Traditional Herbal Medicines for Modern Times

Caper

The Genus *Capparis*

Ephraim Philip Lansky
Helena Maaria Paavilainen
Shifra Lansky

CRC Press
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Dedication

for Yu

E.P.L.

for my family

S.L.

for Kaarina, the best of sisters

H.M.P.

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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. C*aprification* (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-azalel)* 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 prickers (Figure 1.2). Before one can pull off the first caper, one must feel its sting. The prickers 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 *epi*genetic 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), N_2-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

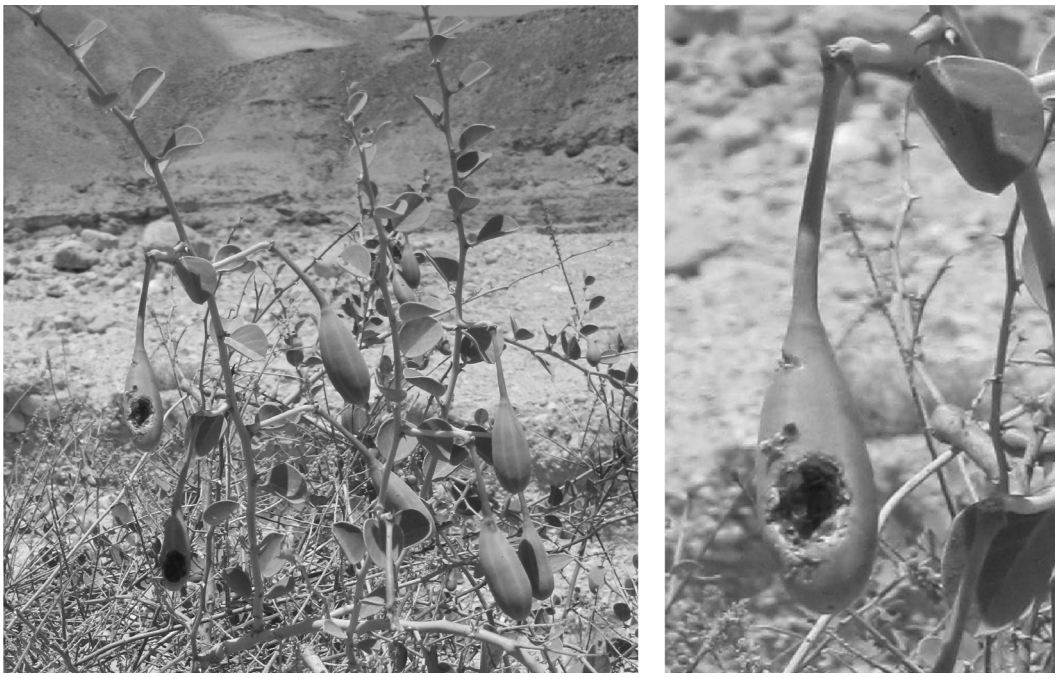

FIGURE 2.3 *Capparis* plants, such as this *C. aegyptia*, are an important source of nutrition also for different insects (cf. Peled 1997). (16.5.2011, near Kibbutz Ketura, Arava, Israel: by Helena Paavilainen.)

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,

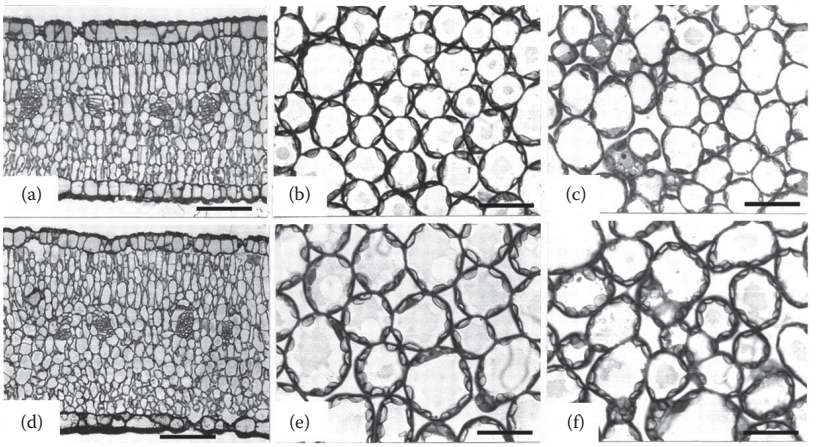

FIGURE 2.5 Anatomy of mature leaves of *C. spinosa* (L5 and L6): (a) and (d) cross-sectioned leaves; (b) and (e) paradermal sections through adaxial mesophyll of L5; (c) and (f) paradermal sections through abaxial mesophyll of L6. Cylindrical, densely packed mesophyll cells expose most of their surface 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.)

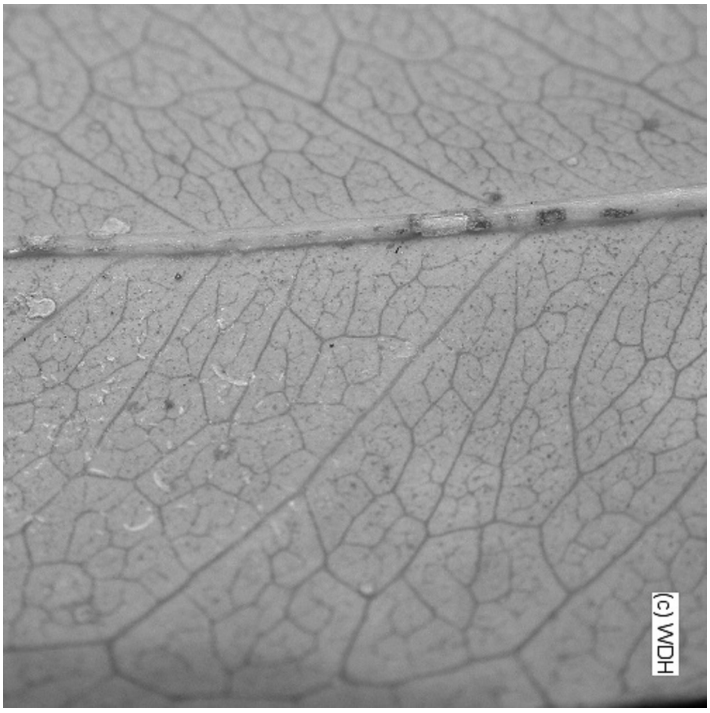

FIGURE 2.8 Detail of the leaf of *Capparis flexuosa* L. (15.6.2001, Grenada, Lesser Antilles: © William Hawthorne.)

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