA	coenzyme A
COX	cyclooxygenase
CSF	colony stimulating factor
CVI	chronic venous insufficiency
CYP	cytochrome P450
d	day
DER	drug-to-extract ratio
DHT	dihydrotestosterone
DNA	deoxyribonucleic acid
DPPH	diphenylpicrylhydrazyl
DSM	Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association)
ECG	electrocardiogram
ED <sub>50</sub>	effective dose in 50% of cases
EDTA	ethylenediamine tetraacetate
EEG	electroencephalogram
EMA	European Medicines Agency
ENT	ear, nose and throat
ER	oestrogen receptor
ERE	oestrogen-responsive element
FSH	follicle-stimulating hormone
GABA	gamma-aminobutyric acid
Gal	galactose
GFR	glomerular filtration rate
GGTP	gamma-glutamyl transpeptidase
GOT	glutamate oxalacetate transaminase (= SGOT)
GPT	glutamate pyruvate transaminase (= SGPT)
GSH	glutathione (reduced)
GSSG	glutathione (oxidised)
HAMA	Hamilton Anxiety Scale
12-HETE	12-hydroxy-5,8,10,14-eicosatetraenoic acid
HDL	high density lipoprotein
HIV	human immunodeficiency virus
HMPC	Committee on Herbal Medicinal Products (of the EMA)
HPLC	high-performance liquid chromatography
5-HT	5-hydroxytryptamine (= serotonin)
IC <sub>50</sub>	concentration leading to 50% inhibition
ICD-10	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision
ICH	The International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use
ICSD	International Classification of Sleep Disorders
IFN	interferon
IL	interleukin
i.m.	intramuscular
iNOS	inducible nitric oxide synthase
INR	International Normalized Ratio, a measure of blood coagulation (clotting) tendency

i.p.	intraperitoneal
IPSS	International Prostate Symptom Score
i.v.	intravenous
kD	kiloDalton
KM Index	Kuppermann Menopausal Index
kPa	kiloPascal
LC-MS	liquid chromatography-mass spectrometry
LD <sub>50</sub>	the dose lethal to 50% of animals tested
LDH	lactate dehydrogenase
LDL	low density lipoprotein
LH	luteinizing hormone
5-LOX	5-lipoxygenase
LPS	lipopolysaccharide
LTB <sub>4</sub>	leukotriene B <sub>4</sub>
M	molar (concentration)
MAO	monoamine oxidase
MBC	minimum bactericidal concentration
MDA	malondialdehyde
MFC	minimum fungicidal concentration
MIC	minimum inhibitory concentration
Mr	molecular
MRS	Menopause Rating Scale
MRSA	methicillin-resistant <i>Staphylococcus aureus</i>
MTD	maximum tolerated dose
MTT	3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide
MW	molecular weight
NBT	nitro blue tetrazolium
NF-κB	necrosis factor kappa-B
NO	nitric oxide
NOS	nitric oxide synthase
n.s.	not significant
NSAID	non-steroidal anti-inflammatory drug
ovx	ovariectomy or ovariectomized
ORAC	oxygen radical absorbance capacity
PA	pyrrolizidine alkaloid
PAF	platelet activating factor
PCR	polymerase chain reaction
PEG	polyethylene glycol
PGE	prostaglandin E
PHA	phythaemagglutinin
p.o.	per os
POMS	profile of mood states
PVPP	polyvinylpyrrolidone
RANKL	receptor activator of nuclear factor kappa-B ligand
RNA	ribonucleic acid
RT-PCR	reverse transcription polymerase chain reaction
s.c.	subcutaneous
SCI	spinal cord injury
SERM	selective oestrogen receptor modulator
SGOT or GOT	serum glutamate oxalacetate transaminase (= ASAT or AST)
SGPT or GPT	serum glutamate pyruvate transaminase (= ALAT or ALT)
SHBG	sex hormone binding globulin
SOD	superoxide dismutase
SSRI	selective serotonin reuptake inhibitor
STAI	state-trait anxiety inventory
t <sub>1/2</sub>	elimination half-life
TBARS	thiobarbituric acid reactive substances
TGF-β	transforming growth factor-beta
TNF	tumour necrosis factor
TPA	12-O-tetradecanoylphorbol-13-acetate
URT	upper respiratory tract
URTI	upper respiratory tract infection
UTI	urinary tract infection
VAS	visual analogue scale
VLDL	very low density lipoprotein

## Elder Flower

**DEFINITION**

Elder flower consists of the dried flowers of *Sambucus nigra* L. It contains not less than 0.8% of flavonoids, expressed as isoquercitrin ( $C_{21}H_{20}O_{12}$ ;  $M_r$  464.4) and calculated with reference to the dried drug.

The material complies with the monograph of the European Pharmacopoeia [Elder flower].

**CONSTITUENTS**

The characteristic constituents are flavonoids (0.7-3.5%) such as rutin, isoquercitrin, hyperoside, astragalin and glycosides of isorhamnetin [Dawidowicz 2006, Leifertova 1971, Lin 2007, Males 1999, Petitjean-Freytet 1991]; about 3% of phenolic acids (chlorogenic, ferulic and  $p$ -coumaric acids) and their glycosides [Leifertova 1971, Lin 2007, Males 1999, Petitjean-Freytet 1991]; and 0.1-0.3% of essential oil consisting mainly of monoterpenes such as linalool and its oxides, citronellol and hotrienol [Eberhardt 1985a, Eberhardt 1985b, Jørgensen 2000, Kaack 2006, Velíšek 1981].

Other constituents include fatty acids and alkanes [Richter 1974, Toulemonde 1983], triterpenes such as  $\alpha$ - and  $\beta$ -amyrin and ursolic acid, sterols [Makarova 1997, Willuhn 1977], *N*-phenylpropenoyl-L-amino acid amides (0.01%) such as *N*-(*E*)-caffeoyl-L-aspartic acid amide [Hensel 2007], and about 2% of potassium [Szentmihályi 1998].

**CLINICAL PARTICULARS****Therapeutic indications**

As a diaphoretic in the treatment of common cold, fever and chills [Bradley 1992, Hiermann 1994, Willuhn 2002].

Efficacy is plausible for this indication on the basis of human experience and long-standing use.

**Posology and method of administration****Dosage**

*Adult dose, three times daily:* 3-5 g of dried flowers as an infusion; 3-5 ml of liquid extract (1:1, ethanol 25% V/V); 10-25 ml of tincture (1:5, ethanol 25% V/V) [Bradley 1992, Hiermann 1994, Willuhn 2002].

**Method of administration**

For oral administration.

**Duration of administration**

No restriction. If symptoms persist or worsen, medical advice should be sought.

**Contraindications**

None known.

**Special warnings and special precautions for use**

None required.

**Interaction with other medicaments and other forms of interaction**

None reported.

**Pregnancy and lactation**

No data available. In accordance with normal medical practice, elder flower should not be used during pregnancy and lactation without medical advice.



**Effects on ability to drive and use machines**

None known.

**Undesirable effects**

None reported.

**Overdose**

No toxic effects reported.

**PHARMACOLOGICAL PROPERTIES****Pharmacodynamic properties*****In vitro* experiments*****Antioxidant and radical scavenging activity***

Free radical scavenging and antioxidant activities of hydro-ethanolic (80% V/V) extracts of elder flower obtained by pressurized liquid extraction at varying temperatures (20-200°C) were determined in the DPPH assay. The extract obtained at 20°C (1.4% flavonoids) reduced DPPH by 92% after 120 minutes, and the extract obtained at 100°C (2.1% flavonoids) by 94% [Dawidowicz 2006].

***Antiadhesive activity***

Preincubation of *Helicobacter pylori* with N-(*E*)-caffeoyl-L-aspartic acid amide (1 mg/ml) led to strong and reproducible inhibition of adhesion of the bacteria to sections of human stomach mucosa. No bactericidal or bacteriostatic activities were observed [Hensel 2007].

***Anti-inflammatory activity***

A dry aqueous extract of elder flower (0.25 mg/ml) inhibited PAF-induced exocytosis of elastase from human neutrophils by 57% in a spectrophotometric assay compared to distilled water as a blank. The positive control (ginkgolide B) inhibited exocytosis by 60% [Tunon 1995].

A dry methanolic extract of elder flower (30 µg/ml in DMSO) inhibited release of the cytokines IL-1 $\alpha$ , IL-1 $\beta$  and TNF- $\alpha$  from human peripheral mononuclear cells by 44, 49 and 50% respectively, compared to a solvent blank. A dry hexane fraction (38, 45 and 31% inhibition respectively) and a dry chloroform fraction (31, 44 and 57% inhibition respectively) from the methanolic extract showed comparable activity, whereas a dry *n*-butanol fraction and the residual water showed lower or no activity at this concentration [Yesilada 1997].

An infusion of elder flower ( $\geq 0.005$  g/100 ml) significantly inhibited induction of TNF- $\alpha$  release ( $p < 0.05$ ) from LPS- and fimbriae-stimulated human monocytic THP-1 cells (cells differentiated into macrophages). Complete inhibition was achieved at 0.16 g/100 ml. Release of the pro-inflammatory cytokines TNF- $\alpha$ , IL-1 $\beta$  and IL-6 using additional bacterial stimuli was also potentially inhibited in the monocytic THP-1 cells, as well as in mouse macrophages, at the same concentrations. In contrast, release of the anti-inflammatory cytokine IL-10 was only moderately inhibited. The infusion significantly inhibited activation of NF- $\kappa$ B, a central factor in pro-inflammatory gene expression, by several stimuli ( $p < 0.05$ ) at 0.08 g/100 ml in both human and mouse macrophages. Bacterial activation (by *Porphyromonas gingivalis*) of integrin, a possible effector of pathological inflammation, in human neutrophils was significantly suppressed by the same infusion ( $p < 0.05$  at 0.08-0.3 g/100 ml). The greatest inhibition of 73-76%, observed at a dilution of 0.3 g/100 ml, was at least as effective as a positive control. The oxidative burst of PMA- and bacteria-activated human neutrophils, monitored by a dichlorofluorescein assay,

were significantly and concentration-dependently inhibited by the same elder flower infusion ( $p < 0.05$ ). Almost complete inhibition was observed at 0.16 and 0.3 g/100 ml respectively [Harokopakis 2006].

N-(*E*)-caffeoyl-L-aspartic acid amide (10 µg/ml) significantly increased mitochondrial dehydrogenase activity ( $p < 0.05$ ) in HepG2 human liver cells by 52%, estimated by the MTT assay after 48 hours. In human keratinocytes, mitochondrial activity and the mitotic cell proliferation rate both increased by about 55% after 60 hours of incubation ( $p < 0.01$ ) at 10 µg/ml. In HepG2 cells proliferation was slightly enhanced. No necrotic cell toxicity was observed [Hensel 2007].

***Antidiabetic activity***

An aqueous extract of elder flower (1 g/litre) increased glucose uptake by 70% ( $p < 0.05$ ), glucose oxidation by 50% ( $p < 0.01$ ) and glycogenesis by 70% ( $p < 0.05$ ) in the absence of insulin in an isolated insulin-sensitive mouse abdominal muscle preparation, but did not significantly alter the insulin stimulus. The extract (0.25-1 g/litre) exerted a significant stimulatory effect on insulin secretion from clonal pancreatic  $\beta$ -cells in a concentration-dependent manner (4.5 pmol insulin/million cells after 20 minutes at 1 g/litre,  $p < 0.01$ ). This insulin-releasing effect was significantly potentiated in the presence of 16.7 mM glucose ( $p < 0.001$ ). The activity decreased by 41% after the removal of constituents of MW  $< 2000$  Da. Consecutive extraction of elder flower with *n*-hexane, ethyl acetate, methanol and water showed that only the methanol and water extracts increased insulin release ( $p < 0.001$ ). Known elder flower constituents such as rutin, lupeol and  $\beta$ -sitosterol had no effect on insulin release [Gray 2000].

***In vivo* experiments*****Diuretic activity***

A dry aqueous elder flower extract (approximately 5:1), administered intraperitoneally in saline to rats as a single dose of 50 mg/kg b.w., significantly increased urinary volumes compared to a saline control in the period from 2 to 24 hours after administration (after 2 hours, 2.4 ml urine/100 g vs. 1.6 ml urine/100 g,  $p < 0.05$ ; after 24 hours, 7.5 ml urine/100 g vs. 5.8 ml urine/100 g,  $p < 0.01$ ). Urinary volumes obtained with hydrochlorothiazide (10 mg/kg) were 2.8 ml/100 g after 2 hours and 7.1 ml/100 g after 24 hours ( $p < 0.05$ ). Increases in urinary excretion of sodium and potassium were observed after 8 hours, while the pH remained unchanged (pH 8.4-8.8). The saline overload was eliminated within 5.0 hours in the case of the elder flower extract and within 5.3 hours in the case of hydrochlorothiazide [Beaux 1999].

***Anti-inflammatory activity***

Intragastric administration of an elder flower dry extract (ethanol 80% V/V) at 100 mg/kg b.w. inhibited carrageenan-induced rat paw oedema by 27% ( $p < 0.01$ ) compared to 45% by indomethacin at 5 mg/kg [Mascolo 1987].

In another study, intraperitoneal administration of an un-saponifiable fraction of elder flower to mice at 0.5 ml/animal moderately enhanced phagocytosis [Delaveau 1980].

***Secretolytic activity***

Daily intragastric administration of a hydroethanolic extract (19% V/V, corresponding to 0.6 g elder flower/100 ml) to rabbits at 6.5 ml/kg b.w. for 3 days significantly increased bronchial secretion by 43% compared to the control (19% V/V ethanol) and by 111% compared to physiological saline ( $p < 0.01$ ) [Chibanguza 1984].

**Pharmacokinetic properties**

No data available.

**Preclinical safety data***Acute toxicity*

After daily intragastric administration of a hydroethanolic extract (19% V/V, corresponding to 0.6 g elder flower/100 ml) to rabbits at 6.5 ml/kg b.w. for 3 days, no significant changes in breathing and pulse rates, number of erythrocytes or sodium, calcium and potassium concentrations were observed, compared to the control (19% V/V ethanol) [Chibanguza 1984].

**Clinical safety data**

No data available.

**REFERENCES**

- Beaux D, Fleurentin J, Mortier F. Effect of extracts of *Orthosiphon stamineus* Benth, *Hieracium pilosella* L., *Sambucus nigra* L. and *Arctostaphylos uva-ursi* (L.) Spreng. in rats. *Phytother Res* 1999;13:222-5. [http://dx.doi.org/10.1002/\(SICI\)1099-1573\(199905\)13:3<222::AID-PTR447>3.0.CO;2-P](http://dx.doi.org/10.1002/(SICI)1099-1573(199905)13:3<222::AID-PTR447>3.0.CO;2-P)
- Bradley PR, editor. *Sambucus*. In: *British Herbal Compendium - A handbook of scientific information on widely used plant drugs*, Volume 1. Bournemouth: British Herbal Medicine Association, 1992: 84-6.
- Chibanguza G, Marz R, Sterner W. Zur Wirksamkeit und Toxizität eines pflanzlichen Sekretolytikums und seiner Einzeldrogen. *Arzneim-Forsch/Drug Res* 1984;34:32-6.
- Dawidowicz AL, Wianowska D, Baraniak B. The antioxidant properties of alcoholic extracts from *Sambucus nigra* L. (antioxidant properties of extracts). *LWT - Food Sci Technol* 2006;39:308-15.
- Delaveau P, Lallouette P, Tessier AM. Drogues végétales stimulant l'activité phagocytaire du système réticulo-endothélial (Stimulation of the phagocytic activity of the R.E.S. by plant extracts). *Planta Med* 1980;40:49-54. <http://dx.doi.org/10.1055/s-2008-1074941>
- Eberhardt R, Pfannhauser W. Analyse flüchtiger Inhaltsstoffe des Holunders. 1. Mitteilung: Extraktionstechniken und Untersuchung wesentlicher Aroma-komponenten. *Mikrochim Acta* (Wien) 1985a;1:55-67.
- Eberhardt R, Pfannhauser W. Analyse flüchtiger Inhaltsstoffe des Holunders. 2. Mitteilung: Untersuchung der Monoterpenverbindungen. *Z Lebensm Unters Forsch* 1985b;181:97-100. <http://dx.doi.org/10.1007/BF01042568>
- Elder Flower - Sambuci flos. *European Pharmacopoeia*, Council of Europe.
- Gray AM, Abdel-Wahab YHA, Flatt PR. The traditional plant treatment, *Sambucus nigra* (elder), exhibits insulin-like and insulin-releasing actions in vitro. *J Nutr* 2000;130:15-20.
- Harokopakis E, Albzreh MH, Haase EM, Scannapieco FA, Hajjshengallis G. Inhibition of proinflammatory activities of major periodontal pathogens by aqueous extracts from elder flower (*Sambucus nigra*). *J Periodontol* 2006;77:271-9. <http://dx.doi.org/10.1902/jop.2006.050232>
- Hensel A, Deters AM, Müller G, Stark T, Wittschier N, Hofmann T. Occurrence of N-phenylpropenoyl-L-amino acid amides in different herbal drugs and their influence on human keratinocytes, on human liver cells and on adhesion of *Helicobacter pylori* to the human stomach. *Planta Med* 2007;73:142-50. <http://dx.doi.org/10.1055/s-2006-957079>
- Hiermann A. *Sambucus*. In: Hänsel R, Keller K, Rimpler H, Schneider G, editors. *Hagers Handbuch der Pharmazeutischen Praxis*, 5th ed. Volume 6: Drogen A-D. Berlin-Heidelberg-NewYork-London: Springer-Verlag, 1994:574-86.
- Jørgensen U, Hansen M, Christensen LP, Jensen K, Kaack K. Olfactory and quantitative analysis of aroma compounds in elder flower (*Sambucus nigra* L.) drink processed from five cultivars. *J Agric Food Chem* 2000;48:2376-83. <http://dx.doi.org/10.1021/jf000005f>
- Kaack K, Christensen LP, Hughes M, Eder R. Relationship between sensory quality and volatile compounds of elderflower (*Sambucus nigra* L.) extracts. *Eur Food Res Technol* 2006;223:57-70. <http://dx.doi.org/10.1007/s00217-005-0122-y>
- Leifertova I, Kudrnacova J, Brazdova V. Studium der Gehaltsstoffe in Flos und Fructus Sambuci während der Vegetationsperiode. *Acta Facultatis Pharmaceuticae Universitatis Comenianae* 1971;20:57-82.
- Lin L-Z, Harnly JM. A screening method for the identification of glycosylated flavonoids and other phenolic compounds using a standard analytical approach for all plant materials. *J Agric Food Chem* 2007;55:1084-96. <http://dx.doi.org/10.1021/jf062431s>
- Makarova OV, Isaev MI. Isoprenoids of *Sambucus nigra*. *Khim Prir Soedin* 1997;891-2, translated into English as *Chem Nat Compd* 1997;33:702-3.
- Males Z, Medic-Saric M. Investigation of the flavonoids and phenolic acids of Sambuci flos by thin-layer chromatography. *J Planar Chromatogr* 1999;12:345-9.
- Mascolo N, Autore G, Capasso F, Menghini A, Palmira FM. Biological screening of Italian medicinal plants for anti-inflammatory activity. *Phytother Res* 1987;1:28-31. <http://dx.doi.org/10.1002/ptr.2650010107>
- Petitjean-Freytet C, Carnat A, Lamaison JL. Teneurs en flavonoïdes et en dérivés hydroxycinnamiques de la fleur de *Sambucus nigra* L. *J Pharm Belg* 1991;46:241-6.
- Richter W, Willuhn G. Zur Kenntnis der Inhaltsstoffe von *Sambucus nigra* L. Ätherisches Öl, Alkane und Fettsäuren der Blüten. *Dtsch Apoth Ztg* 1974;114:947-51.
- Szentmihályi K., Kéry A, Then M, Lakatos B, Sándor Z, Vinkler P. Potassium-sodium ratio for the characterization of medicinal plant extracts with diuretic activity. *Phytother Res* 1998;12:163-6. [http://dx.doi.org/10.1002/\(SICI\)1099-1573\(199805\)12:3<163::AID-PTR217>3.0.CO;2-Y](http://dx.doi.org/10.1002/(SICI)1099-1573(199805)12:3<163::AID-PTR217>3.0.CO;2-Y)
- Toulemonde B, Richard HMJ. Volatile constituents of dry elder (*Sambucus nigra* L.) flowers. *J Agric Food Chem* 1983;31:365-70. <http://dx.doi.org/10.1021/jf00116a046>
- Tunón H, Olavsdotter C, Bohlin L. Evaluation of anti-inflammatory activity of some Swedish medicinal plants. Inhibition of prostaglandin biosynthesis and PAF-induced exocytosis. *J Ethnopharmacol* 1995;48:61-76. [http://dx.doi.org/10.1016/0378-8741\(95\)01285-L](http://dx.doi.org/10.1016/0378-8741(95)01285-L)
- Velísek J, Kubelka V, Pudil F, Svobodová Z, Davídek J. Volatile constituents of elder (*Sambucus nigra* L.) I. Flowers and leaves. *Lebensm Wiss Technol* 1981; 14:309-12.
- Willuhn G, Richter W. Zur Kenntnis der Inhaltsstoffe von *Sambucus nigra*. II. Die lipophilen Bestandteile der Blüten. *Planta Med* 1977;31:328-43. <http://dx.doi.org/10.1055/s-0028-1097541>
- Willuhn G. Sambuci flos. In: Wichtl M, editor. *Teedrogen und Phytopharmaka - Ein handbuch für die Praxis auf wissenschaftlicher Grundlage*, 4th ed. Stuttgart: Wissenschaftliche Verlagsgesellschaft, 2002:14-6.
- Yesilada E, Üstün O, Sezik E, Takaishi Y, Ono Y, Honda G. Inhibitory effects of Turkish folk remedies on inflammatory cytokines: interleukin-1 $\alpha$ , interleukin-1 $\beta$  and tumor necrosis factor  $\alpha$ . *J Ethnopharmacol* 1997;58:59-73.

# E/S/C/O/P MONOGRAPHS

## MOST RECENT VERSIONS

Title	Common name	Publication
ABSINTHII HERBA	Wormwood	Second Edition, 2003
AGNI CASTI FRUCTUS	Agnus Castus	Second Edition, 2003
AGRIMONIAE HERBA	Agrimony	Supplement 2009
ALCHEMILLAE HERBA	Lady's Mantle	Online Series, 2013
ALLII SATIVI BULBUS	Garlic	Second Edition, 2003
ALOE BARBADENSIS	Barbados Aloes	Supplement 2009
ALOE CAPENSIS	Cape Aloes	Second Edition, 2003
ALTHAEAE RADIX	Marshmallow Root	Second Edition, 2003
ANGELICAE RADIX	Angelica Root	Supplement 2009
ANISI FRUCTUS	Aniseed	Second Edition, 2003
ARNICAE FLOS	Arnica Flower	Second Edition, 2003
BALLOTAE NIGRAE HERBA	Black Horehound	Supplement 2009
BETULAE FOLIUM	Birch Leaf	Second Edition, 2003
BOLDI FOLIUM	Boldo Leaf	Second Edition, 2003
CALENDULAE FLOS	Calendula Flower	Second Edition, 2003
CAPSICI FRUCTUS	Capsicum	Supplement 2009
CARVI FRUCTUS	Caraway Fruit	Second Edition, 2003
CARYOPHYLLI AETHEROLEUM	Clove Oil	Online Series, 2014
CENTAURII HERBA	Centaury	Second Edition, 2003
CENTELLAE ASIATICAE HERBA	Centella	Supplement 2009
CHELIDONII HERBA	Greater Celandine	Second Edition, 2003
CIMICIFUGAE RHIZOMA	Black Cohosh	Online Series, 2011
CINNAMOMI CORTEX	Cinnamon	Second Edition, 2003
CRATAEGI FOLIUM CUM FLORE	Hawthorn Leaf and Flower	Second Edition, 2003
CRATAEGI FRUCTUS	Hawthorn Berries	Supplement 2009
CUCURBITAE SEMEN	Pumpkin Seed	Supplement 2009
CURCUMAE LONGAE RHIZOMA	Turmeric	Second Edition, 2003
CURCUMAE XANTHORRHIZAE RHIZOMA	Javanese Turmeric	Supplement 2009
CYNARAE FOLIUM	Artichoke Leaf	Supplement 2009
ECHINACEAE ANGUSTIFOLIAE RADIX	Narrow-leaved Coneflower Root	Supplement 2009
ECHINACEAE PALLIDAE RADIX	Pale Coneflower Root	Supplement 2009
ECHINACEAE PURPUREAE HERBA	Purple Coneflower Herb	Supplement 2009
ECHINACEAE PURPUREAE RADIX	Purple Coneflower Root	Supplement 2009
ELEUTHEROCOCCI RADIX	Eleutherococcus	Supplement 2009
EUCALYPTI AETHEROLEUM	Eucalyptus Oil	Second Edition, 2003
FILIPENDULAE ULMARIAE HERBA	Meadowsweet	Second Edition, 2003
FOENICULI FRUCTUS	Fennel	Second Edition, 2003
FRANGULAE CORTEX	Frangula Bark	Second Edition, 2003
FUMARIAE HERBA	Fumitory	Supplement 2009
GENTIANAE RADIX	Gentian Root	Online Series, 2014
GINKGO FOLIUM	Ginkgo Leaf	Second Edition, 2003
GINSENG RADIX	Ginseng	Second Edition, 2003
GRAMINIS RHIZOMA	Couch Grass Rhizome	Supplement 2009
GRINDELIAE HERBA	Grindelia	Supplement 2009
HAMAMELIDIS AQUA	Hamamelis Water	Online Series, 2012
HAMAMELIDIS CORTEX	Hamamelis Bark	Online Series, 2012
HAMAMELIDIS FOLIUM	Hamamelis Leaf	Online Series, 2012
HARPAGOPHYTI RADIX	Devil's Claw Root	Supplement 2009
HEDERAЕ HELICIS FOLIUM	Ivy Leaf	Second Edition, 2003
HIPPOCASTANI SEMEN	Horse-chestnut Seed	Second Edition, 2003
HYDRASTIS RHIZOMA	Goldenseal rhizome	Online Series, 2013
HYPERICI HERBA	St. John's Wort	Second Edition, 2003
JUNIPERI PSEUDO-FRUCTUS	Juniper	Second Edition, 2003
LAVANDULAE FLOS/AETHEROLEUM	Lavender Flower/Oil	Supplement 2009
LICHEN ISLANDICUS	Iceland Moss	Second Edition, 2003
LINI SEMEN	Linseed	Second Edition, 2003
LIQUIRITIAE RADIX	Liquorice Root	Second Edition, 2003

LUPULI FLOS	Hop Strobile	Second Edition, 2003
MALVAE FLOS	Mallow Flower	Supplement 2009
MARRUBII HERBA	White horehound	Online Series, 2013
MATRICARIAE FLOS	Matricaria Flower	Second Edition, 2003
MELALEUCAE AETHEROLEUM	Tea Tree Oil	Supplement 2009
MELILOTI HERBA	Melilot	Second Edition, 2003
MELISSAE FOLIUM	Melissa Leaf	Online Series, 2013
MENTHAE PIPERITAE AETHEROLEUM	Peppermint Oil	Second Edition, 2003
MENTHAE PIPERITAE FOLIUM	Peppermint Leaf	Second Edition, 2003
MENYANTHIDIS TRIFOLIATAE FOLIUM	Bogbean Leaf	Online Series, 2013
MILLEFOLII HERBA	Yarrow	Supplement 2009
MYRRHA	Myrrh	Online Series, 2014
MYRTILLI FRUCTUS	Bilberry Fruit	Online Series, 2014
OLIBANUM INDICUM	Indian Frankincense	Supplement 2009
ONONIDIS RADIX	Restharrow Root	Second Edition, 2003
ORTHOSIPHONIS FOLIUM	Java Tea	Online Series, 2014
PASSIFLORAE HERBA	Passion Flower	Second Edition, 2003
PAULLINIAE SEMEN	Guarana Seed	Supplement 2009
PIPERIS METHYSTICI RHIZOMA	Kava-Kava	Second Edition, 2003
PLANTAGINIS LANCEOLATAE FOLIUM/HERBA	Ribwort Plantain Leaf/Herb	Online Series, 2013
PLANTAGINIS OVATAE SEMEN	Ispaghula Seed	Second Edition, 2003
PLANTAGINIS OVATAE TESTA	Ispaghula Husk	Second Edition, 2003
POLYGALAE RADIX	Senega Root	Second Edition, 2003
PRIMULAE RADIX	Primula Root	Second Edition, 2003
PRUNI AFRICANAE CORTEX	Pygeum Bark	Supplement 2009
PSYLLII SEMEN	Psyllium Seed	Second Edition, 2003
RATANHIAE RADIX	Rhatany Root	Supplement 2009
RHAMNI PURSHIANI CORTEX	Cascara	Second Edition, 2003
RHEI RADIX	Rhubarb	Second Edition, 2003
RIBIS NIGRI FOLIUM	Blackcurrant Leaf	Second Edition, 2003
ROSAE PSEUDO-FRUCTUS	Dog Rose Hip	Supplement 2009
ROSMARINI FOLIUM	Rosemary Leaf	Second Edition, 2003
RUSCI RHIZOMA	Butcher's Broom	Second Edition, 2003
SALICIS CORTEX	Willow Bark	Second Edition, 2003
SAMBUCI FLOS	Elder flower	Online Series, 2013
SALVIAE OFFICINALIS FOLIUM	Sage Leaf	Second Edition, 2003
SALVIA TRILOBAE FOLIUM	Sage Leaf, Three-lobed	Online Series, 2014
SENNAE FOLIUM	Senna Leaf	Second Edition, 2003
SENNAE FRUCTUS ACUTIFOLIAE	Alexandrian Senna Pods	Second Edition, 2003
SENNAE FRUCTUS ANGUSTIFOLIAE	Tinnevelly Senna Pods	Second Edition, 2003
SERENOAE REPENTIS FRUCTUS (SABAL FRUCTUS)	Saw Palmetto Fruit	Second Edition, 2003
SERPILLI HERBA	Wild Thyme	Online Series, 2014
SOLIDAGINIS VIRGAUREAE HERBA	European Golden Rod	Second Edition, 2003
SILYBI MARIANI FRUCTUS	Milk Thistle Fruit	Supplement 2009
SYMPHYTI RADIX	Comfrey Root	Online Series, 2012
TANACETI PARTHENII HERBA	Feverfew	Online Series, 2014
TARAXACI FOLIUM	Dandelion Leaf	Second Edition, 2003
TARAXACI RADIX	Dandelion Root	Second Edition, 2003
THYMI HERBA	Thyme	Second Edition, 2003
TORMENTILLAE RHIZOMA	Tormentil	Online Series, 2013
TRIGONELLAE FOENUGRAECI SEMEN	Fenugreek	Second Edition, 2003
URTICAE FOLIUM/HERBA	Nettle Leaf/Herb	Second Edition, 2003
URTICAE RADIX	Nettle Root	Second Edition, 2003
UVAE URSI FOLIUM	Bearberry Leaf	Online Series, 2012
VACCINII MACROCARPI FRUCTUS	Cranberry	Supplement 2009
VALERIANAE RADIX	Valerian Root	Supplement 2009
VIOLAE HERBA CUM FLORE	Wild Pansy	Supplement 2009
VITIS VINIFERAE FOLIUM	Red Vine Leaf	Supplement 2009
ZINGIBERIS RHIZOMA	Ginger	Supplement 2009

# E/S/C/O/P MONOGRAPHS

ONLINE  
SERIES

*The Scientific Foundation for Herbal Medicinal Products*

The second edition of ESCOP Monographs, published as a hardback book in 2003 with a Supplement in 2009, has been widely acclaimed for its authoritative information on the therapeutic uses of herbal medicines. Monographs covering a total of 107 herbal substances include extensive summaries of pharmacological, clinical and toxicological data, and copious references to scientific literature form an important part of each text.

Although publication in the form of books was convenient in the past, ESCOP recognizes that online publication now offers a number of advantages, not least in facilitating rapid publication of individual monographs as soon as all stages of preparation have been completed. Commencing from 2011, therefore, new and revised monographs will be published online only.

The European legislative framework for herbal medicines has advanced considerably over the past decade. Directive 2004/24/EC introduced a simplified registration procedure for traditional herbal medicinal products in EU member states and imposed a 2011 deadline for the registration of certain products on the market. The Committee on Herbal Medicinal Products (HMPC), established in 2004 as part of the European Medicines Agency, has made substantial progress in the preparation of Community Herbal Monographs and associated documentation to provide a more harmonized approach to the scientific assessment of herbal medicinal products throughout the European Community

Whether the evaluation of a herbal medicine is based on evidence of clinical efficacy (*well-established use*) or on experience and historical use of that product (*traditional use*) those involved at all levels of the regulatory process need access to detailed, reliable and structured summaries of the available efficacy and safety data. ESCOP monographs meet that requirement and offer an invaluable source of scientific information on herbal medicines to regulators, manufacturers, academics, researchers, health professionals and numerous others.

**E/S/C/O/P**  
EUROPEAN SCIENTIFIC COOPERATIVE  
ON PHYTOTHERAPY

[www.escop.com](http://www.escop.com)

ISBN 978-1-901964-11-0