



Traditional Herbal Medicines for Modern Times

Caper

The Genus *Capparis*



Ephraim Philip Lansky
Helena Maaria Paavilainen
Shifra Lansky



CRC Press
Taylor & Francis Group

Caper

The Genus *Capparis*

Traditional Herbal Medicines for Modern Times

Each volume in this series provides academia, health sciences, and the herbal medicines industry with in-depth coverage of the herbal remedies for infectious diseases, certain medical conditions, or the plant medicines of a particular country.

Series Editor: Dr. Roland Hardman

Volume 1

Shengmai San, edited by Kam-Ming Ko

Volume 2

Rasayana: Ayurvedic Herbs for Rejuvenation and Longevity, by H.S. Puri

Volume 3

Sho-Saiko-To: (Xiao-Chai-Hu-Tang) Scientific Evaluation and Clinical Applications,
by Yukio Ogihara and Masaki Aburada

Volume 4

Traditional Medicinal Plants and Malaria, edited by Merlin Willcox, Gerard Bodeker,
and Philippe Rasoanaivo

Volume 5

Juzen-taiho-to (Shi-Quan-Da-Bu-Tang): Scientific Evaluation and Clinical Applications,
edited by Haruki Yamada and Ikuo Saiki

Volume 6

Traditional Medicines for Modern Times: Antidiabetic Plants,
edited by Amala Soumyanath

Volume 7

Bupleurum Species: Scientific Evaluation and Clinical Applications,
edited by Sheng-Li Pan

Volume 8

Herbal Principles in Cosmetics: Properties and Mechanisms of Action,
by Bruno Burlando, Luisella Verotta, Laura Cornara, and Elisa Bottini-Massa

Volume 9

Figs: The Genus Ficus,
by Ephraim Philip Lansky and Helena Maaria Paavilainen

Volume 10

Phyllanthus Species: Scientific Evaluation and Medicinal Applications
edited by Ramadasan Kuttan and K. B. Harikumar

Volume 11

Honey in Traditional and Modern Medicine, edited by Laïd Boukraâ

Traditional Herbal Medicines for Modern Times

Caper

The Genus *Capparis*

Ephraim Philip Lansky
Helena Maaria Paavilainen
Shifra Lansky



CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

Cover photo: Tsachi Klein, **Cover watercolor:** Zipora Lansky.

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2014 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works
Version Date: 20131009

International Standard Book Number-13: 978-1-4398-6138-7 (eBook - PDF)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

Dedication

for Yu

E.P.L.

for my family

S.L.

for Kaarina, the best of sisters

H.M.P.

Contents

List of Tables.....	xi
List of Illustrations.....	xv
Acknowledgments.....	xxi
About the Authors.....	xxiii

Chapter 1	Mythopoesis/Meditation	1
	Introduction	1
	A Caper Has Been Pulled Off.....	3
	Reference.....	3
Chapter 2	Botany and Introduction.....	5
	Ecology of <i>Capparis</i> spp.....	5
	Overview of Genus <i>Capparis</i>	10
	Ethnographic Data on Various <i>Capparis</i> spp.	32
	References	75

SECTION I *Chemistry*

Chapter 3	Alkaloids	93
	References	100
Chapter 4	Fatty Acids	103
	References	108
Chapter 5	Flavonoids	109
	References	116
Chapter 6	Glucosinolates and Isothiocyanates	119
	References	125
Chapter 7	Minerals	127
	References	129
Chapter 8	Proteins and Amino Acids	131
	References	134
Chapter 9	Sterols.....	137
	References	142

Chapter 10	Triterpenoids and Other Volatile Compounds Excepting Isothiocyanates	145
	References	166
Chapter 11	Vitamins	169
	References	172
Chapter 12	Other Compounds	175
	References	192

SECTION II *Medical Uses*

Chapter 13	Oxidative Tension.....	197
	References	207
Chapter 14	Inflammation	211
	Introduction	211
	Inflammation in Medieval and Ancient Medicine	214
	References	225
Chapter 15	Rheumatism.....	229
	References	235
Chapter 16	Lipid Dyscrasias	237
	References	239
Chapter 17	Diabetes Mellitus	241
	References	245
Chapter 18	Sunburn	247
	References	248
Chapter 19	Pain and Fever	249
	References	252
Chapter 20	Xerostomia	255
	References	256
Chapter 21	Cancer	257
	References	261

Chapter 22	Infections and Infestations	263
	References	269
Chapter 23	Lepsis	273
	References	274
Chapter 24	Hypertension	275
	References	277

SECTION III Miscellany

Chapter 25	Reviews	281
	References	284
Chapter 26	Propagation.....	285
	References	287
Chapter 27	Fermentation.....	289
	References	291
Chapter 28	Recipes	293
Chapter 29	Breaking Advances in Medical Capparology	295
	References	295
Chapter 30	Centers of Capparology.....	297
Epilogue		303

List of Tables

Table 2.1	Classification of Genus <i>Capparis</i> L.....	10
Table 2.2	Overview of <i>Capparis</i> Species Covered in This Book.....	27
Table 2.3	<i>Capparis acutifolia</i>	32
Table 2.4	<i>Capparis aegyptia</i>	33
Table 2.5	<i>Capparis angulata</i>	34
Table 2.6	<i>Capparis aphylla</i>	36
Table 2.7	<i>Capparis baducca</i>	37
Table 2.8	<i>Capparis cartilaginea</i>	39
Table 2.9	<i>Capparis coriacea</i>	40
Table 2.10	<i>Capparis corymbosa</i>	40
Table 2.11	<i>Capparis decidua</i>	42
Table 2.12	<i>Capparis deserti</i>	44
Table 2.13	<i>Capparis divaricata</i>	44
Table 2.14	<i>Capparis flavicans</i>	45
Table 2.15	<i>Capparis flexuosa</i>	46
Table 2.16	<i>Capparis formosana</i>	47
Table 2.17	<i>Capparis grandis</i>	47
Table 2.18	<i>Capparis heyneana</i>	48
Table 2.19	<i>Capparis himalayensis</i>	48
Table 2.20	<i>Capparis horrida</i>	49
Table 2.21	<i>Capparis humilis</i>	50
Table 2.22	<i>Capparis incanescens</i>	50
Table 2.23	<i>Capparis leucophylla</i>	51
Table 2.24	<i>Capparis linearis</i>	53
Table 2.25	<i>Capparis longispina</i>	53
Table 2.26	<i>Capparis masaikai</i>	53
Table 2.27	<i>Capparis moonii</i>	54
Table 2.28	<i>Capparis orientalis</i>	55
Table 2.29	<i>Capparis ovata</i> Desf.; <i>C. ovata</i> Desf. var. <i>canescens</i> (Coss.) Heywood; <i>C. ovata</i> var. <i>palaestina</i>	56

Table 2.30	<i>Capparis rotundifolia</i>	57
Table 2.31	<i>Capparis salicifolia</i>	58
Table 2.32	<i>Capparis sepiaria</i>	59
Table 2.33	<i>Capparis sicula</i> ; <i>C. sicula</i> ssp. <i>sicula</i>	61
Table 2.34	<i>Capparis sikkimensis</i> ; <i>C. sikkimensis</i> subsp. <i>formosana</i>	62
Table 2.35	<i>Capparis sinaica</i>	63
Table 2.36	<i>Capparis sola</i>	64
Table 2.37	<i>Capparis spinosa</i> L.; <i>C. spinosa</i> L. var. <i>spinosa</i> ; <i>C. spinosa</i> subsp. <i>spinosa</i> ; <i>C. spinosa</i> subsp. <i>rupestris</i> ; <i>C. spinosa</i> var. <i>aegyptia</i> ; <i>C. spinosa</i> var. <i>deserti</i> ; <i>C. spinosa</i> var. <i>mucronifolia</i> <i>C. spinosa</i> Desf. var. <i>canescens</i>	65
Table 2.38	<i>Capparis stylosa</i>	70
Table 2.39	<i>Capparis tenera</i>	71
Table 2.40	<i>Capparis tomentosa</i>	71
Table 2.41	<i>Capparis zeylanica</i>	75
Table 3.1	Alkaloids of <i>Capparis</i> spp.	94
Table 4.1	Fatty Acids of <i>Capparis</i> spp.	104
Table 5.1	Flavonoids of <i>Capparis</i> spp.	110
Table 6.1	Glucosinolates and Isothiocyanates of <i>Capparis</i> spp.	121
Table 7.1	Minerals of <i>Capparis</i> spp.	128
Table 8.1	Proteins of <i>Capparis</i> spp.....	131
Table 9.1	Sterols of <i>Capparis</i> spp.	138
Table 10.1	Volatile Oils of <i>Capparis</i> spp.....	147
Table 11.1	Vitamins of <i>Capparis</i> spp.	170
Table 12.1	Other Compounds of <i>Capparis</i> spp.	175
Table 13.1	Antioxidant Properties of <i>Capparis</i> spp.	198
Table 13.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp.	202
Table 14.1	Medieval/Ancient Authors Cited in Table 14.2	212
Table 14.2	Use of the Different Parts of the <i>Capparis</i> Plant in Ancient and Medieval Sources.....	217
Table 14.3	Anti-inflammatory and Immunological Properties of <i>Capparis</i> spp.	223
Table 14.4	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Inflammation.....	224
Table 15.1	Antirheumatic Properties of <i>Capparis</i> spp.	230
Table 15.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Arthritis (Including Rheumatism and Gout)	234
Table 16.1	Lipid-Corrective Properties of <i>Capparis</i> spp.	238

Table 17.1	Antidiabetic Properties of <i>Capparis</i> spp.	241
Table 17.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Diabetes	244
Table 18.1	Potential Benefit of <i>Capparis</i> spp. for Photorepair and Photoprotection	248
Table 19.1	Pain-Relieving Properties of <i>Capparis</i> spp.....	249
Table 19.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. as an Antipyretic.....	251
Table 19.3	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. as an Analgesic	251
Table 20.1	Oral Hygiene Properties of <i>Capparis</i> spp.....	255
Table 20.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. for Oral Hygiene.....	255
Table 21.1	Anticancer Properties of <i>Capparis</i> spp.....	258
Table 21.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Neoplasias	261
Table 22.1	Anti-infective Properties of <i>Capparis</i> spp.....	264
Table 22.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Infections	267
Table 23.1	Antiepileptic Properties of <i>Capparis</i> spp.	274
Table 23.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Epilepsy.....	274
Table 24.1	Hypotensive Properties of <i>Capparis</i> spp.	275
Table 24.2	Contemporary Ethnomedical Uses of <i>Capparis</i> spp. against Hypertension or Cardiac Disorders	276
Table 25.1	Reviews of <i>Capparis</i> spp.	281
Table 26.1	Propagation Science for the Genus <i>Capparis</i> : 2012	286
Table 27.1	Fermentation Methods for <i>Capparis</i> spp.....	289
Table 29.1	Advances in Medical Capparology in 2012–2013	295

List of Illustrations

Figure 1.1	The ability of caper bushes to grow on bare stone walls is astonishing: <i>Capparis spinosa</i> plants on the Western Wall.	2
Figure 1.2	Spines of <i>Capparis spinosa</i> . A close look shows how sharp they really are, both in summer when the plant is fresh and in winter when it is dry.	2
Figure 2.1	Caper bush (<i>Capparis aegyptia</i>) in the arid Arava Valley.	6
Figure 2.2	As a response to the severe environmental stress in desert conditions, desert plants often contain higher concentrations of secondary metabolites. <i>Capparis cartilaginea</i> in the arid desert of Negev, near Kibbutz Ketura.	6
Figure 2.3	<i>Capparis</i> plants, such as this <i>C. aegyptia</i> , are an important source of nutrition also for different insects.	7
Figure 2.4	Home-pickled capers and caper fruit.	7
Figure 2.5	Anatomy of mature leaves of <i>C. spinosa</i> (L5 and L6): (a) and (d) cross-sectioned leaves; (b) and (e) paradermal sections through adaxial mesophyll of L5; (c) and (f) paradermal sections through abaxial mesophyll of L6. Cylindrical, densely packed mesophyll cells expose most of their surface to intercellular air space. Bars represent 50 μm (a and d) or 20 μm (all other micrographs).	8
Figure 2.6	<i>Capparis spinosa</i> leaves are well suited to preserve the scanty moisture available.	8
Figure 2.7	The hard <i>Capparis aegyptia</i> leaves, as part of their adaptation system, have the bluish tinge typical of desert plants.	8
Figure 2.8	Detail of the leaf of <i>Capparis flexuosa</i> L.	9
Figure 2.9	Leaf of <i>Capparis cynophallophora</i>	9
Figure 2.10	A morphological drawing of <i>Capparis spinosa</i> L.	11
Figure 2.11	<i>Capparis aegyptia</i> flower.	11
Figure 2.12	<i>Capparis sola</i> , fruit and dehiscent fruit.	12
Figure 2.13	Morphology of different organs of <i>Capparis</i>	13
Figure 2.14	Fruit of <i>Capparis flexuosa</i> cut transversely, exposing the inner structure of the seeds.	14
Figure 2.15	<i>Capparis spinosa</i> . Notice the relative positions of the bud stems and the leaves. ...	14
Figure 2.16	(a) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis spinosa</i> L.	15
Figure 2.16	(b) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis sepiaria</i> L. var. <i>subglabra</i> (Oliv.) DeWolf.	15
Figure 2.16	(c) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis flexuosa</i> L.	16

Figure 2.16	(d) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis decidua</i>	16
Figure 2.16	(e) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis sola</i>	17
Figure 2.16	(f) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis cartilaginea</i>	17
Figure 2.16	(g) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis micracantha</i> var. <i>henryi</i>	17
Figure 2.16	(h) Examples of the variability of flowers within genus <i>Capparis</i> : <i>Capparis moonii</i>	18
Figure 2.17	Considerable variation may also exist between the flowers of the same plant: <i>Capparis cartilaginea</i> with flowers of different age showing differing colors that range between white and red.	18
Figure 2.18	(a) Variations in fruit within genus <i>Capparis</i> : <i>Capparis cartilaginea</i> , ripe red fruit.	19
Figure 2.18	(b) Variations in fruit within genus <i>Capparis</i> : <i>Capparis spinosa</i> , unripe green fruit.	19
Figure 2.18	(c) Variations in fruit within genus <i>Capparis</i> : <i>Capparis decidua</i> , ripening red fruit.	20
Figure 2.18	(d) Variations in fruit within genus <i>Capparis</i> : <i>Capparis odoratissima</i> Jacq., ripe red fruit, one of them cut vertically.	20
Figure 2.18	(e) Variations in fruit within genus <i>Capparis</i> : <i>Capparis tomentosa</i> Lam., unripe green fruit.	21
Figure 2.18	(f) Variations in fruit within genus <i>Capparis</i> : <i>Capparis erythrocarpos</i> Isert var. <i>rosea</i> (Klotzsch) DeWolf, ripe, bright red fruit.	21
Figure 2.19	(a) Different habits within <i>Capparis</i> : <i>Capparis spinosa</i> growing on the wall of a house.	22
Figure 2.19	(b) Different habits within <i>Capparis</i> : <i>Capparis decidua</i>	22
Figure 2.19	(c) Different habits within <i>Capparis</i> : <i>Capparis aegyptia</i>	23
Figure 2.19	(d) Different habits within <i>Capparis</i> : <i>Capparis sepiaria</i> var. <i>subglabra</i> (Oliv.) DeWolf.	23
Figure 2.19	(e) Different habits within <i>Capparis</i> : <i>Capparis cartilaginea</i>	24
Figure 2.19	(f) Different habits within <i>Capparis</i> : <i>Capparis moonii</i>	24
Figure 2.20	Morphology of <i>Capparis</i> spp. Key to the morphological drawings on the following pages.	25
Figure 2.21	Morphology of <i>Capparis</i> spp. Structural differences in hairs of different <i>Capparis</i> spp.	25
Figure 2.22	Morphology of <i>Capparis</i> spp. Differences in the leaf structure of various <i>Capparis</i> spp.	26
Figure 2.23	Morphology of <i>Capparis</i> spp. Structure of the stem of <i>Capparis</i> spp.	26

Figure 2.24	Dioscorides (2nd century CE) recommended capers, among other things, for spleen problems, sciatica, and toothache.....	31
Figure 2.25	All parts of <i>Capparis</i> —buds, fruit, seeds, leaves, stems, bark, and root—are medicinal, although historically the most important part for medical use was the root bark. <i>Capparis aegyptia</i> in spring.	32
Figure 2.26	<i>Capparis aegyptia</i> in the beginning of summer. The fruit are still green.....	33
Figure 2.27	<i>Capparis aphylla</i> is a useful medicinal plant, but also its wood has economic importance.....	35
Figure 2.28	The most important parts of <i>Capparis cartilaginea</i> for traditional use are the fruit (for food) and the leaves and stems (medicinally). The ripe fruit are red.	38
Figure 2.29	The yellow inside of ripe split fruits of <i>Capparis cartilaginea</i> presented by Dr. Elaine Soloway. Note the seeds.	38
Figure 2.30	Red flowers of <i>Capparis decidua</i> in the desert during the hot season.	41
Figure 2.31	All the parts of <i>Capparis decidua</i> are traditionally considered medicinal. <i>Capparis decidua</i> (Forssk.) Edgew. (as <i>Sodada decidua</i> Forssk).	42
Figure 2.32	<i>Capparis flexuosa</i> L. plant growing beside a rock.	45
Figure 2.33	<i>Capparis flexuosa</i> is cultivated for its horseradish-tasting fruit.	46
Figure 2.34	<i>Capparis horrida</i>	49
Figure 2.35	<i>Capparis leucophylla</i>	51
Figure 2.36	<i>Capparis linearis</i> L.....	52
Figure 2.37	<i>Capparis moonii</i> buds and white flowers.....	54
Figure 2.38	<i>Capparis orientalis</i> Veill. (as <i>C. rupestris</i> Sm.).	55
Figure 2.39	<i>Capparis sepiaria</i> is used as a hedge plant, but it has also recognized medicinal value (see Chapter 17, “Diabetes Mellitus”) <i>Capparis sepiaria</i> L. var. <i>subglabra</i> (Oliv.) DeWolf.	58
Figure 2.40	<i>Capparis sicula</i> Duhamel (as <i>C. obovata</i> Royle).....	60
Figure 2.41	<i>Capparis sikkimensis</i> subsp. <i>formosana</i>	62
Figure 2.42	<i>Capparis sola</i> flowers, buds, stem, and leaf.....	63
Figure 2.43	All parts of <i>Capparis spinosa</i> are used in ethnomedicine, although it is mostly known in modern societies for its pickled buds, capers.	64
Figure 2.44	The root and root bark of most of the <i>Capparis</i> spp. are the part most appreciated in medicine. At the same time, it is the part that grows slowest and is most difficult to harvest. <i>Capparis spinosa</i> starting its spring growth between stones on a wall.	65
Figure 2.45	Fruit, leaves, stems, bark, and roots of <i>Capparis tomentosa</i> are all used in ethnomedical practice.	71
Figure 2.46	<i>Capparis zeylanica</i> shows interesting potential through its ethnomedical use. All the parts of the plants, except the flower, are used.	74
Figure 3.1	Bark and roots of <i>Capparis spinosa</i> contain high concentrations of alkaloids.	93

Figure 4.1	Red <i>Capparis sola</i> fruit (nibbled) and seed.	103
Figure 4.2	Unripe fruit of <i>Capparis spinosa</i> . Notice the difference both in seed color and in the consistency of the pulp between different stages of ripening.	104
Figure 5.1	All the aerial parts of <i>Capparis spinosa</i> contain flavonoids, especially the leaves and the buds.	109
Figure 5.2	The fruit of <i>Capparis spinosa</i> also contains considerable amounts of antioxidant flavonoids.....	109
Figure 6.1	<i>Drypetes</i> sp.	119
Figure 6.2	All aerial parts of <i>Capparis spinosa</i> are rich in glucosinolates and isothiocyanates.	120
Figure 6.3	Leaves of <i>Capparis flexuosa</i> contain several glucosinolates and isothiocyanates.	120
Figure 7.1	Buds of <i>Capparis spinosa</i> are rich in selenium.	127
Figure 9.1	Seed of <i>Capparis sola</i>	137
Figure 9.2	Seeds of <i>Capparis spinosa</i> contain interesting sterols. Ripe, dehiscent fruit on which the seeds still cling.	138
Figure 10.1	The strong aroma of caper buds has its origin in volatile compounds. Commercial pickled capers.	146
Figure 11.1	Flowers and fruit of <i>Capparis decidua</i> contain considerable amounts of vitamins.	170
Figure 13.1	Fruits and leaves of <i>Capparis spinosa</i> are antioxidant, as seen both in its traditional use and in modern research.	198
Figure 13.2	Root, root bark, and bark of <i>Capparis spinosa</i> are used in ethnomedicine for gynecological problems.	201
Figure 13.3	<i>Capparis fascicularis</i> DC. var. <i>fascicularis</i> branches and fruit. The root of <i>C. fascicularis</i> is used in Kenya against gastrointestinal problems.....	201
Figure 14.1	<i>Capparis aegyptia</i> was one of the sources for ancient and medieval capers and <i>Capparis</i> medications. Like in other <i>Capparis</i> spp., the buds, fruit, leaves, and young stems are all available simultaneously.	214
Figure 14.2	Two different <i>Capparis</i> varieties by John Gerard in his <i>Herball</i> in the beginning of the article on <i>Capparis</i> . Notice the roots.	215
Figure 14.3	Bark and root bark were the most important parts of <i>Capparis</i> for ancient and medieval medicine. An unusually well-developed <i>Capparis spinosa</i> trunk.	215
Figure 14.4	Both the aerial parts and the roots of <i>Capparis decidua</i> are considered anti-inflammatory in traditional medicine.	216
Figure 14.5	The entire plant of <i>Capparis micracantha</i> var. <i>henryi</i> , especially the dried leaves and the root, have been used against asthma.	222
Figure 14.6	Bark, root, and the entire plant of <i>Capparis sepiaria</i> have found use in ethnomedicine as anti-inflammatory agents, although modern research has not yet confirmed its anti-inflammatory effect.	222

Figure 15.1	The isothiocyanates in <i>Capparis cartilaginea</i> leaves have an antirheumatic effect.	233
Figure 15.2	Most of the parts of <i>Capparis spinosa</i> —roots, bark, fruit, leaves, and buds—have traditionally been used against rheumatism and other joint problems. Modern research supports the concept.....	234
Figure 16.1	Aerial parts of <i>Capparis decidua</i> , including fruit, have a hypolipidemic effect.	239
Figure 17.1	<i>Capparis sepiaria</i> leaves reduce blood sugar <i>in vivo</i>	244
Figure 17.2	Dried fruit of <i>Capparis spinosa</i> is used in Israeli traditional medicine as an antidiabetic. Modern research supports the claim. Unripe fruit of <i>Capparis spinosa</i>	244
Figure 18.1	<i>Capparis spinosa</i> buds (and leaves) show great potential for skin care and protection applications.	247
Figure 19.1	The dried leaves of <i>Capparis tomentosa</i> have been used for malaria.	250
Figure 19.2	Aerial parts of <i>Capparis sepiaria</i> are used in traditional medicine as febrifuges. Modern research has recognized the root extracts' analgesic and anti-inflammatory effects.	250
Figure 20.1	<i>Capparis jamaicensis</i> has been used in Venezuela against mouth problems.	256
Figure 21.1	Seeds of <i>Capparis spinosa</i> show promise in anticancer research.....	260
Figure 21.2	Only a few <i>Capparis</i> species are used in ethnomedicine for the treatment of cancers. <i>Capparis tomentosa</i> is one of them, with the whole plant used.	261
Figure 22.1	Root and bark of <i>Capparis spinosa</i> have the most alkaloids and thus the strongest anti-infective effect, but they are difficult to collect in great amounts. The plant in its natural surroundings and a closer view.	263
Figure 22.2	Modern research shows that both aerial and nonaerial parts of <i>Capparis spinosa</i> are effective against infections.....	268
Figure 22.3	Leaves, bark, and roots of <i>Capparis tomentosa</i> are considered effective against infections in ethnomedical practice.	269
Figure 23.1	<i>Capparis baducca</i> has been used in Mexico as an antispasmodic. Modern research supports this use.	273
Figure 24.1	<i>Capparis micracantha</i> is used in ethnomedicine for the treatment of carditis.....	276
Figure 26.1	Young cotyledons of <i>Capparis sola</i>	285

Acknowledgments

E.L. I am indebted to Aryeh Naftali, poet, musician, and gentleman farmer, and his family of Reb Shlomo Carlebach *z"l chevra* on Moshav Modi'in for first introducing me to the joy, mystery, and practical benefits of wildcrafting and pickling capers during my first year in Israel, 18 years ago. Shelly Shen-Aridor of the University of Haifa Library was a loyal and devoted research partner, miraculously turning up rare articles at all times of day and night, and was always ready to review photographs. Professor Eviatar Nevo, founder of the Institute of Evolution, International Graduate Center of Evolution, and prime mover of the Faculty of Sciences at the University of Haifa, first introduced to me the five species of *Capparis* in Israel. I hope our treatment here is worthy of his scholarship! Dr. Eli Harlev was instrumental in making contacts for safaris into the Negev Desert to locate the more obscure species. Family members Dr. Yu Shen, Zipora, Shifra, Aaron, Gail, and Yale Lansky and Rabbi Sue Ann Wasserman sampled *C. spinosa* buds and fruits preserved with balsamic vinegar and shared their experiences. Drs. Martin Philip Goldman and Daniel Rubin provided generous spiritual and material support. Finally, I wish to thank our editors at CRC: Barbara Norwitz and John Sulzyski, whose vision and patience provided the context once again for our project to occur, and Dr. Roland Hardman, who generously shared his lifetime of pharmacognostical knowledge and enthusiasm to help us traverse the roads less traveled. Thank you again for all.

H.P. My first expression of gratitude is due to Dr. Ephraim Lansky as the initiator and moving force of this project. His choice of *Capparis* as the focus of our work surprised me at first, but time—and capers themselves—have shown that his choice was a good one. Thank you for letting me participate in this. And, if the project would not have begun without Dr. Lansky, it would not have come to completion without Shifra Lansky and her grasp on the intricacies of chemistry. Thank you.

During the data-collecting stage and in particular when collecting the photographic material, I was again and again surprised by the generosity and kindness of people I met. Dr. Elaine Soloway from Kibbutz Ketura introduced me personally to three types of *Capparis* that she cultivates and studies in the surroundings of the kibbutz and hosted my photographing visits in the kibbutz. Dr. Hagar Leschner, director of the National Herbarium at the Hebrew University of Jerusalem, searched the best caper plants for me during our botanic trips. Ryan Brookes, Eli Harlev, William Hawthorne, Satish Nikam, C. E. Timothy Paine, Sébastien Sant, Abhijeet Shiral, Ming-I Weng, Bart T. Wursten, and the staff of SCCF Native Plant Nursery generously shared their photographs and thus enabled me to overcome geographic limitations. (My special thanks to the photographer who not only sent me the photos I asked for but also went to the botanical garden and took some extra photos of another *Capparis* species for the book.) You all have been an enormous help and encouragement.

I am also very grateful to the editorial team at CRC—Barbara Norwitz, John Sulzyski, Jill Jurgensen, Roland Hardman, and Marsha Hecht—for accepting the idea of this project and for their encouraging and supportive attitude and endless patience. It has been very good to work with you on this project. I hope the results are satisfying.

And last but not least, my gratitude goes to the three persons who have supported me most in my work: to Prof. Samuel Kotték, my guide and mentor, who has helped and advised me from the beginning of my historical-medical studies and still does, and to my mother and sister, Maija and Kaarina Paavilainen, for encouraging me in tired moments and simply listening. Without you, my academic path would have been much lonelier.

About the Authors

Ephraim Philip Lansky holds an interdisciplinary BA in psychology/biology from New College in Sarasota, Florida, USA. He completed his MD at the University of Pennsylvania and an internship in medicine and psychiatry at Pennsylvania Hospital, both in Philadelphia. He also achieved certification as an instructor of advanced trauma and cardiac life support and is experienced in basic emergency medicine. He received an MBA from the University of Bradford (United Kingdom) and a PhD from Leiden University (The Netherlands) for his thesis, “Anticancer Pharmacognosy of *Punica granatum*.” Author or coauthor of 23 peer-reviewed publications, 5 patents, and 2 books (*Pomegranate: The Most Medicinal Fruit*, Basic Books, New York; and *Figs: the Genus Ficus*, CRC Press, Boca Raton, FL), he is also the founder of Rimonest Limited and Punisyn Pharmaceuticals Limited, companies devoted to the economic development of the pomegranate fruit for nutritional/cosmeceutical and medical applications, respectively. A second-degree black belt and teacher of Kokikai Aikido, Dr. Lansky also is an avid archer and downhill skier. He has over 25 years of clinical experience in complementary and holistic medicine, including acupuncture, herbology, homeopathy, and hypnosis. He makes his home in Haifa, Israel, where he is a member of the research faculty and director of the Laboratory of Applied Metabolomics and Pharmacognosy (LAMP) at the University of Haifa. His chief academic and clinical interest is anticancer pharmacognosy.

Shifra Lansky holds a BSc in chemistry from Hebrew University in Jerusalem where she is presently pursuing her graduate studies. Her focus is on characterizing the three-dimensional structures of naturally occurring proteins. Shifra enjoys playing the violin, painting, and skiing in her spare time.

Helena Paavilainen is a researcher at the Hadassah Medical School, Hebrew University of Jerusalem, Israel. Her main research interests are ethnomedicine, historical ethnopharmacology, and the history of pharmacology, especially the Hebrew, Arabic, and Latin traditions. She wrote her PhD thesis (published as “Medieval Pharmacotherapy: Continuity and Change; Case Studies from Ibn Sina and Some of His Late Medieval Commentators,” Leiden: Brill 2009) on the development of medical drug therapy in medieval times and on the potential validity of medieval herbal treatments. She also coauthored with Dr. Lansky the monograph *Figs: The Genus Ficus* (Boca Raton, FL: CRC Press, 2010). She currently works as a freelance consultant bioprospecting ancient and medieval herbal texts for practical applications in medicine, functional nutrition, and agriculture.

1 Mythopoesis/Meditation



INTRODUCTION

The name of the genus, *Capparis*, and the common name for its edible parts, *caper*, both derive from the word for goat. *Caprification* (Lansky and Paavilainen 2011) is the fertilization of female fig trees by wasps from male trees carrying the latter's pollen. The word hints at the caprice of the goat, primordial symbol/spirit of the randy male.

Spreading of pollen resembles a casual event, and “caprice” conveys the lighthearted demeanor of Capricorn (“your hills skip like rams”). As this spirit of skipping lightly is sacrificed by the heavier elements of society, a need for expiation, כפרה (*kapara*, Hebrew) emerges, underlying the Day of Atonement, יום כפור (Yom Kippur). The goat is the universal symbol of internal forgiveness and “at-one-ment,” the scapegoat (*se’ir le-azazel*) in Torah, and the sacrifice of the innocent and passive elements of the psyche and of their material “projections” in society and “reality,” that is, the physical results of Mind.

The capture of the caper plant for this purpose is reflected in the “crown of thorns” from a plant, if not identical to *Capparis spinosa*, at least closely resembling it in terms of its prime prickly mechanism of defense. The plant conveys the “sacrificial attitude” required for the internality and passivity (parasympathetic arousal) needed for rest and repair, reduction of inflammation, and healing of many diseases. In that “like cures like,” the pain of the caper’s thorn ameliorates deeper and sharper pains.

Caper may be understood as nothing less than the spirit of life, and this is also reflected in the ability of *Capparis* to establish itself in the most hostile little niches, for example, growing directly out of a stone wall or in the fiercest and driest of deserts (Figures 1.1, 2.1). This attitude of adventure seeking and extreme adaptability is reflected in the slang of “caper,” a kind of dangerous tale of adventure, often against logic or law. The exploratory urge in Capricorn and the caprice of goats is reflected in the capers of dalliance from the mean. Caper flowers, fruits, roots, and leaves may also provide solace and comfort.



FIGURE 1.1 The ability of caper bushes to grow on bare stone walls is astonishing: *Capparis spinosa* plants on the Western Wall. (7.4.2010, Western Wall, Old City of Jerusalem, Israel: by Helena Paavilainen.)



FIGURE 1.2 Spines of *Capparis spinosa*. A close look shows how sharp they really are, both in summer when the plant is fresh and in winter when it is dry. (7.7.2011 and 7.4.2010, respectively, Jerusalem, Israel: by Helena Paavilainen.)

A CAPER HAS BEEN PULLED OFF

So, now let us look deeply into the caper's heart and soul and see what it takes, and what it makes, in the way of phytoactive compounds that are able to benefit and tantalize *Homo sapiens* with health and pampering. The caper developed on a hill overlooking a valley to the sea off a Mediterranean coast who knows how many years ago, and now it has spread back to the hills. The evolution of the caper depended on multiple contingencies that, once converged, allowed the plot to be planted. Of note was its staying power even when nurture was most deeply hidden. And, what of the reason for the venture into new biospheres? Caprice? Capricorn, caper, *Capparis*, *Kaprisin* (Hebrew for "Cyprus"), from where it commenced one Cyprus morning?

Or, is the caper also a compensation to balance a biospheric need? Atonement for the human spirit: *kappara*, *kapooris*, *kippur*? (*Kappara*, *kapooris*, *kippur* are Hebrew words conveying different relations to the process of compensation on a spiritual phase and may also apply to an evolutionary phase, in-depth psychology, a sacrificial attitude, means of achieving at-one-ment, psychophysiological, somatopsychic integration.)

But, regarding the plant: First, consider the pricklers (Figure 1.2). Before one can pull off the first caper, one must feel its sting. The pricklers are sharp. At some point, you may evict droplets of blood, but the damage is not usually severe. Nevertheless, capricious would-be takers are discouraged.

REFERENCE

Lansky, E.P. and H.M. Paavilainen. 2011. *Figs: The Genus Ficus*. Boca Raton, FL: CRC Press.

2 Botany and Introduction

ECOLOGY OF *CAPPARIS* SPP.

Capparis plants are not the preferred food choice of goats (Garcia et al. 2008), and this owes to the presence of the secondary metabolites, which are more concentrated when the plants grow in harsh desert conditions (Figures 2.1 and 2.2), making such plants relied on in partially barren areas (e.g., those of northeast Brazil) undesirable from the standpoint of goat nutrition (Costa et al. 2011) and even potentially poisonous to the animal when, say, leaves from *C. tomentosa* are included as a forced part of a ruminant's regular diet, causing weakness of the hind limbs, staggering, and swaying (Ahmed et al. 1981). In Nubian goats, feeding of *C. tomentosa* leaves resulted in inappetence, locomotor disturbances, paresis (especially of the hind limbs), and recumbency. Associated lesions comprised perineuronal vacuolation in the gray matter of the spinal cord at the sacral region, centrilobular hepatocellular necrosis, degeneration of the renal proximal convoluted and collecting tubules, serous atrophy of the cardiac fat and renal pelvis, and straw-colored fluid in serious cavities. Later, anemia developed, and the results of kidney and liver function tests correlated with clinical abnormalities and pathologic changes (Ahmed et al. 1993).

Yet, fruits and buds of *Capparis* sp. were among the most preferred foods of six white-faced saki monkeys (*Pithecia pithecia*) on Round Island, Guri Lake, Venezuela, during a period of fruit abundance (Cunningham and Janson 2007). And, we contend here that these same potentially toxic secondary metabolites in the caper plant also infuse it with medicinal power worthy of our consideration. Secondary metabolites in caper plants, or “capers” (i.e., plants of the genus *Capparis* and their parts), their chemistry, and putative therapeutic functions are the subjects of this book (Figure 2.3).

The word *caper* usually refers to the flower bud of any member of the genus *Capparis*. Such capers particularly, plus the *Capparis* fruit, termed also caper berries, caper melons, and caper capsules, are preserved by pickling in brine or vinegar (Figure 2.4). In this way, they have provided a tasty addition to the Mediterranean diet for many centuries, mainly buds and fruits of *C. spinosa*, which to many Americans are known only as the centers of rolled anchovies. Other parts of *Capparis* plants, such as their leaves and roots, are also used in medicine, although usually not for food. However, recipes for brine-pickled *Capparis* leaves are extant. There is a long history of safe usage of these parts both in diet and as plant drugs throughout the world, and the details of this usage are summarized in this chapter, especially in tables.

Secondary metabolites in capers are, like secondary metabolites in all plants, significantly sensitive to environmental changes, stresses, biodiversity, and perturbations (Conforti et al. 2011a,b, Ozkur et al. 2009). This highly important principle that secondary metabolites can be manipulated by environmental factors leads to a science of plant manipulation independent of, or complementary to, genetic engineering per se.

Environmental stimuli push genetic changes, if not via mutation or selection, then at least epigenetically through methylations and acetylations. Thus, as always, environmental factors can be controlled and manipulated to achieve at least *epigenetic* changes. The important parameters for the scientist investigating such phenomena are light, temperature, moisture, and pressure (altitude). In *C. spinosa*, when water was harshly limited, the best photosynthetic performance occurred (Levizou et al. 2004). More is known regarding variation in mineral content of *C. spinosa* and *C. ovata* in response to harvest date and bud size (Özcan and Akgul 1998), N₂-fixing microorganisms from the *C. spinosa* rhizosphere (Andrade et al. 1997), and environmental stress: “Increased



FIGURE 2.1 Caper bush (*Capparis aegyptia*) in the arid Arava Valley. (16.5.2011, near Kibbutz Ketura, Southern Arava, Israel: by Helena Paavilainen.)



FIGURE 2.2 As a response to the severe environmental stress in desert conditions, desert plants often contain higher concentrations of secondary metabolites. *Capparis cartilaginea* in the arid desert of Negev, near Kibbutz Ketura. (16.5.2011, Kibbutz Ketura, Southern Arava, Israel: by Helena Paavilainen.)

K and Ca uptake to maintain the hydric balance, thorny stems and a heavy investment in chemical defenses to prevent grazing, with a deep mycorrhizal root system allow *Capparis* to grow successfully in very infertile soils and to endure environmental stress” (Pugnaire and Esteban 1991). In greenhouse conditions, cold stratification treatments (i.e., layering of seeds between layers of moistened but not wet vermiculite, peat, or other absorbent material and storing at 1–5°C for

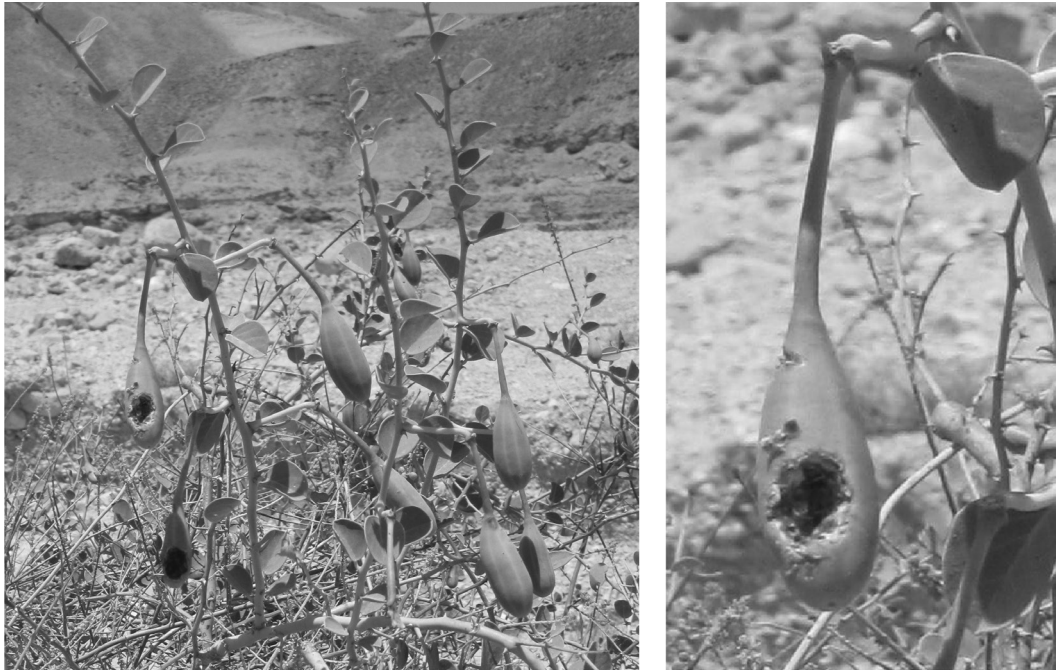


FIGURE 2.3 *Capparis* plants, such as this *C. aegyptia*, are an important source of nutrition also for different insects (cf. Peled 1997). (16.5.2011, near Kibbutz Ketura, Arava, Israel: by Helena Paavilainen.)



FIGURE 2.4 Home-pickled capers and caper fruit. (By Ephraim Lansky.)

60 days) was more effective than storing for 50, 40, 30, 20, or 10 days in *C. ovata* in promoting germination (Olmez et al. 2006). In the wild, growth of *C. decidua* was best in angular and blocky (loam) soils and poorest in granular and crumb (sandy) soils, while water-holding capacity and wilting coefficient associated with growth promotion were maximized when the pH of the subsurface soil was 6.7–7.6, and abundance was greatest when the pH was 7.2–8.2 (Qaiser and Qadir 1972).

Capparis leaves are tough, bright, and shiny and covered with epicuticular wax to aid in the conservation of moisture (Figures 2.5–2.9) (Oliveira et al. 2003). In the case of *C. spinosa*, a winter-deciduous perennial shrub and consistent floristic element of Mediterranean ecosystems growing from May to October (i.e., exclusively during the prolonged summer drought), the leaves are thick,

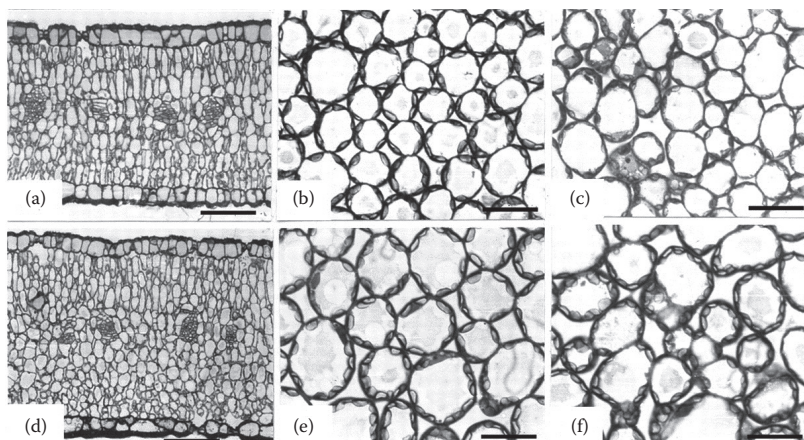


FIGURE 2.5 Anatomy of mature leaves of *C. spinosa* (L5 and L6): (a) and (d) cross-sectioned leaves; (b) and (e) paradermal sections through adaxial mesophyll of L5; (c) and (f) paradermal sections through abaxial mesophyll of L6. Cylindrical, densely packed mesophyll cells expose most of their surface to intercellular air space. Bars represent 50 μm (a and d) or 20 μm (all other micrographs). (From Rhizopoulou and Psaras 2003, *Ann Bot* 92(3): 377–83. Reprinted with permission.)



FIGURE 2.6 *Capparis spinosa* leaves are well suited to preserve the scanty moisture available. (7.4.2010, Jerusalem, Israel: by Helena Paavilainen.)

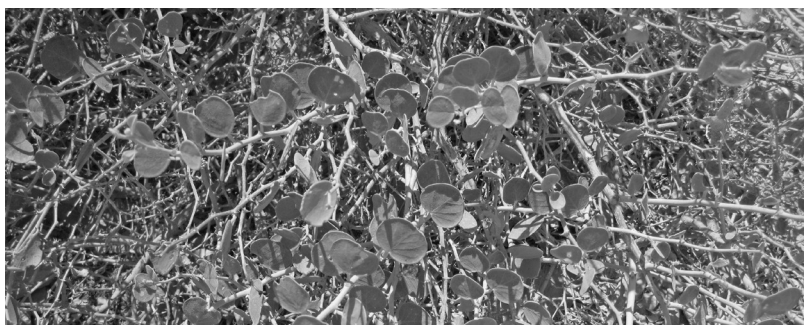


FIGURE 2.7 (See color insert.) The hard *Capparis aegyptia* leaves, as part of their adaptation system, have the bluish tinge typical of desert plants. (16.5.2011, near Kibbutz Ketura, Arava, Israel: by Helena Paavilainen.)

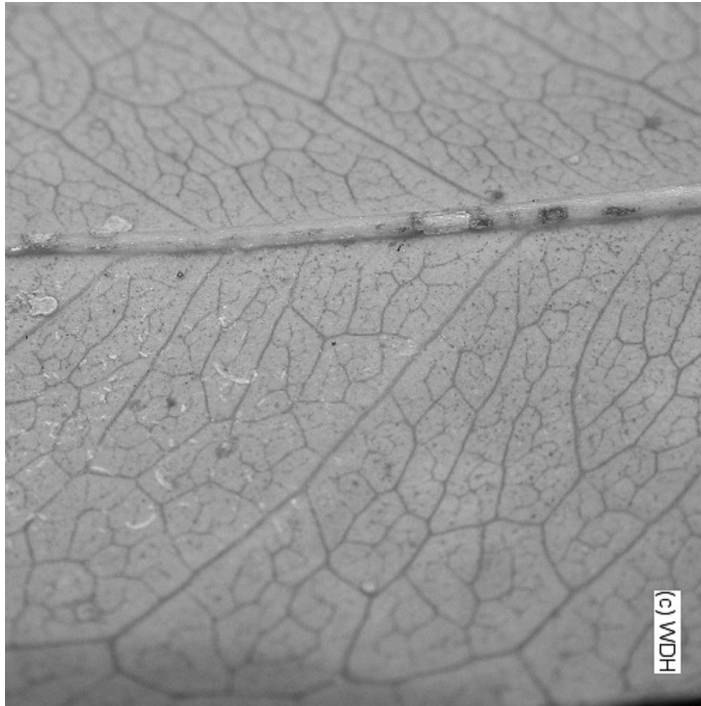


FIGURE 2.8 Detail of the leaf of *Capparis flexuosa* L. (15.6.2001, Grenada, Lesser Antilles: © William Hawthorne.)



FIGURE 2.9 Leaf of *Capparis cynophallophora*. (15.2.2013, Royal Botanic Garden, Edinburgh, Scotland: by C. E. Timothy Paine.)