PINE POLLEN :: *Ancient Medicine* for A NEW MILLENNIUM

STEPHEN HARROD BUHNER

FOREWORD BY:
Daniel Vitalis

PINE POLLEN

Ancient Medicine for a Modern World

Stephen Harrod Buhner

SurThrival
Springvale, Maine

ISBN 978-1-620-95497-3

Published by SurThrival

SurThrival@gmail.com

www.SurThrival.com

Book design by Sterling Hill Productions

CONTENTS

Go to the pine
if you want to learn about the pine,
or to the bamboo
if you want to learn about the bamboo.

— MATSUO BASHO
Seventeenth century Japanese poet

INTRODUCTION

by DANIEL VITALIS

Those of us who have chosen to embark down the winding road of nutrition and herbalism have certainly undertaken something bold indeed. We have chosen to obtain our foods and medicines from other species—living things—rather than from synthetic compounds and from those who manufacture them. We have chosen to go to the Earth, and to work with the creatures who inhabit her wild lands.

The foods that we eat are still—as they have always been— composed of once living things. Despite the advances of so-called "food science," we still must rely on the life cycle for our daily food needs. For many of us this concept may seem novel, perhaps because we have fallen so very far from this kind of wisdom in our most recent generations, from the understanding that all of our food is derived of the tissues of living creatures. We eat cells. Plant cells, animal cells, fungal, and even bacteria cells. As omnivores we eat all kinds of cells, but each of them began as the tissue of a living organism.

For quite nearly all of human history (and until very recently) the medicines that we have relied upon have come to us in much the same way, by way of life-forms. Only in the last century have inorganic and synthetic "medicines" come into fashion. Prior to this, and just as with food, our medicines were also derived from living tissues. Actually, what is today called "herbalism" was once—to put it simply—food.

"Let food be thy medicine and medicine be thy food"
-HIPPOCRATES

The foods that come to us from naturally occurring ecosystems, and especially the plant foods that come from these ecosystems, are genetically wild and chemically unchanged. They *as organisms* must live out their lives in these wild places, in places where their soils remain untilled, where their delicate structures are not kept safely behind fencerows. These plants are not pruned, and the soils around them are not weeded. Their predators—herbivores, insects, yeasts, and molds—are not kept chemically in check by interest vested farmers.

Instead they must become hardy and produce powerful chemical compounds that protect them, that sustain them, and that place them into symbiosis with some organisms whilst deterring predation from others.

Many of the compounds (we sometimes call them "secondary plant metabolites") that are produced by the metabolism of these plants' tissues are biologically active within our own bodies as well, and when strongly so, we call these plants *medicines*.

Today, ten thousand years after the neolithic revolution brought about sedentism, farming, and the domestication of the organisms that we use for foods, we are today all but lacking (maybe even completely lacking) these medicines that were once part of our dietary staple (and still are to those who hunt and gather for sustenance or hobby).

This is because our (relatively newly acquired) domesticated species of plants, more often than not, have had the medicines that are born in their tissues bred out to remove their often strongly pungent or bitter flavors or even outright toxicity. The farmer's near-constant weeding, pest control (whether by organic or "commercial" means), fencing, tilling, and fertilizing creates an existence in which the plant no longer needs to fend for itself, and so it can cease the production of its powerful medicinal and protective compounds. We are now more than ever consuming rearrangements of just a handful of these nutritionally bland and medicinally deficient domesticated plants species each year.

Through and because of this process it is as if we ourselves have become deficient in medicines and in the phytonutrients that we had adapted to for so many hundreds of thousands of years. No amount of synthesized (though most often architecturally plant derived) pharmaceuticals seems to assuage this deficiency, try as we might.

It is this deficiency, one that could almost be described as a "lack of wildness" in our diets (and thusly in our lives as well), that has spurred the reemerging interest in herbal medicine, natural whole food nutrition, and wild foods.

While scientific nutrition and modern medicine have unarguably lent us many valuable insights with regard to the chemical composition of wild plants, both seem to have struggled to *perceive* the inherent value of any species (including our own) as a whole and the interconnected role they play in providing "medicines" to their ecosystems.

As we begin (once again) to naturalize ourselves—both nutritionally and medicinally—we may begin to discover that there is far more to a plant than just its chemical composition, more than just its list of constituent phytonutrients, vitamins, and minerals. Rather, and more vital to our personal healing —as well as to the continuation of life as we know it—is our becoming acquainted with the organism producing the food or medicine itself. With the life-form, the *being*.

By learning just a little more about the lives of the beings that make up our foods and medicines, about their roles within their (and our) ecosystems, the way that they relate to the other organisms they live amongst, and the way that they procure their own food from their environments, we can begin to perceive something of the character of the organism we are working with.

No one has taught me this more than Stephen Harrod Buhner, and so for me to write this introduction is something of an honor. He has shown those of us in the herbal community how to merge two seemingly incompatible worldviews—that of the old—the way of seeing the wholeness of a thing—with that of the new—the way of learning the parts of a thing.

By looking at a plant's "personality" whilst simultaneously integrating the knowledge that has been gained from the validated and peer-reviewed scientific studies, we attain a kind of binocular vision, what is often called (though now somewhat cliché) a "holistic" view, and thus we can construct an effective understanding of a plant's medicine as it relates to us in our bodies, minds, lives, and even ecosystems.

Of course this book tells the story of Pine. Its tale has been painted in the broad brushstrokes of holism and the fine details of science. It is designed to take us beyond our default view of pine as a common tree and building

resource in order to introduce us afresh to Pine, the living, respirating, life witnessing conscious entity that inhabits and even rules over the boreal forests.

As a species (and like any), Pine has its own "personality" and way of relating to other species. Like all organisms it must draw the resources necessary for its life cycle from its surroundings, but it also gives back, providing novel substances to the organisms among which it lives. Perhaps the most obvious way that it does this is to produce its many nutritious foodstuffs, not the least of which is its nutritionally rich pollen.

In its own metabolism it produces androgens like testosterone and DHEA, in which, each spring, it bathes the animals and plants of its ecosystem like a king showering golden coins upon his subjects. Its nutritional richness is seldom matched not just in quality, but even more so in quantity. Pine pollen is produced in such staggering abundance that it dwarfs the yields typical of most other wild foods and medicines.

Pine's abundantly wealthy personality and androgenic physiology demonstrates a way and means by which a man can develop and age with grace, physical strength, and reproductive integrity, supplying so much of what he needs to maintain healthy hormone levels as he approaches, moves into, and moves beyond andropause.

As we—both individually and collectively—move into this new millennium on our Earth, each of us coping with the environmental, toxicological, technological, and social demands of this uniquely climactic time, organisms—*beings*—like the Pine tree stand alongside us as willing allies, if we will but choose to take up allegiance with them.

I can say without reservation that I believe the Earth's ecology—literally the life-forms that make up our ecosystems (and that grand concept we call nature)—contains every tool we could require for the living out of healthy, vigorous, and sustainable lives here on our green planet.

For those for whom Pine represents just such a tool, and just such an ally, it is my hope that this book will enrich your mind and heart the way that relationship with Pine has enriched mine.

—DANIEL VITALIS

PREFACE

Although the Western world has been undergoing its greatest herbal renaissance in over a century the medicinal actions of trees are often overlooked, perhaps none more so than pine. Given the drive for new plant medicines and the continual search for a new herb-of-the-day that will simulate excitement in the general populace (e.g. rhodiola, maca), it is astonishing that pine has been unrecognized for so long. This is particularly perplexing since the pollen of pine trees has been used for millennia in China and Korea as both food and a particularly powerful tonic and adaptogen, especially for the elderly.

Thousands of Chinese herbs have entered the Western pharmacopoeia; the earliest and best known is perhaps ginseng. Pine pollen, given its potency, its similarity to ginseng in some of its actions, and its status as, perhaps, *the* premier phytoandrogen on the planet, should have been recognized long before now as the powerful medicinal it is. This monograph is intended to remedy that oversight and help establish it as one of the most important medicinals in the herbalist's repertory. And while most parts of the pine have been used as highly nutritive foods and all have been used as medicine (bark, needles, essential oil, resin, buds, cones, seeds, and pollen), this monograph will focus primarily on the pollen.

• 1 •

ABOUT PINE

The pine tree seems to listen, the fir tree to wait: and both without impatience–they give no thought to the little people beneath them devoured by their impatience and their curiosity.

— FRIEDRICH NIETZSCHE

Pine *(Pinus spp)*
Family: Pinaceae
Common names (English): Pine. The different species of pine each have their own unique names: Scots pine—which should never be called scotch pine—*(Pinus sylvestris),* black pine *(Pinus nigra),* Korean pine *(Pinus koraiensis),* masson pine *(Pinus massonia),* Chinese pine, a.k.a. Chinese oil pine, a.k.a. Chinese red pine *(Pinus tabulaeformis)*, and so on.

Growth and Range

Most people who live in the northern hemisphere of this planet know the pines, for they have long been our neighbors. We know them by their evergreen needles that show up so startlingly green against winter snow. We know them by their scent which comes to us as we walk through the forests surrounding our cities and towns. And we know them by their sap, so impossible to remove, that gets on our hands and clothes every time we sit down on the needle-carpeted floor of a pine forest.

We know them, too, because they are our most common building material; many of the 2X4s we buy (and 2X6s, 8s, 10s, and 12s) are milled

from pine trees. But it's usually us northern peoples, or those who have visited northern climes, who know these things about pine. They commonly range from the Arctic as far south as North Africa, the Philippines, and Central America. Only one was originally native south of the equator and that is *Pinus merkusii,* native to Sumatra. (Still, pines, like all plants, have hitchhiked with people wherever they have traveled; they now grow wild in many places that are historically new to the species; pine forests are now common in Chile, for instance.) A look at the fossil record shows that the normal distribution of pine has been like this a very long time; the fossilized remains of the family Pinaceae, of which the pine is the predominant member, are only found in the northern parts of the globe.

Botanists have spent centuries making order out of the riotous growth of the plant world; they have created artificial groupings of plants beginning with large groupings, then going all the way down to individual species. The largest grouping is of course *Plantae* (called a kingdom), which includes all the plants there are. Somewhat lower down the size scale are the families, and pine is, as I mentioned, in the family Pinaceae. There are eleven different members of that family; it also includes the firs, spruces, (true) cedars, larches, and hemlocks. You can see the similarity each of these trees have to the others; most of the Pinaceae look similar, with similar smells and the same kind of irrepressible sticky sap. Most are evergreens and do not lose their needles in the winter. (Of course there's an exception; there almost always is. The larches lose their needles in the fall. In consequence, they are considered deciduous trees rather than evergreens —the word deciduous means *falling down* or *off.* It has nothing to do with being a hardwood or growing in New England.)

To get more specific about botanical names plants are, as noted, first gathered together in a family (well, there is stuff even bigger than families, but I'm not going to go into those), then those members of the family that are alike are gathered together in a genus. Then the members of the genus that are even more similar to each other are classified together as belonging in their own species groupings. So the pine family is Pinaceae (which again has eleven different types of trees in it). Each of those eleven types belongs to a specific genus. The firs are genus *Abies,* while the pines are genus *Pinus.* To talk about any particular kind of pine then—say Scots pine—you would first write or say its genus name, that is, *Pinus,* and then its species

name—in this instance, *sylvestris*. Thus the full name of Scots pine is *Pinus sylvestris*. (Most people in Asia, by the way, unlike those of us in the Western world, are named similarly—last name first, first name last, which reveals a very different focus in our respective cultures. Here the emphasis is on us as individuals, while there the focus is on the family group from whom you come.)

This way of naming plants is particularly Western; it is not written in stone. It has no inherent truth of the universe to it. It is, in fact, something people just made up—which accounts for so many plants being continually shuffled around from group to group just about the time the earnest botany student finally learns their Latin names. Other cultures use very different naming approaches. Indigenous peoples, for example, perceive a great many more distinctions in plant species than Western scientists do. Their perceptions tend, generally, to be proved right over time.

Some of the Latin names for plants are very useful, as they indicate, to some extent, what the plants actually do in the world. Others are mostly useless. They sound impressive but often mean something as ridiculous as *Porter's Liguria, Italy,* as the plant osha's Latin, *Ligusticum porterii,* does. Mostly what botanical terminology does is allow people from different cultures (who use different languages) to communicate about plants with less confusion. The point here is that most Latin names are just made up; they confer no special understanding on anyone who uses them, and you don't really need to know a plant's Latin name to know a great deal about the plant (often if you learn the plant from personal experience, you will end up knowing more than the "experts").

There are a great many different types of pine trees. In fact, there are more species of pine than any other conifer (from the French *conus* meaning "cone" and the suffix *-fer* meaning "bearing," i.e., cone bearing). There are 109 in all. They are also the oldest members of their family, which is probably why the family to which they belong bears their name. The other family members are relative newcomers, only appearing in the fossil record during the early Tertiary, about sixty million years ago. Comparatively, the pines are very old; they were widespread during the Cretaceous, some 140–150 million years ago.

China claims the largest diversity of the Pinaceae family; species from all eleven genera grow there. Mexico, while not having as many members of

the genus, has the largest species diversity of *Pinus* itself; there are forty-three different types of pines that grow there.

Pinus species, perhaps due to their lengthier stay on the planet, live in the most diverse habitats of any of the Pinaceae. They grow in extreme northern latitudes, from the tundra tree line in Eurasia to high into the alpine ecosystems of Europe and North America, finally giving way to bare rock and snow among the mountain peaks. They grow along the edges of the sea among salt spray and sand dunes and extend deep into the lowland tropics of Central America and Southeast Asia. They can grow half buried in sand dunes, and many have adapted to growing in poor soils. As an example, the Scots pine, *Pinus sylvestris,* is native to Europe and grows from Norway to Spain and into parts of Asia. It prefers a well-drained, acidic soil with full sun and is very tolerant of dry, infertile landscapes.

The pines are noted for the development of highly sophisticated coevolutionary partnerships across a broad range, which is part of what allows them to grow in such diverse climes. Many have formed relationships with various species of mycorrhizae, that is, the underground plant—it often looks like a grouping of intertangled white threads spread throughout the soil—that gives rise to mushrooms (its fruiting body). Many plants, including the pines, form such relationships by having their roots entwine with the micorrhizal thread system. The micorrhizal network connects to multiple points on the roots, and substances from surrounding plants and soil flow through the micorrhizal system and into the trees. Among other things, this supplies nutrients, which allow the pines to survive poor soils. Other substances enhance immune function, making the trees more able to survive disease.

The pines have also developed a great many coevolutionary relationships to help them propagate. Pines are one of the most adaptable plants on the planet; there is a great deal more to them than meets the eye.

Propagation

Pine seeds vary tremendously in size. The jack pine seed is tiny, one-eighth of an inch long; some 250,000 are needed to make up one pound. Torrey

pine seeds, on the other hand, are huge. They are an inch long, and there are only about four hundred seeds per pound. The white pine's seeds aren't quite that large, but they—like all stone pines—are some of the largest on earth. Like all pine seeds, they are highly nutritious.

Most pines easily propagate from seed. However, how they do so in the wild is highly variable; they have generated a great many ways to spread their seed over the last 150 million years.

Most people know that pines generate their seeds in cones (they are *cone bearing,* after all). For most pines, the time to maturity of the seed from the first faint beginnings of cone growth (which begins as a tiny bud on the branch) is about two years. The cones usually begin to form in summer, often around July. By early spring of the next year the conelet begins to be visible. It looks something like a pincushion about a quarter of an inch in diameter. As soon as pollen season begins, the tiny conelet creates a sticky, sugary solution in its ovules, which is then sent to the tips of the scales. Once it reaches them, the scales spread wide and wait for the pollen to come to them, where it will get caught in the sticky solution.

The amount of pollen released by pine trees is huge. It falls from the trees over some conelets' scales and is carried to others by wind dispersion. Once pollen grains are caught in the sticky solution they are reabsorbed back into the cone, the pollen going along with it, and the scales close.

The pollen is then kept in a kind of storage for fertilization of the pine ova, but the pollen isn't released until the next spring. Once fertilization takes place, the cones begin to rapidly increase in size as the seeds go through their developmental stages. By late summer mature seeds have formed in the cones, the weight of the cone increasing some forty times. During this growth process a rich carbohydrate solution flows from the tree into the seeds, one reason pine seeds are such potent foods.

Normally, the trees in stands rotate their production from year to year even though stand production of seeds by a pine forest remains fairly constant. In this way trees can rest during off years and recover their carbohydrate reserves even while seed production of the stand remains constant.

In most pines, once the seeds reach maturity the cone scales open and release the seeds. Some seeds are designed to simply drop to the ground;

others to catch a ride on the wind. Others have more unusual methods of spreading their seed.

If you have ever fooled around with an old pinecone that has already released its seeds and been shed by the tree you know just how tough the cones are. Breaking off an individual scale is hard to do. If you manage to do so, it will reveal the presence of strong fibers that run from the cone core through the scale. These protect the cone from damage and also are essential to the release of the pine seeds (a.k.a. pine nuts).

The seeds tend to reach maturity in late summer when it is quite dry. As the cones dry out, the fibers shrink and contract. This pulls the scales back and releases the seed, which then goes on its journey in search of a place to germinate. Most pines do it this way, but there are a few that take quite a different approach. The jack pine, *Pinus banksiana,* is a good example. Another is the white pine, *Pinus strobus.* Their methods of propagation are very different.

The jack pine—like many pines—has learned how to endure fire; but more than this, it has learned how to depend on fire for its propagation. Its relationship with fire is so old and deep that it has also learned how to help generate fires wherever it grows.

The tree sheds needles that are high in resin and low in water, needles that burn hot and quick. The trees are also self-pruning; they drop limbs as they grow, in part so that fires cannot "ladder" up the trunk into the higher branches but also to build up an additional pile of "litter" around the base of the tree in order to provide fuel for fires. There is emerging evidence that pine needles also help generate the fires that pines need to keep competing species out of their territory and, in the instance of the jack pine, help propagate its seeds.

As wind passes through pine needles the trees build up a tremendous static electric charge, much as we do when we rub our feet over a carpet over and over again. Once the static charge is high enough, lightning strikes are initiated that, in many instances, begin a fire in the needle and limb litter that has built up on the forest floor. Most trees cannot easily survive forest fires, but pines have adapted spectacularly in order to do so.

In most pines, the bark is layered and constructed in a series of largish flakes. You can think of it as something like a pile of children's blocks. Place three in a row with a space between each, then lay another block on

top of the space, balanced on the edges of the blocks underneath; then add another, similarly, on top of those two. This leaves air spaces in the bark that help cool the tree when fires burn around its trunk. As the outer bark catches fire, the air spaces cool the interior of the tree. As the fire progresses that piece of outer bark soon flakes off, dropping to the ground. Other similar layers are underneath, all of which help prevent fire from getting deep into the heart of the tree.

Once a fire burns hot in such a forest, many of the other trees are killed off, but the pines generally survive. A hot fire burns back all the leaf litter, and often much of the organic material in the soil, leaving a bare mineral earth behind. Pines grow well in this kind of soil, and the bright sunlight that comes in a forest where competing trees have burned off stimulates a lot of new growth.

Many pines are similar in their responses to fire and burned soil, but when it comes to the cones and seeds, jack pines are in a category by themselves.

Colin Tudge, in his wonderful book *The Tree* (NY: Crown, 2005), comments that the cones of the jack pine are *literally* almost as hard as iron, the scales held together by a powerful resinous glue. The only animal known to be able to chew through the cone is the American red squirrel, though it usually doesn't, since it prefers easier meals. The seeds will stay viable in the cone for twenty years or perhaps longer; no one really knows how many years they can last.

The resinous glue on the cone scales will only begin to melt at a temperature of 122 degrees Fahrenheit. The glue melts, the scales spread open as the fibers contract, and the seeds can then emerge once a few final things occur.

The seeds themselves are remarkably resistant to fire, able to survive temperatures of 1,652 degrees Fahrenheit (the heat of a potter's kiln) for up to thirty seconds; at 1,292 degrees they will last as long as three minutes.

When the heat from a fire engulfs a cone, the resin gluing the scales together begins to melt and oozes to the surface of the scales. It immediately catches on fire. Each cone is then surrounded, as Tudge reports it, by "a gentle lamp-like flame" for around a minute and a half. It takes exactly this amount of flame and heat to melt all the resin and allow the cone to open. Essentially, once the fire reaches a temperature hot enough to

melt the resin, the cone itself provides just the right amount of flame to open the scales.

The seeds aren't released just yet, however. They are held in the cone until the fire has burned through and the cone begins to cool. As the cone cools, it contracts, which then stimulates the release of the seeds. This usually takes several days. At that point the cone initiates the release of the seeds into the exact habitat most likely to produce germination. Up to twelve thousand seedlings per acre will sprout after a hot fire has cleared the land.

Interestingly enough, about one in ten of the cones, especially in higher latitudes, will open simply from the warmth of the sun. The farther north the trees grow, the more the cones will open from sun warming. It is a highly adaptable strategy for growing when, for whatever reason, there is no fire.

Compared to the jack pine, the white pine's strategy for propagation is significantly different. For the white pine, the coevolutionary relationship is not with fire but with birds; most commonly the Clark's nutcracker. This relationship—like most coevolutionary ecosystem relationships—remained unrecognized (by Western scientists) until very recently. The person most responsible for bringing to light the relationship between the white pine and Clark's nutcracker is Ronald Lanner in his remarkable book, *Made for Each Other* (Oxford University Press, 1996).

The white pine is a member of what are called the stone pines. Unlike most pines, the cones of stone pines do not possess the tough fibers that pull back the scales to release the seeds. They instead do something much different to get the seeds out of the cones.

As white pines' cones dry, the scales open slightly but never enough to release the seeds. Even a severe shaking of the trees from powerful windstorms won't be enough to cause the seeds to drop from the cones. And even if the scales themselves break off (which they can do since they don't possess the fibers of other types of cones), the seeds will remain in place, for the seeds are held just slightly behind the weakest part of the scale, the part that most often tends to break away.

Since the white pine's cones will not open by themselves they need something else to do it for them. This plant—like many others—has

developed a highly sophisticated mutualism with birds. There are a number of birds that will open the cones, but the main one is the Clark's nutcracker.

Clark's nutcracker possesses a sublingual pouch in which it can store up to one hundred white pine seeds at a time. The bird can open the scales on a cone as delicately as a surgeon with a scalpel performs an operation. The seeds are taken into the pouch and, when full, the bird begins depositing the seeds in caches for up to ten miles beyond and around the stand of trees it is feeding on. During the harvesting season the Clark's nutcracker will store up to thirty thousand seeds in some 10,000 locations. It then feeds on these stored seeds over the winter and early spring. It can remember every location for up to two years and it remembers which locations it has harvested seeds from and which it has not. Interestingly, researchers have found that the birds store triangulation data about the caches, measuring by eye the distance to memorable landscape features so exactly that they can determine the cache location. The seeds they do not use begin to germinate the next spring, and this is how white pines propagate and spread.

Medicinal and Food Uses of Pines

The human species has been around for perhaps a million years in one form or another—in something similar to our current form perhaps one hundred thousand years. And the pines have been with us through all that time. Ever since humans have been they have used pines—for weapons, accessories (baskets, boxes, spoons, sandals), shelter, art, commerce, decoration, cosmetics, food, and, of course, medicine. Every part of the pine has been, and often still is, used for medicine (and often for food): seeds, buds, needles, bark, resin, and of course, the pollen.

• 2 •

ABOUT PINE POLLEN

She was cut off from the past and therefore did not live in the present. But suddenly, as she stood close against a pine tree and breathed in its sharp, bitter scent, a clear space opened to her childhood, as though a wind had sprung from the sea, clearing a mist. It was not a memory from the past, it was the past itself.

— DONALD THOMAS, *The White Hotel*

Pine pollen *(Pollen pini)*

Common names: *English*: pine pollen; *Chinese:* Songhuanfen (or Song Huan Fen); *Korean:* songhwaju; *Latin:* pollen pini.

Caution: A number of sources and websites translate *Pollen pini* as "bee pollen" and thus sell bee pollen as *Pollen pini.* Look carefully and make sure that what you are buying really is pine pollen and *not* bee pollen.

Pine Pollen

Pines are primarily monoecious trees; that is, having both male and female reproductive organs on the same tree. A few species are what is called sub-dioecious; that is, being predominantly one sex or the other, though not completely, thus giving them the *sub*-dioecious rather than dioecious classification.

The male reproductive organs of the pines are sometimes called *cones,* an irritating and unnecessary confusion since the female organs of the pine are *always* called cones (they are the *pine cones* that everyone knows about).

The male organs have a couple of other more useful names and not necessarily vulgar ones at that.

The male organs of the pine don't look at all like cones (so why give them that name?) but rather *catkins*–which is what they generally are called by the articulate.

The catkins grow in a clump at the end of pine branches and look somewhat like small, curved, corn-on-the-cob or perhaps small, curved cattail tops. They are typically small, from one to five centimeters in length (about ⅓ of an inch to two inches). The catkin season is short, lasting a month at most, and normally occurs in spring—usually March to May (a few do it in the fall). The catkins produce the pollen that fertilizes the female part of the tree, the pine cones.

Pines are wind pollinated trees; they don't need a pollinator to help them reproduce (though they may need a coevolutionary partner). Each spring, the catkins release huge amounts of pine pollen which spreads by wind (and gravity) to the female cones where the seeds are fertilized.

Under magnification the pollen looks a bit like Mickey Mouse, or so they say—a big head with two huge cupped ears. It also looks a bit like a small basket with two large balls in it, sticking out over the edges. The balls are cupped on one side to catch the wind. The wind catches in the cupped areas, the head or basket acting as a sort of keel hanging underneath, and the pollen sails much like a ship through the air until it finds its way inside the overlapping scale of a cone where it gets stuck in the sticky exudate. (The needles around the cones and the cones themselves literally alter wind flow patterns to more accurately funnel the pollen into place so that fertilization can take place—the plant has been at this a long time.) Under each little overlapping scale of a cone, a pine seed or pine nut will grow.

The interior of the catkin is basically a central stalk covered with pollen-bearing sacs, and there are a lot of catkins on the trees. An individual tree can produce up to six million grains of pollen in season—a sixteen year-old tree will release some 3–4 ounces of pollen per day. That is actually quite a lot; the pollen is very light, and it takes lots of it to make up any significant weight. And all this is occurring in a forest with, often, thousands of trees.

The season for *Pinus taeda,* a species native to North Carolina, lasts from about April 1 to April 21. Over that three week period a single pine might release between sixty and eighty ounces of pollen. The older the tree and

the greater the spacing between trees, the greater the pollen production. A ninty-thousand acre pine forest can produce about one thousand tons of pollen in season, about 1.5 million dry quarts per day. (Just imagine a quart can of engine oil. Imagine it filled in this instance not with oil but with pine pollen. Now imagine 1.5 million of those being dumped in a forest each and every day for fourteen to twenty-one days. And that is just *one* forest.)

So, each tree makes about three to four ounces of pollen per day. There are twenty-eight grams in an ounce—irritatingly, half the research is in metric measurements and the other half in English weights, which means that I have to actually figure this stuff out to make any sense when I talk about it—and each gram of pollen has some one million pollen grains in it. So each tree is releasing some 90–120 million pollen grains per day. This is why, during pine pollen season, the ground for miles around is often covered with the fine, flour-like pollen the trees produce. Sometimes so much is released that local communities use snow shovels to remove it from their sidewalks, and rain puddles take on the look of yellow latex paint.

In other words, a *lot* of pine pollen is produced in a good year. Unfortunately, in the United States, this is just seen as a nuisance, another example of plants having unrestrained sex with no regard for the needs or sensibilities of the people who live around them. So, the pollen is almost never used as either medicine or food. It merely remains a source of complaint, and, unbeknownst to the millions who sweep it up and throw it away, one of the most healthful foods and medicines that exists.

Primary Species Used

The primary species of trees used for their pollen are: in the United States, *Pinus sylvestris* and *Pinus nigra*; in Korea, *Pinus koraiensis*; in China, *Pinus massonia* and *Pinus tabulaeformis*. However, ***any*** species will do.

Collection and Preparation

Most people who seek pine pollen collect the catkins rather than trying to capture pollen only; it's much easier. If you want *only* the pollen you can put plastic bags around the catkin-bearing branch ends and wait for the pollen to fall into them. Then you collect the bags and dump it all out. This is a much more difficult and time-intensive process than collecting the catkins, and you get a much smaller production at a much slower rate. Those who are interested in larger quantities (and the impatient, i.e., most of us) collect the catkins when pollen production is highest, usually in early April. This is done by climbing the tree, getting covered with sap—wear old clothes and keep a bottle of turpentine handy to clean your skin—picking the catkins by hand, and then placing them in a bag that is precariously hanging from your belt or shoulder or the limb while you precariously hang onto the limb you're balancing on. Then, after an exhausting, gummy day, you take the bags of catkins home for processing. Usually this means throwing the bags on the floor, peeling off your clothes, throwing them roughly in the direction of the laundry room, opening a beer (or several), trying to clean the sap off your skin with turpentine and then screaming when it gets in the millions of cuts and scrapes you got climbing the trees. So, actual processing often occurs only the next day. It begins after you blearily pry yourself out of bed, find that you missed a lot of sap in your hair, which is now glued together, that alcohol and turpentine vapors don't mix well in the central nervous system, and have taken a lot of aspirin and have stared glumly at the remains of last night's congealed food on the kitchen counter. It is only then that you take your swollen hands and pick up the bags full of catkins and tremblingly try to pour them into large, openmouthed containers for processing and find that, however careful you are, most of them miss and fall on the floor from where you have to laboriously retrieve them. Then and only then do you begin to make them into a tincture—basically you add some alcohol and water and let it steep for a couple of weeks.

In China, the largest producer of commercial pine pollen, the catkins are collected, then placed in open tray containers to dry (often in the sun). When they are well dried, the catkins are shaken, which separates the pollen, and the catkins are carefully picked out of the mix and discarded.

My preference, if I am going to dry the catkins before making them into a tincture, is for a shaded, dry location, since sunlight has a tendency to

degrade plant matter. If the pollen is being tinctured, the entire catkin should be used fresh during the tincturing process. (You can also get the processed pine pollen from China and tincture it yourself. This does produce a "stronger" tincture, but it's not as fresh or, I don't think, quite as good as that from fresh catkins. However, fresh pollen that has *not* been sitting in a warehouse a long time is nearly as good.)

Oddly, since pine pollen has been used as both medicine and food in China for millennia (the oldest mention is in a text *The Pandects of Materia Medica,* by Shen Nong, who wrote it during the Han dynasty some 2000 years ago), many Chinese producers now crush the pollen to break the cell walls during the manufacturing process. (A low-temperature, high-speed airflow pulverization process is used which breaks up 99 percent of the cellular material.) They assert that the pollen is more easily digestible if the cell walls are broken. I have mixed feelings about this since pine pollen has been a primary food and medicinal substance for a very long time—the pollen was eaten as a primary staple in China and Korea long before crushing began. It has always been known as a powerful tonic and nutritive food.

The only study I have been able to find on the difference in digestibility between crushed and uncrushed pine pollen was conducted on mice. It showed just a 20 percent increase in digestibility when the cell walls were broken. Not huge. Based on its long traditional use, and given the quantities of pine pollen available during pollen season, if pine pollen is being used as a food or nutritive substance, I don't believe that the pollen needs to be crushed in order to facilitate digestibility.

> *However, for pine pollen that is being sold as a supplement in capsule or tablet form, given the small quantities being ingested, I think that breaking the cell wall makes sense, as it increases the amount that is bioavailable to the body by 20 percent.*

If, however, the pine pollen is being tinctured, it certainly does not need to be broken—the studies I have seen don't show much difference in solubility between broken and unbroken pollen.

In my own use of uncrushed pine pollen, taken in tincture form, I have found the tincture to be exceptionally potent, as or more potent than the crushed Chinese material that I have tinctured and used. Further, I tend to prefer *Pinus sylvestris* over the Chinese species *Pinus massonia.* I like both the taste and physiological impacts much more.

If you are collecting your own pollen and tincturing it, *crushing of the pollen grains is not necessary.*

Tincturing Pine Pollen

Pine pollen should be tinctured using 60–70 percent pure grain alcohol and 30–40 percent water. I generally use a 70 percent alcohol solution, and I tincture using a 1–5 ratio (a.k.a. 1:5). So, to get an idea of how this works in the real world, if you have 4 ounces of pine pollen dry weight, you will need 5 times that amount of liquid (that is the 1:5—for every one ounce of herb, you use 5 ounces of liquid). In this example you would use 20 ounces total liquid measurement. (A kitchen measuring cup is just fine.)

Of that 20 ounces of liquid, 70 percent will be pure grain alcohol and 30 percent will be water (and try to get good water without chlorine, fluoride, and so on ad nauseam). In this example you would use 14 ounces alcohol (70 percent of 20) and 6 ounces water (30 percent of 20). Put the combined liquid in a jar with the pine pollen, put the lid on the jar, and shake well. Put in a darkish place, shaking daily, for two weeks. At the end of that time, shake it again (the pollen falls as a sludge to the bottom and sticks there if you don't shake it, and then you have to scrape it out with a spatula) and pour the resulting watery sludge into a strong cloth that is carefully draped over a *large* measuring cup. Fold the cloth together to keep the pollen inside it (most of the liquid will have gone through the cloth already) and squeeze out the rest of the liquid. Save the liquid and put the marc, the leftover solids, on the garden, which will thank you later with amazing yields. Put the liquid in a labeled, amber bottle and keep out of the sun. See "Dosages" section for how much to take.

I highly suggest the use of pure grain alcohol for tincturing. "Pure" grain alcohol is, however, only 95 percent pure; the rest is water. Most herbalists

don’t take this 5 percent into account, and I don’t either; I just treat the alcohol as 100 percent pure when I am figuring out the percentages. Some states, however, don’t allow their citizens to buy pure grain alcohol (generally the brand *Everclear)* because they don’t think the citizens responsible enough to have access to it. (People put it in watermelons and play rock music and have a *really, really* good time when they eat the watermelons, which legislators *really, really* hate.) In those kind of states you will probably need to buy a much lower strength alcohol of one sort or another. Very cheap vodka is the usual choice. You just need to read the labels and get as high an alcohol content as you can in whatever liquor you buy. It probably won’t be high enough, but it will still work, just not as well. (Some vodkas are only 40 percent alcohol, and no, using twice as much won’t bring it up to 80 percent.)

Or—like many people—you can drive to a neighboring state and get what you need. There is almost always an Everclear state adjoining the “no, you can’t” state you live in.

Or, you can make your own still and distill your own pure grain alcohol, but then, that is another book …

Actions of Pine Pollen

Tonic, nutritive, adaptogen, androgen, antioxidant (among other things it increases superoxide dismutase levels, aka SOD—a potent antioxidant—in heart, liver and brain), enhances immune function, enhances endocrine function, antinociceptive (reduces sensitivity to pain), anti-inflammatory, antiarthritic, antitumor cytostatic (kills tumor cells without affecting normal cells), anticholesteremic (lowers cholesterol levels), hepato-tonic (stimulates liver regeneration).

Basically: potent overall tonic to the body and its functioning, powerful nutritive, and exceptionally effective androgen which raises testosterone levels in the blood and balances the androgen/estrogen ratio.

Chemistry

The chemistry of pine pollen is complex. A partial list shows it contains 3–16 percent water, 6–28 percent protein, 44 percent carbohydrates, 4–10 percent sugar, 2 percent flavonoids, 15–22 percent amino acids, 1–20 percent lipids—sterols including many brassinosteroids, gibberellins, cytokinins, and auxins, various polyphenols, glutathione transferase, pentacosane, narcissin, stearic acids, isorhamnetic glycoside, 6-aminopurine, sitosterol, ursolic acid, luteolin, palmitic acid, myo-inositol-1-phosphate synthase, phosphatidylcholine, phosphatidylethanolamine, phosphatidylglycerol, phosphatidyl-myo-inositol, phosphatidylserine, bisphosphatidylglycerol, lignin, cellulose, hemicellulose, and various polysaccharides (i.e., sugars) of importance—two of which are ararabinogalactan and xylogalacturonan. Arabinogalactan is a compound sugar (i.e., *polysaccharide*) made up from a number of monosaccharides that have combined in rather unique ways as they form the compound structure: L-arabinose, D-galactose, L-rhamnose, D-xylose, D-galacturonic acid. Vitamin D (2 and 3), testosterone, epitestosterone, androstenedione, dehydroepiandrosterone, androsterone, magnesium, selenium, silicon, potassium, calcium, iron, strontium, phosphorus, sulphur, chlorine, manganese, plus various other vitamins, minerals, amino acids (see "Scientific" and "Uses as Food" sections), and so on.

Scientific

Oddly, given its extensive history in China, research on pine pollen in the West is still in its infancy. Nevertheless, it is, at the beginnings of the new millennium, starting to be discovered as an important nutritive *and* medicinal. The realization that it is a powerful phytoandrogen (that is, a plant that contains testosterone) has probably done the most to stimulate interest in the herb (on the part of mostly male researchers). Its androgenic actions are due to a number of substances in the pollen, not only the testosterone and other male steroids.

Pine pollen contains large quantities of sterols, steroid-like substances, that are exceptionally potent. In essence, they are plant steroids. Plants generally contain five major steroids (there are others, of course, but they are considered to be *secondary* steriodal compounds, i.e., chemicals such as testosterone). The five primary ones are auxins, cytokinins, gibberellins, brassinosteroids, and ethylene.

Plant steroids have generated interest in commercial agriculture because their use strongly stimulates plant growth. (This is similar to an athlete taking human steroids to quickly build up muscle tissue—just as with athletes, a lot of unforeseen problems occur later on.) Such plant steroids are often very potent. Brassinolide (only discovered in 1979), is a powerful growth stimulant—as little as one nanogram (a *billionth* of a gram) applied to a bean sprout can significantly increase its growth. Brassinolide (and other brassinosteroids) is, essentially, testosterone for plants. Basically, its use causes hyper growth in agricultural plants.

In general, brassinosteroids are highly active in and essential to plant growth and development. There are over thirty different types of brassinosteroids that have been found so far— many of them are in pine pollen, including three rather potent ones: brassinolide, castasterone, and typhasterol. Interestingly, they are very similar in structure to animal steroid hormones and are highly biologically active. Most types of pollen contain large quantities of them.

Because of their potent biological activity in plants, research in recent years has begun to explore the impacts of these kinds of plant steroids on human health and disease. Two forms of the brassinosteroid brassinolide have been found to enhance the function of liver microsomes—these are crucial to the transformation and safe disposal of xenobiotics, that is, foreign chemicals that end up in the body.

Brassinosteroids such as brassinolide and castasterone have shown antiviral activity, sometimes of exceptional strength, against a number of viruses. Among them are herpes simplex type one (HSV-1), measles, and arena viruses. They have been found to be ten to eighteen times more potent than ribavirin, the main pharmaceutical antiviral.

In vivo studies have found that brassinosteroid compounds prevent HSV-1 in a dose-dependant manner with no cytotoxicity; that is, without

damaging effects on healthy cells. They reduced the incidence of herpetic stromal keratitis, including inflammation, vascularization, and necrosis.

Castasterone (followed closely by epibrassinolide) has been found to be the most highly active brassinosteroid against common breast and prostate cancer lines in laboratory studies in micromolar concentrations (i.e., at extremely tiny doses), again without affecting healthy cells. It's use inhibits cancer cell growth and stops proliferation of cancer cells. The brassinosteroids are considered to be highly novel steroidal compounds with unique anticancer actions while possessing very low toxicity.

Epibrassinolide, another steroid in this group, has been found to reduce the activity of 5 alpha reductase. 5 Alpha reductase is the enzyme that acts on testosterone to convert it into the more powerful androgen DHT. There is some evidence that abnormal DHT levels are involved in prostate enlargement and midlife hair loss. Researchers are now exploring its effectiveness in the treatment of benign prostatic hyperplasia (BPH) and androgen-related hair loss.

Early research indicates that brassinosteroids may be effective in the treatment of not only cancer but also Alzheimer's disease, Huntington's disease, steroid-induced osteoporosis, sexual differentiation disorders, hyperadrenocorticism associated with sex steroid excess, androgen insensitivity syndrome, glucocorticoid insensitive asthma, steroid induced cataracts, and deficiency of P450 oxidoreductase. They have shown some effectiveness in lowering serum cholesterol levels.

Pine pollen also contains very high concentrations of another family of plant steroids called gibberellins. These are plant hormones that are widely spread throughout the plant world; seventy-five have been identified so far. Numbered, rather unimaginatively, GA 1-75, they are especially abundant in the pollens, seeds, and young seedlings of plants. They stimulate the initial stages of germination, significantly enhancing seedling growth. Normal food plants, if sprayed with GA3, for example, exhibit hyper growth—they significantly increase their size.

Gibberellins, also potent anti-inflammatories, decrease arachidonic acid release; decrease formation of leukotrienes, thromboxanes, prostaglandins, and prostacyclin (all involved in inflammation); and increase the stability of lysosomes. They increase the activity of cyclic AMP and GMP, which

inhibits lymphocyte stimulation and the release of histamine and lysosomal enzymes.

They possess antitumor activity, have been found to be immunoactivating, and are effective in the treatment of BPH, psoriasis, and herpes simplex 1 and 2. In vivo trials found gibberellins (especially GA3 and GA7) to be highly effective in the topical treatment of burns, wounds, thromphlebitis, bronchitis, open fractures, peptic ulcer, aphthous ulcer, and decubitus.

Their impacts on the prostate are complex. They tend to act as prostate regulators rather than just reducing inflammation. If the prostate is enlarged they tend to reduce its size; if too small (as in castration of male rats) they increase its size or prevent atrophy. Dosing with 1 mg of GA4 resulted, in one human trial, of significant reduction of an enlarged prostate within an hour of administration.

But gibberellins are also stimulating interest because they are structurally very similar to testosterone; so close, in fact, that they bind to testosterone receptors in the human body. The physiological effects of testosterone are therefore mimicked by gibberellins; gibberellins are in essence testosterone mimics and thus androgen-like compounds. Like human androgens, they stimulate growth in both plants and animals. They possess both anabolic- and libido-enhancing activity, act as an adrenal and pituitary tonic, and are considered to be both androgenic and gonadotrophic. Because of their adrenal and pituitary actions, they stimulate androgen production in the body; energy levels increase. Gibberellins help prevent the atrophy that accompanies castration (in rats), which is one of the signs of strong androgenic action. They are present in most pollens at about 1 microgram per gram.

The gibberellins and brassinosteroids in pine pollen play integral parts in the health of the ecosystems of which pine trees and forests are a part. Pine pollen is produced in much larger quantities than needed for pollination. The excess pine pollen falls to the ground and is absorbed by the plants that grow in those ecosystems, much to their benefit. It is, in fact, essential to the health of those ecosystems, and the plants, insects, and animals in them.

Pine pollen is also relatively high in arabinogalactan. It comprises about 1 percent of each pollen grain. Arabinogalactan is a polysaccharide abundant in the pine family. Most of the commercial forms are harvested

from larch *(Larix spp)* trees, which have particularly high levels of the compound. Arabinogalactan has been generating a lot of interest of late as both an immune-stimulating supplement and as an adjunct in the treatment of cancer.

Arabinogalactan is approved as a dietary supplement by the FDA. It is a good source of dietary fiber and increases butyrate (and other short-chain fatty acid production) in the gut. Butyrate is essential for colon health and helps protect the intestinal mucosa against disease, including cancer. It has been found to be a probiotic in that it stimulates the production of bifidobacteria and lactobacillus in the GI tract. Arabinogalactan also prevents excess ammonia buildup in the liver, something that can occur in diseases such as portal-systemic encephalopathy.

It is a useful adjunct in the treatment of cancer because of its immune stimulating actions. The polysaccharides of which the compound is composed stimulate the natural killer (NK) cell activity and cytotoxicity, increase gamma interferon production, stimulate general immune responses, and have been found to block metastasis of cancer cells to the liver. Arabinogalactan stimulates phagocytosis, competitive binding of bacterial fimbriae, and bacterial opsonization. It is especially effective against Gram-negative bacteria, including Klebsiella species. The supplement has been found helpful in chronic fatigue, hepatitis B and C, multiple sclerosis, and lyme disease. It will help to some extent in raising CD4 white blood cell counts which are often lowered in diseases such as AIDS.

Amino acid content is high in all pine pollens. For instance, chemical analysis of *Pinus montana* pollen has found that it contains the following: arginine (6.4 g/100 g), leucine (6.5 g/100 g), lysine (5.1 g/100 g), methionine (1.5 g/100 g), phenylalanine (2.1 g/100 g), tryptophane (0.8 g/100 g), tyrosine (2.1 g/200 g), plus trace amounts of alanine, amino-butyric acid, aspartic acid, cystine, glutamic acid, glycine, hydroxyproline, isoleucine, proline, serine, threonine, valine.

The *Pinus massonia* and *Pinus tabulaeformis* combination that is often used in Chinese pine pollen tablets contains similar amino acids (per 100 grams): asparagic acid (1098 mg), threonine (492 mg), serine (522 mg), amino glutaric acid (1579 g), aminoacetic acid (698 mg), alanine (564 mg), isoleucine (539 mg), leucine (846 gm), tyrosine (365 mg), phenylalanine (572 mg), lysine (802 mg), histidine (189 mg), cystine (112 mg), valine

(646 mg), merionin (166 mg), arginine (998 mg), proline (884 mg), and tryptophan (149 mg).

Phenylalanine is linked with neurotransmitters in the brain and affects mood and stimulates dopamine levels in the brain. Both phenylalanine and tyrosine are L-dopa precursors. L-dopa is metabolized into dopamine in both the heart and brain. Dopamine is a neurotransmitter without which neural communication in the brain would be impossible. L-dopa has also been found to increase sexual interest and activity and facilitate erections in men. It is specific for treating anorgasmia, a woman's inability to have an orgasm. Essentially, L-dopa is a prosexual chemical. Tyrosine is also the precursor for epinephrine (adrenaline) and norepinephrine. Arginine is a precursor of nitric oxide (an erection stimulant) and possesses wound-healing and immune-enhancing functions (which is why pine pollen is so effective for skin conditions). Arginine boosts growth hormone release, improves fertility, and is spermigenic (that is, increases sperm production) at 4 g/day.

Much of the excitement surrounding pine pollen is, however, due to the presence of human androgens in the pollen: testosterone, androstenedione, dehydroepiandrosterone, androsterone, and epitestosterone. These, and the many other androgen stimulants or mimics that are present in pine pollen, make it one of the most potent natural phytoandrogens known and a welcome addition to the herbal pharmacopoeia.

Analysis of numerous pine pollens, including those from *Pinus sylvestris, Pinus nigra, Pinus bungeana,* and *Pinus tabulaeformis* has shown the presence of androgenic constituents, including testosterone, in all the pollens.

Pinus nigra, or black pine, pollen contains the androgens: androstenedione (0.7-0.8 mcg per 10 g, .000009% by weight), testosterone (0.7 mcg per 10 g, approximately .000009% by weight), dehydroepiandrosterone (DHEA) (.0000015% by weight, about 0.1 mcg per 10 g), and androsterone (0.0000022% by weight, approx. 0.2 mcg per 10 g). The testosterone in *Pinus bungeana* pollen runs 11 ng per 0.1 gm dry weight (about 1.1 mcg per 10 g dry weight), while *Pinus tabulaeformis* runs 27 ng per 0.1 g dry weight (2.7 mcg per 10 g dry weight). Research on Scots–NOT Scotch–pine *(Pinus sylvestris*) pollen has found testosterone, epitestosterone, and androstenedione in the same kinds of micromolecular

amounts. Testosterone is present at 0.8 mcg per 10 g dry weight, epitestosterone at 1.1 mcg per 10 g, and androstenedione at 5.9 mcg per 10 g dry weight. A microgram (mcg) is a millionth of a gram, a nanogram (ng) is a billionth of a gram.

While those these amounts might seem extremely small it takes as little as four nanograms (one thousandth of a microgram, one billionth of a gram) to change an infant's sex to male while it is developing in the womb. That figure can be mathematically represented by 0.004 mcg. In comparison to that figure *Pinus nigra* pollen contains 0.7 mcg per 10 grams of pollen. (And oral dosing in China runs from 5 to 10 grams per day, which, barring the problems of testosterone going through the GI tract, would give a comparatively high dose of testosterone every day.) Androgens are very potent chemicals. These amounts are enough, *when pine pollen is taken by mouth* ***as a tincture,*** to raise testosterone levels within a few minutes of ingestion.

Testosterone levels in the blood tend to peak in mid-morning, in mid-afternoon, and between 3:00 and 5:00 a.m. During aging the height of those peaks lowers, sometimes considerably, especially in those who are testosterone compromised. Taking pine pollen tincture upon rising, again at noon, and again before bed will help simulate the body's normal patterns of testosterone production. Androstenedione, commonly present in pine pollen, is one of two androgens in the body that are converted directly into testosterone, making it a metabolic *precursor* of testosterone. The body converts DHEA to androstenedione and then converts that (usually) into testosterone or (sometimes) into estrone, an estrogen. Androstenedione and testosterone convert back and forth between each other using a specific (zinc-dependant) enzyme *17-beta-hydroxysteroid dehydrogenase,* which is why zinc is essential to the diet for healthy androgen levels.

Androstenedione can also be made through an entirely different process in the body. Instead of using the pathway which begins with pregnenolone, 17a-hydroxypregnenolone, DHEA, andro, it is generated beginning with pregnenolone, then a conversion into progesterone, 17a-hydroxyprogesterone, and finally androstenedione to testosterone. For this second pathway the enzyme *17,20-lyase* is used. Anything that reduces the levels of the particular enzyme (or the zinc it needs) that converts androstenedione to testosterone or that makes androstenedione in the first

place results in lower levels of testosterone. Licorice, for instance, inhibits the 17,20-lyase enzyme and can reduce both serum testosterone and androstenedione levels.

Androstenedione, in comparison with testosterone, is a *weak* androgen. However, regular intake of androstenedione can and does increase testosterone levels in the blood.

While DHEA, again a common androgen in pine pollen, itself is only a mild androgen, it is the precursor for both androstenedione and androstenediol, two of the precursors of testosterone, making it essential for testosterone production. As well, research over the past twenty years has shown that it has significant effects on human health in almost every organ system in the body.

DHEA is the most abundant steroid in the human bloodstream; most of it (about 70 percent) is made from DHEA sulfate. The body essentially stores DHEA in a more stable form as DHEA sulphate (DHEAS) and converts it to DHEA (and then other androgens) whenever it is needed. During middle age, levels of testosterone and DHEA tend to decline. DHEA levels peak around a man's twenty-fifth year and then decline by about 2 percent per year. By age eighty blood levels are only at 10–15 percent of that peak. Normal levels of DHEA in the blood are 250–650 micrograms per deciliter (about one tenth of a quart) of blood; DHEAS levels tend to be 500–1000 times higher. (DHEAS and DHEA can be considered interchangeable when talking about the health effects of DHEA.) People with levels of DHEA below 100 mcg/dl consistently show higher levels of cancer, heart disease, diabetes, and arthritis.

Most DHEA is synthesized in the adrenal glands; about 10 percent is made in the testes, while the rest is made in the brain, the heart, and the liver. Because of its synthesis in the brain DHEA is also considered to be a neurosteroid, having potent impacts on the central nervous system and brain function.

DHEA in peripheral tissues is often converted to more active androgens, and these levels never appear in the bloodstream. Basically, peripheral tissues in the human body make more active androgens from DHEA whenever they need them. Peripheral tissues in the body normally contain all the enzymes necessary to convert DHEA to androstenedione and then to testosterone. This allows the more potent androgens to be used at the site

where they are most needed in the exact levels needed; and perhaps this explains how DHEA is able to affect so many different parts of the body. In essence, the androgens synthesized from DHEA exert their effects within the same cells where synthesis takes place, and these synthesized androgens are rarely released into general blood circulation (thus never showing up in blood tests). The parts of the body that are engaging in androgen synthesis are essentially using an extremely sophisticated biofeedback loop to determine exactly what levels of androgens are necessary and then making exactly what they need from the DHEA that normally circulates in the body. At least 30–50 percent of the total androgens in men are synthesized in peripheral tissues in just this way. The enzymes that are used for this androgen synthesis (or metabolic conversion) and the basic androgenic precursors, especially DHEA, are, thus, absolutely necessary for overall health.

Because DHEA can be converted to the estrogens estrone and estradiol, some people feel that DHEA is a potential problem when used in androgen replacement therapy. No research has found this to occur; estrogen levels in men consistently remain unaffected by DHEA intake. For example, one study of sixty-to seventy-year-old men who received intramuscular DHEA injections showed increased levels of DHEA and androstenedione in their blood. *No change was found in their levels of estrone and estradiol.* Even with extremely high oral dosing in young, healthy men (1600 mg per day), estrone, estradiol, and SHBG levels remain level.

DHEA supplementation will generally increase levels of DHEA in the blood as well as increasing serum androstenedione and testosterone. Overall, DHEA supplementation increases androgen levels in peripheral tissues, increases serum androstenedione, and improves functioning in most organ systems of the body. The majority of chronic diseases associated with male aging can be significantly helped with DHEA supplementation.

DHEA use has been shown to be associated with higher levels of energy and well-being, lower obesity/waist-to-hip ratio, enhanced libido and erectile ability, reduced depression, enhanced cognition, reduced death from coronary heart disease, and improved insulin sensitivity and glucose tolerance.

In short, pine pollen is a potent source of natural androgens, including testosterone and androgen mimics, it is a great nutritional source, especially

of amino acids, vitamins, and minerals, and it is an excellent general tonic for the human body, useful in preventing or alleviating a number of conditions common to aging.

History of Use: Traditional Chinese Medicine

Known as songhuanfen (or song huan fen) pollen from the masson pine *(Pinus massoniana)* and the Chinese pine *(Pinus tabulaeformis)*, often combined, has been used in traditional Chinese medicine for millennia as a health restorative, longevity tonic, and antiaging nutrient (all attributable, in part, to the presence of androgens, androgen mimics, and phytosteriods as well as the amino acids, vitamins, and minerals in the pollen).

Traditional Chinese physicians prescribe it for moistening the lungs, relieving rheumatic pain, relieving fatigue, increasing endurance, strengthening the immune system, improving the skin, strengthening the heart, strengthening the GI tract and stomach, increasing mental and physical agility, prostate problems, and decreasing weight—basically, everything that newer scientific studies are showing it does.

Pine pollen is also used externally as a poultice to arrest discharges, to stop bleeding, and for skin problems such as eczema, impetigo, acne, and diaper rash. Pine pollen is often made into a cream for application to the skin, generally to arrest aging and reduce age spots. However, it is exceptionally good for numerous skin problems, including impetigo, discoid lupus, and shingles.

History of Medicinal Use: Ayurvedic

Pine pollen is unknown in Ayurvedic practice as far as I can determine.

History of Use: Western Botanic Practice

Pine pollen has not been a part of traditional Western botanic medicine; I can find no references to its use—not even among the Greeks or Romans. Even a look at the historical records of the medicinal plant use of the indigenous cultures of North America shows little trace of its use, which I find hard to understand, since they tended to be acute observers and utilizers of all natural food and medicinal sources they came into contact with; my guess is that it simply wasn't recorded. Still, some traces remain. Among the Hopi and Apache it was used ceremonially, and among the Iroquois it was a common food staple.

Pine pollen as a discrete medicinal has only recently entered Western botanic practice (and awareness) with the emergence of interest in the use of phytoandrogens.

Clinical Studies and Trials

Most of the scientific studies have been carried out in China and Korea, and few of the papers have been translated into English, though this is slowly beginning to change. Newer research is being translated into English, and some interesting pine pollen research is beginning to come out of eastern Europe as well.

In vivo studies with mice have found that Chinese pine pollen has a distinctive antifatigue effect, enhances survival times under stress, increases SOD (superoxide dismutase) activity in the liver, protects the liver from chemical stressors, including alcohol, reduces cholesterol levels, increases HDL levels while reducing LDL levels, and protects arterial blood vessels from damage. Other in vivo tests with pine pollen found that it reduces lipofuscin buildup in the heart, brain, and liver. Lipofuscin is granules of a brown pigment, the residue of lysomal digestion, which is considered to be an aging pigment. Buildup of lipofuscin occurs as animals age, and it interferes with healthy function of the organs in which it congregates. Liver spots, for example, are deposits of lipofuscin in the skin. It has actually been used in skin creams in China for a long time to help combat that problem.

Other in vivo trials in mice have found pine pollen to reduce sensitivity to pain and to be strongly antiinflammatory. It also has been found effective in the treatment of chronic arthritis in mice, reducing swelling, and in the production of inflammatory cytokines (TNF-alpha, IL-1beta, and IL 6). Studies showed it markedly reduced serum levels of LDL cholesterol and increased HDL components. Forty-nine days of use in mice reduced serum levels of rheumatoid factor, anti-type II collagen antibody, TNF-alpha, IL-1beta, IL 6, protein carbonyl, advanced glycation endproducts, malondialdehyde, and LDL cholesterol. In vivo studies have also found *Pinus nigra* pollen to possess antitumor activity. Ten micrograms injected subcutaneously into mice reduced human melanoma tumor size by 50 percent. In vitro studies have found it to be potently antioxidant and antiinflammatory. It reduced the expression of matrix metalloproteinase (MMPs), especially 1 and 3, inhibited JNK activation, and inhibited tumor necrosis factor alpha, as well as IL-1 and IL-6.

None of the human trials conducted in China have yet been published in English.

Anecdotal

Chinese physicians (TCM) in China, and those who use pine pollen on their direction, regularly report increased vitality, health, reduced impacts of aging, and increased sexual vitality and libido from the use of pine pollen. I have both used and recommended it as a tonic and phytoandrogen since 2002. Users regularly report that use of the tincture results in a near immediate increase in energy, that libido, erection, sexual vitality, and mental alertness all increase with its use over time. Along with regular exercise (this does *not* mean 3x a week, 30 minute workouts–it means hiking or bicycling or heavy lifting for several hours every day), its use does increase muscle mass and endurance in those past middle age.

Pine Pollen as a Nutritive Food

Pine pollen is a food staple of long duration in both China and Korea, often as a tea and also as an additive in many traditional recipes. Though growing harder to find in South Korea, it is still used regularly in the North. Traditionally, pine pollen has been sold in grocery stores in South Korea in boxes much like those that contain baking soda in the United States. Historically, it has been included regularly in food in those countries as an antiaging and invigorating additive.

In addition to its high amino acid content, pine pollen contains a great many vitamins and minerals. *Pinus montana* contains the following (per gram of pollen): riboflavin (5.6 mg), nicotinic acid (79.8 mg), pantothenic acid (7.8 mg), pyridoxine (3.1 mg), biotin (0.62 mg), inositol (9 mg), and folic acid (0.42 mg).

Chinese pine pollen analysis is similar. Study has found that it contains (per 100 grams): Vitamin B1 (6070 mcg), B2 (486 mcg), B6 (1300 mcg), E (3240 mcg), C (562 mcg), D3 (22.8 mcg), A (43.2 mcg), nicotinamide (24000 mcg), folic acid (930 mcg), and B-carotin (26.2 mcg).

Vitamin D in *Pinus sylvestris* and *P. nigra* runs about 2 mcg per 10 grams. D2 and D3 are present between 0.1 and 3 mcg per 10 grams of pollen. The pollen also contains the hydroxylated metabolites of D3. Vitamin D3 plays an essential role in regulation of intestinal calcium and phosphorus absorption, calcium mobilization from bone, and renal reabsorption of calcium and phosphorus. It also modulates osteoclast differentiation, suppression of parathyroid cell growth and parathyroid hormone gene expression, and affects growth and differentiation of keratinocytes in skin. This explains in part the traditional effectiveness in Chinese medicine of pine pollen for intestinal complaints and, again, skin problems.

Chinese pine pollen—like all pine pollens—contains numerous essential elements (in ppm): potassium (3118.8), sodium (516.8), calcium (481), magnesium (1427.5), phosphorus (3609.1), iron (129.9), manganese (280.7), copper (4.3), zinc, (9.8), and selenium (0.1). And as well, all pine pollens contain a number of so-called primary constituents. *Pinus ponderosa* contains 11.17 percent fatty substances, 0.23 percent ketose sugar, 1.14 percent glucose, 16.40 percent sucrose, and 1.29 percent starch.

In both Australia and Chile, researchers are exploring the development of pine pollen as a primary food crop. In Chile they have found that wild

forests can produce extremely large quantities of the pollen (much more than forests that have experienced "human management"). The male catkins are collected, placed in plastic bags, then kept at a constant temperature of 20–22 degrees celsius (68–72 degrees Fahrenheit). This is the temperature which best stimulates the ripening of the pollen and the opening of the catkins, releasing the pollen. Each collector can gather an average of about twenty liters of catkins (five gallons dry weight) per day. This yields about two liters of pollen after processing (i.e., about two pounds).

Chilean researcher Manuel Pederos has found that the pollen from radiate pines contains some fifty amino-acids, twenty-two of which are essential to life as well as all the vitamins necessary for health.

Very few people in the West seem to know it as a food plant. The Iroquois used the male catkins when full of pollen as a food staple during pollen season. The catkins were cooked individually or with meat. Steve Brill, a contemporary herbal specialist, mentions in his book on wild plant foods that the pollen is tasty and delicious and a fine substitute for cattail pollen as a food and in recipes.

Pine Pollen Cornbread with Pine Tips

1 cup white flour (whole wheat will be too heavy)
½ cup pine pollen
½ cup cornmeal
¼ cup roughly chopped pine tips (see below under pine syrup)
1 cup milk
1 egg
¼ cup melted butter or oil
¼ cup sugar or honey
3 tsp baking powder
1 tsp salt

1) Preheat over to 450 degrees (important)
2) Mix ingredients together well
3) Pour into greased baking pan and place in oven

4) Reduce heat to 350 degrees
5) Cook until done. The top will be light brown. A toothpick in the center will remain clean of batter when withdrawn—about 45 minutes.

Pine Pollen Pancakes

Use the exact same recipe as above except delete the cornmeal entirely. Mix well. The batter should not be too thick to pour. It should be thin enough to spread but thick enough to hold a decent shape. Cook until golden brown on both sides.

Pine Tip Syrup

I still have some pine tip syrup from fifteen years ago that is still good and still tasty; it lasts a long time.

The pine tips (you can also use fir or spruce) are collected in the spring. Each spring the pine tree sends out new growth at the end of its branches. The new growth will be much lighter in color than the old growth needles and much softer. The color is somewhat of a cross between a lime and lemon; in fact, these tips are very high in vitamin C and possess a wonderful citrus-like taste with a light piney taste combined. It is these new growth tips that are used—the older growth needles are too tough, too full of tannins; they should not be used (except for tea).

When picking the pine tips, just grab them and pull; it's much like picking blackberries, and they will come right off. They will often be emerging from a papery casing; discard that before using the tips.

When roughly chopped and cooked in food the tips possess a wonderful fruity flavor—a tart, almost berry flavor.

To make a syrup take:

1 quart tips

1 quart water

2¼ cups sugar

Put the tips in the water and soak over night, covered. Bring to a boil and simmer, covered, for 3 hours. Strain out the tips and return the liquid to the pot. Add the sugar and simmer on low for another 2–3 hours, uncovered. It will become thicker and turn a reddish-brown color. Pour into sterilized bottles and store. It is great on pancakes. It is also exceptionally good for coughs and bronchial problems—a tablespoon as needed.

Other Uses as Food

You can substitute it for tumeric in curry dishes and use it as a thickener in soups and stews.

Specific Indications for Medicinal Use

Pine pollen tincture is specifically indicated for men in middle age who are experiencing androgen insufficiency problems— low libido, low energy, erectile dysfunction, elevated estrogen levels, poor testosterone/estrogen ratio, and so on. It is also indicated for use in conditions presenting with general fatigue, chronic muscle weakness, or low immune function as a continuing symptom. In these latter situations it should be taken in lower doses than for androgen insufficiency and generally mixed with other herbs that can help the conditions (e.g. *Aralia nudicaulis* and American ginseng).

The powder is indicated as a nutrient supplement in chronic diseases of any sort—chronic fatigue, lyme disease, hepatitis B and C, AIDS, and so on. It should be consumed regularly as a long-term nutritive supplement in such instances.

The pollen powder won't affect androgen levels much by itself; the testosterone and other androgens in the powder don't make it through the GI tract in enough quantity. To increase testosterone levels ***only*** the tincture is reliable. See Note below.

Dosage

To Raise Androgen Levels
Tincture: Full dropper 3 times daily or as desired (i.e. 30 drops, 1.5 ml, or 3/8 tsp 3 times daily). Hold in the mouth for a minute or so, then swallow. This allows more contact with the mucous membranes, increasing the amount that is taken through them into the bloodstream. Once you swallow, little of the tincture will reach the stomach; most will be absorbed through the membranes of the throat and esophagus on the way down.

As tonic, nutritive, and adaptogen
Tablets: 3–6, 500 mg tablets 3 times daily—or the equivalent amount of powder. In other words, 4.5–9 grams daily.

> NOTE: Impacts/Importance of tincture: I have used pine pollen tincture since 2002 and found it extremely effective in practice. When taken as a tincture the pollen constituents enter the bloodstream almost immediately, and there is an immediate upsurge in energy and, over time, an increase in strength, vitality, libido, and optimism. Sexual stamina and erectile function both increase. These effects are commonly reported among users.
>
> Because the pollen, when taken as pill or powder, must travel through the GI tract and its digestive processes, it is much less effective for raising androgen levels than the tincture. The pollen powder is an excellent nutritive and tonic supplement, but for testosterone enhancement, the tincture is a better approach and the only reliable one.

Side Effects

Although uncommon, a small percentage of people are allergic to pine pollen. This runs from about 1.5–10 percent of the population depending on

the geographical location. Allergies are usually mild running from rhinoconjunctivitis to mild asthma in extremely susceptible people. There is one case of anaphylaxis to pine nuts in the literature, but nothing so severe for the pollen. If you have previous sensitivity to pollens, it makes sense to go slow with pine pollen, beginning with a tiny dose, until you are sure that you are not sensitive.

Extensive in vivo toxicological tests in China have shown that pine pollen is not toxic even at large doses. It has traditionally been used as a permanent adjunct to diet in both China and Korea. Government publications and the historical literature list no side effects.

Contraindications

Pine pollen tincture is contraindicated for those with androgenic excess conditions. There are no contraindications for the powder except for allergies to it.

> NOTE: Pine pollen *tincture* is ***for*** men in middle age or older or for those with the various kinds of disease conditions that pine pollen helps rectify. Pine pollen *powder,* on the other hand, can be used as a nutrient food or supplement by anyone with no restrictions other than for those with pine pollen allergy. It truly is good for all, female, male, child, adolescent, bodybuilder, or the aged.
>
> Except in unusual circumstances, due to medical conditions, pine pollen *tincture* does not need to be used by adolescent men. And it really shouldn't be used as a muscle enhancer by body builders—though it is becoming a part of that culture. Neither adolescent males nor bodybuilders normally need to use exogenous testosterone sources, though due to impatience or the influence of photographs in men's magazines, many want to.

Comments Regarding Testicular Atrophy

The intake of pharmaceutical testosterone is often accompanied by atrophy of the male sex organs—pine pollen tincture when used appropriately ***will not*** cause such atrophy, nor will it produce any of the many side effects that accompany pharmaceutical testosterone. However, a few muscle builders in their twenties and thirties have reported taking up to an ounce a day of the tincture as a natural steroid and have experienced some testicular atrophy. Again, pine pollen is NOT for muscle building but for men in middle age and for those with specific medical conditions that it is indicated for.

Herb/Drug Interactions

There are no listings in the literature nor any anecdotal reports of pine pollen powder or tincture/pharmaceutical interactions, positive or negative. I doubt, however, that it should be used by those who are using pharmaceutical testosterone or DHT. Kind of an overkill really.

EPILOGUE

I wonder sometimes
what the pollen
from a 5000-year-old
bristlecone pine would be like ...

REFERENCES

Angelella, GM and Riley, DG. (2010) Effects of pine pollen supplementation in an onion diet on Frankliniella fusca reproduction, *Environ Entomol* 39(2):505-12.

Anonymous (1987) Edible Pine Pollen, *Chilean Forestry News,* Jan-Feb issue

Anonymous, (2000) Larch Arabinogalactan, *Alternative Medicine Review,* October issue.

Armentia, A. et al. (1990) Allergy to pine pollen and pinon nuts: a review of three cases, Comment, *Ann Allergy* 64(5):480.

Bo-Lin Fan, et al. (2005) Toxicological Research of Pollen Pini, abstract, Chinese Electronic Perodicals Service (CEPS), catalog number 203581.

Bouveng, HO. (1965) Polysaccharides in pollen II, the xylogalacturonan from mountain pine (Pinus mugo Turra) pollen, *Acta Chem Scand* 19:953-63.

Bouveng, HO, Lundstroem, H. (1965) Polysaccharides in pollen 3, the acidic arabinogalactan in mountain pine pollen, *Acta Chem Scand* 19:1004-5.

Brill, Steve. *Identifying and Harvesting Edible and Medicinal Plants in Wild (and Not So Wild) Places,* NY: William Morrow, 1994.

Chen, J. Et al. (2009) Synthesis of gibberellin derivatives with antitumor activities, *Bioorg Med Chem Lett* 19(18):5496-9.

Choi, EM. (2007) Antinociceptive and anti-inflammatory activities of pine (Pinus densiflora) pollen extract, *Phytother Res* 21(5):471-5.

Chong-Yuan Zhi and Kai-Fa Wang. (2001) A study on nutrient components of pollen grains of Pinus tabulaeformis, Pinus bungeana and Picea wilsonii, abstract, Chinese electronic Periodicals Sevice (CEPS), catalog number 228270.

Davis, Robert and Nocholas Maro. (1989) Aloe vera and gibberellin activity in diabetes, *Journal of the American Podiatric Medical Association* 79(1):24-6.

Erin, N. Et al (2008) Gibberellic acid, a plant growth regulator, increases mast cell recruitment and alters Substance P levels, *Toxicology_*254(1-2):75-81.

Eun Ju Lee and Thomas Booth (2003) Macronutrient input from pollen in two regenerating pine stands in southeast Korea, *Ecological Research* 18(4):423-430.

Freeman, G. (1993) Pine pollen allergy in northern Arizona, *Ann Allergy* 60(6):491-4.

Garcia, JJ, et al. (1997) Pollinosis due to Australian pine (Casuarina): an aerobiologic and clinical study in southern Spain, *Allergy* 52(1):11-17.

Gawienowski, AM, et al. (1977) Androgenic properties of gibberellic acid in the chick comb assay, *Experientia* 33 (11): 1544–5.

Grasses of Eden, et al. Brassinosteroids for use in treating prostatic hyperplasia and androgenic alopecia, International patent application PCT/IL2009/001141, June, 2010.

Gumber, SC, MW Loewus, FA Loewus. (1984) Myo-inositol-1-phosphate synthase from pine pollen: sulfhydryl involvement at the active site, *Arch Biochem Biophys* 231(2):372-7.

Hageneder, Fred. *The Meaning of Trees,* San Francisco: Chronicle Books, 2005.

Hanssen, Maurice. *The Healing Power of Pollen,* Wellingborough, Northamptonshire (UK): Thorsons, 1979, Appendix: A Comparative

Analysis of Three pollens: Zea Mays, Alnus spp., and Pinus Montana, online at www.graminex.com.

Harborne, Jeffrey, Herbert Baxter, Gerard Moss. *Phytochemical Dictionary: A Handbook of Bioactive Compounds from Plants,* London: Taylor and Francis, 1999.

Harris, R. and D. German. (1985) The incidence of pine pollen reactivity in an allergic atopic population, *Ann Allergy* 55(5): 678-9.

Helmers, H. and Machlis, L. (1956) Exogenous substrate utilization and fermentation by the pollen of Pinus ponderosa, *Plant Physiology* 31(4):284-9.

Janeczko, Anna and Andrzej Skoczowski. (2005) Mammalian sex hormones in plants, *Folia Histochemica Et Cytobiologica* 43(2): 71-9.

Kalliel, J. and G. Settipane. (1988) Eastern pine sensitivity in New England, *N Engl Reg Allergy Proc* 9(3):233-5.

Kamienska, A. and R. Pharis. (1975) Endogenous gibberellins of pine pollen: II. Changes during germination of *Pinus attenuata, P. coulteri,* and *P. ponderosa* pollen, *Plant Physiology* 56(5):655-9.

Kamienska, A., R. Durley, and R. Pharis. (1976) Endogenous gibberellins of pine pollen: III. Conversion of 1,2-[H]GA(4) to gibberellins A(1) and A(34) in germinating pollen of *Pinus attenuata* Lemm., *Plant Physiology* 58(1):68-70.

Khan, Ikhlas and Ehab Abourashed, *Leungs Encyclopedia of Common Natural Ingredients,* NY:Wiley, 3rd edition, 2009.

Lanner, Ronald. *Made for Each Other: A Symbiosis of Birds and Pines,* NY: Oxford University Press, 1996.

Lee, KH, Choi, EM. (2009) Effect of pine pollen extract on experimental chronic arthritis, *Phytother Res* 23(5): 651-7.

Lee, RH, Kim AJ, Choi, EM. (2009) Antioxidant and antiinflammatory activity of pine pollen extract in vitro, *Phytother Res* 23(1):41-8.

Lipovova, P. et al. (2008) Antitumor and biological effects of black pine (pinus nigra) pollen nuclease, *Neoplasma* 55(2):158-64.

Ma, Y. (1994) Determination of amino acids in pollen of Pinus tabulaeformis by pico tag method, *Chinese Journal of Chromatography* 12(1):63.

Malicova, J, et al. (2008) Anticancer and antiproliferative activity of natural brassinosteriods, *Phytochemistry* 69(2):418-26.

Marcos, C. et al. (2001) Pinus pollen aerobiology and clinical sensitization in northwest Spain, *Ann Allergy Asthma Immunol* 87(1):39-42.

Matousek, J. Et al (2009) Antitumor effects and cytotoxicity of recombinant plant nucleases, *Oncol Res* 18(4):163-71.

McIlwain, DL and Clinton Ballou (1966) Characterization of the phosolipids in *Pinus ponderosa* pollen, *Biochemistry* 5(12):4054-61.

Michelini, Flavia, et al. (2004) In vitro and in vivo antiherpetic activity of three new synthetic brassinosteriod analogues, *Steroids* 69(11-12):713-720.

Moerman, Daniel. *Native American Ethnobotany,* Portland, OR: Timber Press, 1998.

Oden, Per. Use of gibberellin for the treatment of prostatis, U. S. Patent 5,580,857, December, 1996.

Oleksyn, J. et al. (1999) Nutritional status of pollen and needles of diverse *Pinus sylvestris* populations grown at sites with contrasting pollution, *Water, Air, and Soil Pollution* 110(1-2):195-212.

Parkinson, Richard. Treatment of Herpes Simplex, U.S. Patent 4, 424, 232, January 3, 1984.

Qing-Yin Zeng, Hai Lu, xiao-Ru Wang. (2005) Molecular characterization of a glutathione transferase from *Pinus tabulaeformis* (Pinaceae), *Biochimie* 87:445-55.

Saden-Krehula, M. and M. Tajic. (1987) Vitamin D and its metabolites in the pollen of pine. Part 5: Steroid hormones in the pollen of pine

species, *Pharmazie* 42(7):471-2.

Saden-Krehula, M., M. Tajic, D. Kolbah. (1978) Sex Hormones and Corticosteroids in Pollen of *Pinus nigra, Phytochemistry* 17:345-6.

Saden-Krehula, M., M. Tajic, D. Kolbah (1971) Testosterone, epitestosterone and androstenedione in the pollen of scotch pine *P. Sylvestris L., Cellular and Molecular Life Sciences* 27(1):108-9.

Saden-Krehula, M., et al. (1983) Steroid Hormones in the Pollen of Pine Species IV.: 17-Ketosteroids in *Pinus nigra* Ar, *Naturwissenschaften* 70(10):520-522

Saden-Krehula, et al. (1971) Testosterone, Epitestosterone, and Androstenedione in the Pollen of Scotch Pine, *Pinus sylvestris* L., *Experientia* 27:108-9.

Sakuri, A. and S. Fujioka (1993) The current status of physiology and biochemistry of brassinosteriods, *Plant Growth Regulation* 13:147-59.

Senna, G, et al. (2000) Anaphylaxis to pine nuts and immunological cross-reactivity with pine pollen proteins, *J Investig Allergol Clin Immunol* 10(1):44-6.

Slavakova, Barbora, et al. (2008) Brassinosteriods: Synthesis and activity of some fluoro analogues, *J. Med. Chem* 51(13):3979-3984.

Sysa, AG, et al. (2010) Effect of the structure of the brassinosteriod side chain on monooxygenase activity of liver microsomes, *Applied Biochemistry and Microbiology* 46(1):23-27.

Tudge, Colin. *The Tree,* NY: Crown Publishers, 2005.

Ustav organicke chemie a biochemie akademie ved ceske repurliky V.V.I. et al. Natural brassinosteriods for use in treating hyperproliferation, treating proligerative diseases and reducing adverse affects of steriod dysfunction in mammals, pharmaceutical composition and its use, International Patent Application PCT/CZ2008/000097, February 2009.

Vesely, DL and MH Rochat (1980) gibberellic acid, a plant growth hormone, enhances mammalian guanylate cyclase activity, *Res Commun Chem Patho Pharmacol* 28(1):123-32.

Vesely, DL, et al. (1985) Plant growth hormones activate mammalian guanylate cyclase activity, *Endocrinology* 116(5):1887-92.

Wang, Ting et al. (2001) Provitamins and vitamin D2 and D3 in *Cladina* spp. over a latitudinal gradient: possible correlation with UV levels, *Journal of Photochemistry and Photobiology, B-Biology* 62:118-22.

Wang, Y., HJ Wang, ZY Zhang. (2005) Analysis of pine pollen by using FTIR, SEM, and energy-dispersive X-ray analysis, *Guang Pu Xue Yu Guang Pu Fen Xi* 25(11):1797-800.

Wu, Minne and David Wu, Gibberellins (including gibberellins A3 and A7) used in ulcer or wound healing, U.S. Patent 6,121,317, Sept 19, 2000.

Zhao, L.,W. Windisch, M. Kirchgessner. (1996) A study on the nutritive value of pollen from the Chinese masson pine *(Pinus massoniana)* and its effect on fecal characteristics in rats, *Z Ernahrungswiss* 35(4):341-7

INDEX

Stephen Harrod Buhner
Acclaimed author of:
Secret Teachings Of Plants:
The Intelligence of the Heart in the Direct Perception of Nature.

Although the Western world has been undergoing its greatest herbal renaissance in over a century, the medicinal actions of trees are often overlooked, perhaps none more so than pine. Given the drive for new plant medicines, the continual search for a new herb-of-the-day that will simulate excitement in the general populace (e.g. rhodiola, maca), it is astonishing that pine has been unrecognized for so long. This is particularly perplexing since the pollen of pine trees has been used for millennia in China and Korea as both food and a particularly powerful tonic and adaptogen, especially for the elderly. The fairly recent realization that it is a powerful phytoandrogen (that is, a plant that contains testosterone) has probably done the most to stimulate contemporary interest in the herb. The pollen's androgenic actions are due to a number of substances, not just the testosterone and other male steroids it possesses. In short, pine pollen is a potent, complex, source of natural androgens, including testosterone, and androgen mimics, is a great nutritional source, especially of amino acids, vitamins and minerals and is an excellent general tonic for the human body, useful in preventing or alleviating a number of conditions common to aging.

Stephen Harrod Buhner is an Earth poet and the award-winning author of fifteen books on nature, indigenous cultures, the environment, and herbal medicine. His work has appeared and been profiled in publications throughout North America and Europe including Common Boundary, Apotheosis, Shaman's Drum, The New York Times, CNN, and Good Morning America.