The *Dendrological Atlas:* A Legacy in the Making

An interview with Hungarian botanist Zsolt Debreczy on his life's work — a proposed fourteen-volume manual of trees and shrubs.

If one were to take literally the adage "one picture is worth a thousand words," then the *Dendrological Atlas* project, with its proposed 3,300 full-plate drawings and 20,000 photographs, is going to be worth millions. This monumental project is the dream of Hungarian botanist Zsolt Debreczy of the Museum of Natural History in Budapest, who has been working on it since 1971. Upon completion, the *Atlas* is projected to cover 6,500 species and 7,200 cultivars of cold-hardy, woody plants in fourteen volumes, with a grand total of 12,000 pages.

Working in collaboration with Debreczy is his wife, Gyöngyvér Biró, a microbiologist by training, who does the literature searches and helps with the writing and field work. Botanist-photographer István Rácz has been working with Debreczy since 1976, producing the photographic documentation for the project. In addition, several illustrators, including the late Vera Csapody, have worked with the team to produce pen and ink illustrations based on Debreczy's pencil sketches.

The *Dendrological Atlas* team has traveled extensively throughout the temperate zones including Asia, Europe, North America, and North Africa. They first came to the Arnold Arboretum for a brief visit in 1983, and in 1988, as recipients of a Mercer Fellowship from Harvard University, they were able to return.

The goal of the *Atlas* project is to create a comprehensive, beautifully illustrated work that includes all the trees and shrubs of the temperate climate zones of the world. The work builds upon the foundation laid by such authors as Alfred Rehder, W. J. Bean, and Gerd Krüssmann but adds totally original illustrations, visually oriented keys, and in-depth taxonomic descriptions.

According to plans, the *Atlas* will consist of two parts: Gymnosperms (Volumes 1 to 3) and Angiosperms (Volumes 4 to 12). The format of the work can be seen on the following pages. Debreczy, Rácz, and Biró hope to finish the project by the year 2000, almost thirty years after the the first drawings were made.

The following interview with Zsolt Debreczy addresses some of the questions frequently asked the *Dendrological Atlas* team regarding this ongoing project.

When did you start working on this project?

I started it in 1971 with Dr. Vera Csapody, the renowned Hungarian plant illustrator, who had published or illustrated almost 60 books before I started to work with her. Her first undertaking, with the great research botanist Sándor Jávorka, was on the Hungarian flora—with over 4,200 drawings of the plants native to the Carpatho-Pannonian region (historical Hungary), published in 1934. After I wrote a successful book on the winter-hardy evergreens with Vera Csapody's illustrations, we started the *Dendrological Atlas* project in 1971.

Was the project originally planned to be as large-scale as it now is?

Not at all! At first we planned simply to illustrate Rehder's *Manual*, the most widely used reference book for identification of temperate trees and shrubs. We started with small, two-

dimensional illustrations based mainly on herbarium specimens. Following my sketches, Vera Csapody immediately worked them out in black ink. As time went on, we used more and more living specimens for making the drawings and of course they looked different from those made from pressed specimens. It soon became clear that a consistent style, a "single voice," was needed to bridge this problem. Vera Csapody was in her eighties when we switched our format to produce full-page, three-dimensional illustrations. This happened in 1975, and it marks the beginning of the project in its present format. We also had to solve the problem of consistency in the photographs, which we resolved in 1976 when István Rácz joined the team. Later my wife Gyöngyvér Biró and some younger illustrators joined the group, and the *Atlas* became a major project of the Museum of Natural History in Budapest.

The collecting trips started in 1977. I organized them to cover most countries in Europe, North America, North Africa, the Caucasus, and Asia Minor. We worked in the best living collections of Europe, including many English parks and arboreta, and we studied in the best herbaria as well. We soon realized that if every major woody plant species in the temperate zones was to be illustrated with two pages, this would require at least five thousand pages of illustrations. That is when the *Atlas* became a whole series of books. To date, almost three thousand line drawings have been done, and our photo archive now contains more than sixty thousand pictures from which the photo plates will be assembled.

The scope of the project seems to invite collaboration. Are you working with scientists in other parts of the world?

We have already received tremendous help from many institutions, colleagues, private persons, and even family members. Without their help and generosity, our present status could never have been reached. In fact, this project is being supported by all those people who maintain the herbaria and living collections we use for study and for documenting specimens.

At first we worked with various Hungarian and Central European institutions and arboreta, and later with the excellent German, Dutch, Belgian, and English collections, such as Bedgebury Pinetum and Kew Gardens. And now we are particularly pleased to be able to work at the Arnold Arboretum, built by such greats as Sargent, Wilson, and Rehder. Today we are cooperating with numerous research fellows and scientists on a consulting basis, and we incorporate their comments and suggestions into our work.

Your project is as much art as it is science. How do you see these two often conflicting elements fitting together in your work?

Many of the illustrations may have artistic merit. The illustrator and photographer are limited by the accuracy requirements of science. The illustrations and photographs have to reflect the beauty of nature, but they do not have the same kind of freedom that art does. In the *Atlas,* the text and the pictures share the same pages; they transmit different information in complementary ways. We intend our work to be precise and correct in terms of science, but much of this information may be out-of-date after a few years, or decades. We believe the illustrations will retain their value long after some of the taxonomy has been revised.

In the same way, you try to fuse taxonomic botany and practical horticulture. Is this not also difficult?

We are botanists but feel we are part of both camps. While we "grew up" doing extensive herbarium and field work, we have spent far more time in living collections than most botanists. Horticulture can produce a tremendous amount of information regarding plant morphology and morphological diversity, but it is not always appreciated by botanists who find the data provided confusing or unreliable. The botanists, on the other hand, have the

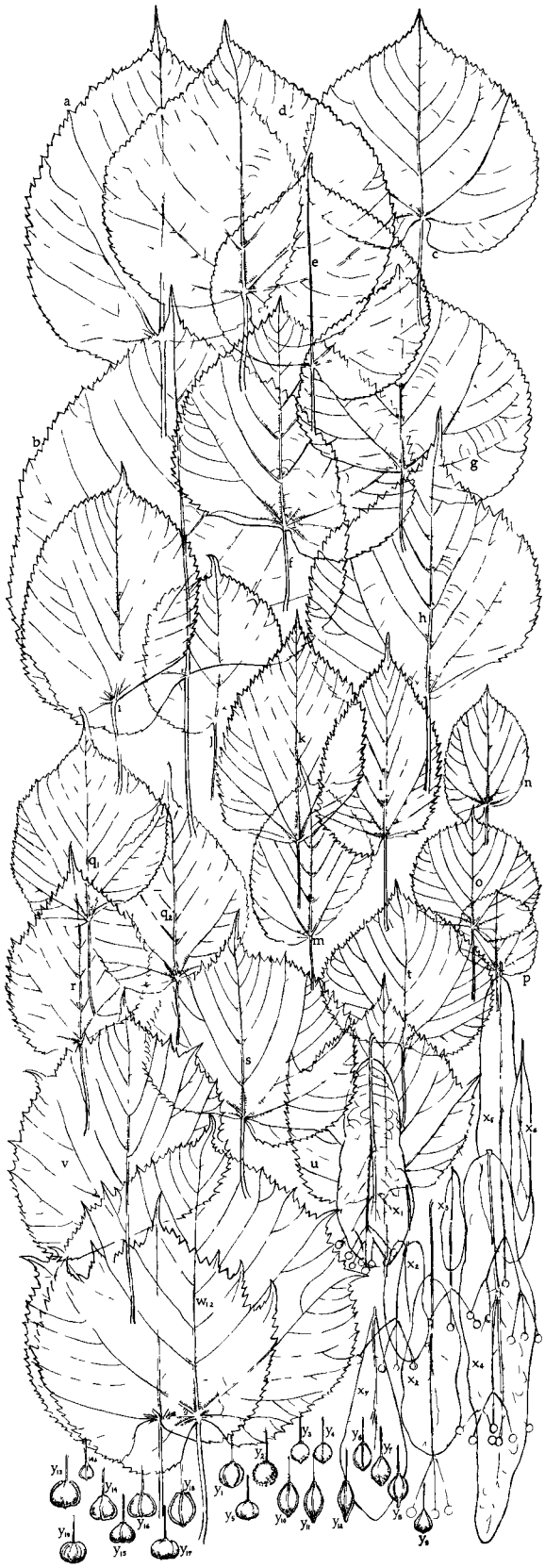
The Dendrological Atlas *team, from left: István Rácz, Gyöngyvér Biró, and Zsolt Debreczy. The film for this photograph, along with many of those taken for the* Dendrological Atlas *project, was generously donated by ORWO Filmfabrik in Wolfen, Germany. Photo by P. Del Tredici.*

necessary tools and experience to interpret the data and keep track of the proper classification.

A project of this magnitude seems overwhelming because it assumes that you know about all species of trees and that you will live long enough to complete it. Do you ever have doubts about your ability to finish this work?

I was thirty years old when I started this project and I was often told: "You are too young to start working on a project like this!" Now it would be too late for me to start a project on this scale. For the past nineteen years I have been working extensively on vegetation mapping and preparation of the *Atlas*. During this period I have not published anything in the field of taxonomy and I am glad that I did not. Rather, I worked with numerous colleagues and traveled as much I could, devoting most of my time and energy to *seeing* and *understanding* the problems of the whole temperate world dendroflora. As a

continued on page 28



Big-leaf Linden (Large-leaved Lime)

Tilia platyphyllos SCOPOLI (1772)

T europaea LINNAEUS in part (1753), T officinarum CRANTZ in part (1762), T grandifolia EHRHART (1790)

Corresponding plates

Chinese	大叶椴
French	*Tilleul a grandes feuilles, Tilleul femelle*
German	*Sommerlinde, Grossblattrige Linde*
Hungarian	*Nagylevelű hárs*
Italian	*Tiglio nostrale, Tiglio d'estate, Tiglio a foglie grandi*
Polish	*Lipa wielkolistna*
Russian	*Липа Крупнолистная, Липа плосколистная* (*Lipa Krupnolistnaya Lipa ploskolistnaya*)
Spanish	*Tilo, Teja, Tillera (Arag.); Tejo blanco (Burgos), Tell, Tey (Catal.), Tila (Serrania de Cuenca); T. de Holanda (Arg.)*

NATIVE TO Europe, Asia Minor, West-Asia
VERTICAL RANGE 10 to 1 900 m
CLIMATIC ZONE VIII-VI-VII, X(VI-V-IV)
HARDINESS ZONE 4
ECONOMIC IMPORTANCE occasionally as timber, excellent bee-forage
HORTICULTURAL VALUE good specimen tree, the first flowering among the lindens

MORPHOLOGY **TREE** to 40 m, **CROWN** oval, **TRUNK** straight, often multi-stemmed, without swollen burrs; **BARK** smooth, gray when young with rows of lenticels, dark gray and deeply furrowed when old, main **BRANCHES** upright at first, later horizontally spreading, light gray to brownish-gray and smooth when young, dark gray with suberous lines of longitudinal rows by age, **BRANCHLETS** greenish to reddish-brown, sometimes red above, green below with dense or scattered, upright, straight, simple hairs, rarely glabrous; **BUDS** (4 mm) globose to subglobose with two-three outer scales, dark reddish-brown above and hairy with elate, straight, simple hairs; **LEAVES** (1 5-5 + [6-12] x [4-11] cm) typically orbicular-ovate, rarely oblongish or trilobate, abruptly acuminate at apex, cordate, obliquely cordate, sometimes truncate at base, sharply serrate; dull green and scattered pubescent above (rarely, except on the principal veins, glabrous), usually densely pubescent below with yellowish-white, straight, simple hairs, axillary tufts represented by dense, simple, straight, at first whitish, later grayish or yellowish-brown, non-tufted hairs, normally extended along the main ribs, **PETIOLE** (1 5-5 cm) normally pubescent, occasionally glabrous, **INFLORESCENCE** 3-7 flowered cyme with membranaceous, thinly veined, lanceolate **BRACT** (6-13 x 0.8-1.7 cm), usually obtuse at the end, more or less pubescent only along the venation above, glabrous below except for the midrib near the junction of the peduncle; **FLOWERS** 12-16 (20) mm in diameter, light yellow, of "open type": leaves of the perianth spread 180° or more, **SEPALS** (4-6 mm) imbricate, somewhat stellate tomentose at, and near the apex, long hairy at their margin and inside, **PETALS** (6-8 x 2-3 mm) oblanceolate, exceeding the sepals, light yellow; **STAMENS** (60, 8-10 mm) exserted longer than petals; **PISTIL** (up to 12 mm) exserted, ovary subglobose, cordate in outline; **FRUIT** (8-10 x 6-8 mm) very variable in size, form and other features, typically 5 ribbed (rarely almost smooth and globose), thick shelled, densely tomentose or pubescent, **SEED** (3-4 x 2-3 mm) dark shiny brown.

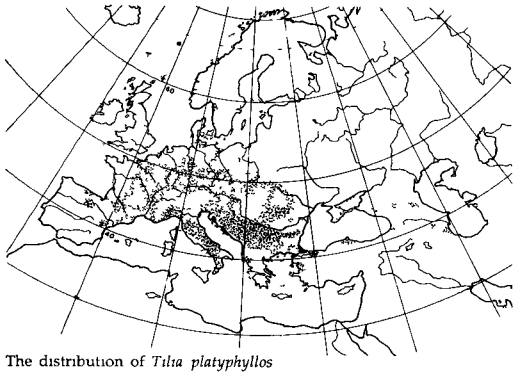
HABITAT: *Tilia platyphyllos* is a common European linden, distributed north to Scandinavia, south to Hispania, to the Appenin- and Balkan Peninsula, and extending east to Asia Minor and West Asia

Preferring a humid climate, this linden is a constant component of the beech, hornbeam, peduncle and sessile oak forests of Western and Central Europe (associating with *Fagus sylvatica, Carpinus betulus, Quercus robur, Q petraea* etc). This species is also one of the main components of the Central

◁ **Leaf- bract- and fruit variability within *Tilia platyphyllos***
(Scale 40 % here) This is the way that morphological variation, with the necessary data, will be presented in the *Atlas* The big-leaf linden is a particularly variable species, normally, the interpretation of variation will require less space
(A pencil drawing by Zs Debreczy)

Europaean ravine forests where it usually grows on rocky, north facing slopes with *Acer platanoides, A pseudoplatanus, Cornus mas, C. sanguinea, Corylus avellana, Fraxinus excelsior* and *Staphylea pinnata*

In areas of low humidity and relatively little rainfall (less than 550 mm per year), *T platyphyllos* tends to colonize narrow valleys and other level depressions that collect water In dryer woodland areas such as the Turkey oak-sessile oak forests of southern C Europe, it tends to form a small multi-stemmed tree or subcanopy shrub



The distribution of *Tilia platyphyllos*

VARIABILITY and RELATIONSHIPS: Although there is great variability within the species, *T platyphyllos* is easily recognized since it is the only linden with dense, simple hairs both on the branchlets and on the leaf surfaces It is also one of the six European *Tilia* species that have no staminodes in their flowers.

Other distinguishing characteristics that separate this species from other European lindens are 1) its prominent tertiary venation (except for *T. begonifolia*), 2) its axillary hairs (whitish at first, yellowish later) are simple and perpendicular to the corresponding veins, while *T cordata, T dasystyla* and *T europaea* have tufts with tangled or curly hairs and in *T begonifolia* and *T euchlora* the hairs are perpendicular but tufted, 3) the fruit shell in *T platyphyllos* is very hard and ribbed while that of the other European species is thin or medium-thick shelled and less or non-ribbed

Mainly on the basis of the exceptionally variable leaf, inflorescence, flower and fruit characteristics, over one hundred varieties and more than thirty reputed hybrids had been described during the first decades of the century (see appendix) from both wild and cultivation. Recent studies show that these variants and "hybrids" are simply forms of the species, some of which, after a careful selection, could have horticultural merit

CULTIVATION In Europe, *T platyphyllos* is often planted in large parks or along avenues It performs best in areas with a humid, maritime climate This tree has been known to live to be 900 - 1,000 years old There are many old specimens growing in Europe, of which a famous one in Oldenburg, Germany exceeds 14 m in girth and is thought to have been planted around 950 This linden is an excellent lawn tree but not appropriate for use as street tree for it is not very resistant to pollution and is often attacked by aphids and sooty mold

CULTIVARS:

'AUREA' *(T platyphyllos var Aurea [LOUDON] KIRCHNER, T grandifolia var aurantia HORT.)* [cultivated since 1838] Form with yellow branchlets and buds conspicuous in winter There are numerous clones under this name, one has normal habit but slow growth with relatively small leaves, which are truncate or slightly cordate at base with strikingly white tufts below, later becoming brownish

'BANGITA' [J WAGNER, 1931, Hungary, prop cv nov] Tree of normal growth, with very small (1 + [4-5 5]x1 3 cm) leaves most of which are somewhat roundish oblong-ovate, minutely serrate but deeply trilobed on the end of the shoot, reminding a tiny 'Vitifolia' leaf The inflorescence is a short (5 x 3 cm) cyme with small bract (1 + 3 + 2 cm) and relatively large (ø 1 2 cm) flowers It was found and has been cultivated at Eszterhaza (Fertod), W Hungary, in the property of Count Eszterhazy

'BROWNII' *(=T p ssp Braunii [SIMONKAI] C K SCHNEIDER ?)* Pyramidal tree with ascending branches and branchlets reaching 5 m in height and 3 m in width at about 15 yrs The leaves are similar but somewhat smaller than those of the species

'COMPACTA' [known since about 1930] Slow-growing, bushy tree with globose, compact habit, reddish-brown hairy branchlets and smaller leaves (3 + 7x5 cm) The oldest known specimen was 2 m tall when 30 years old and 4 m 10 years later

'FASTIGIATA' *(T platyphyllos f fastigiata REHDER, T grandifolia pyramidalis BEISSNER)* [known since 1854] Pyramidal form of cuneate-oval habit with ascending branches and branchlets and normal vigor, about 6 m broad at a height of 18 m

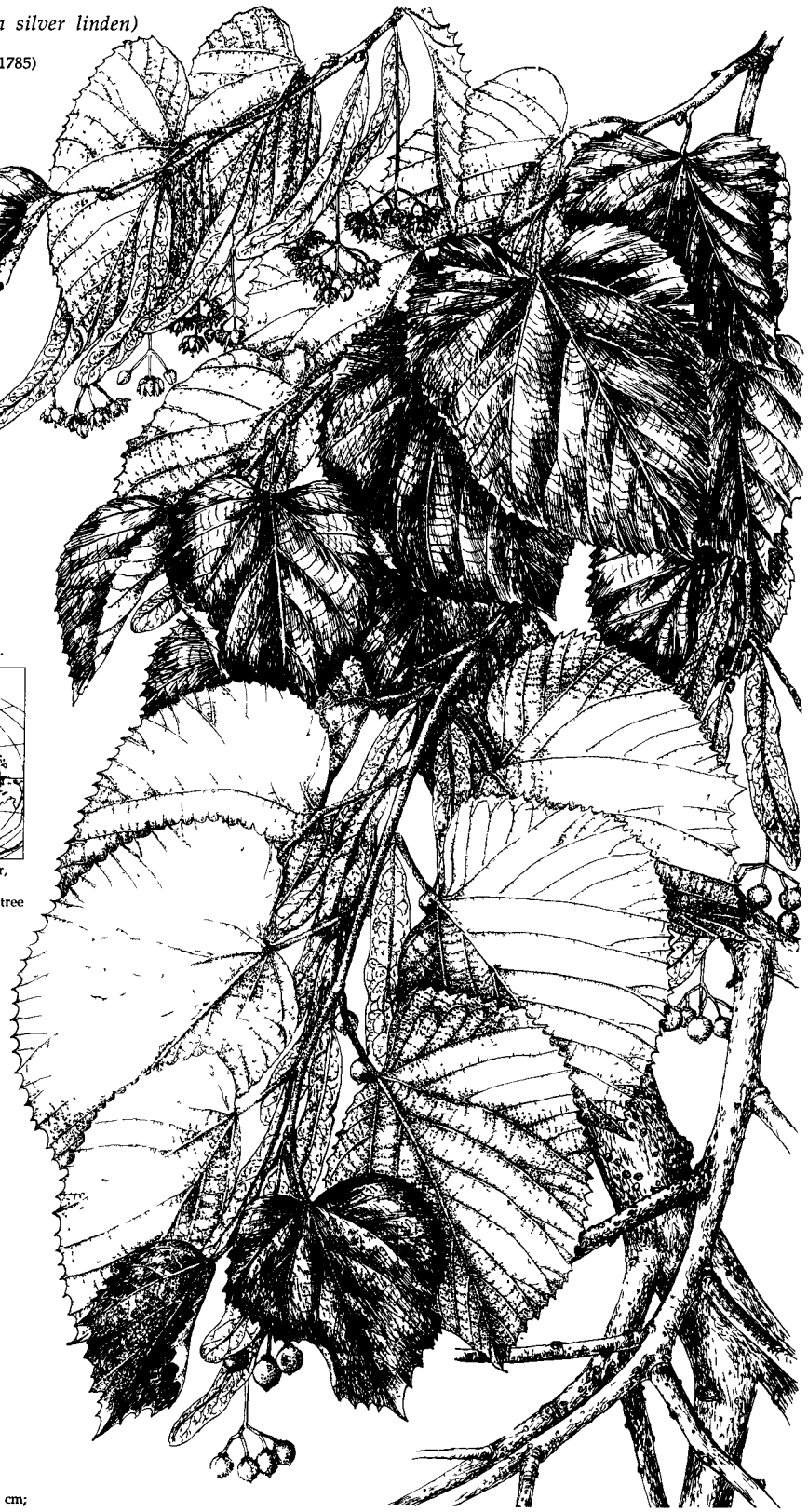
'FASTIGIATA LACINIATA'

(cont)

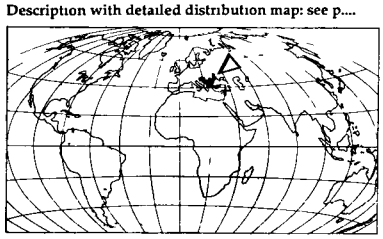
The occurrence of *Tilia platyphyllos* on a dry, west facing basaltic slope within the climate-zone of the xerothermic Balkan-type oakwood of Mt. *Koves-hegy* in Pannonia (Transdanubia), Hungary, Lake Balaton area. Altitude ca 250 m, annual rainfall 680 mm, average temperature of the growing season 18°C (The climate diagram given for Tapolca, within a 10 km distance of Mt Koves-hegy)

Hungarian silver linden (European silver linden)

Tilia tomentosa MOENCH (1785)



NATIVE TO SE Europe, Asia Minor, West-Asia
VERTICAL RANGE up to 1 500 m
CLIMATIC ZONES VI/V-V, VII/VI, X/IV,
HARDINESS ZONE 4
Description with detailed distribution map: see p....



ECONOMIC IMPORTANCE occasionally as timber, local uses as handcrafts, excellent bee-forage
HORTICULTURAL VALUE very good specimen tree (attractive winter habit with light gray bark, ornamental foliage, abundant **bloom)**
FL Mid- to late July

Photo plate
Specimen 90 yrs, height 22 m, stem diameters 20-50 cm;

Tilia tomentosa MOENCH

continued from page 23
result, I now have a deeper understanding of the diversity of this flora and a more solid basis on which to make taxonomic judgments than I would have had earlier in my career.

Undertaking a project like this does not necessarily mean that one knows everything about all kinds of trees. The value of this work, we believe, stands on its genuineness: while using others' work, the *Atlas* is intended to give our own summation of the temperate dendroflora.

Are you describing any new species or varieties in the *Atlas*, or are you working primarily with preexisiting taxonomies?

This work differs from those produced in the era of plant exploration during the early part of this century. Taxonomic revisions will be presented in the *Atlas*, but these will be new combinations rather than descriptions of new taxa. New treatments of selected groups will be published elsewhere.

How do you determine what species to include and what to exclude in the *Atlas*? Many on the proposed list of woody plants you include in your project are not very hardy. What makes them part of your geoflora?

We define the "hardy dendroflora" as the woody flora of the winter-cold areas of the world. The dominant part of this "geoflora" is growing in the Northern Hemisphere and is a remnant of the so-called Paleoarctic or Arcto-Tertiary flora. The species of this flora became established in their present locations during the cooler periods of the Tertiary period. In a sense, they were preadapted to survive the severe cold of the glaciations long before they occurred. Though this flora is an extratropical one, some of its members extend to subtropical-tropical high mountains as a result of recent migrations, and are therefore treated in our study. Our selection of plants is based on scientific considerations rather than on merely horticultural criteria regarding the hardiness of certain woody plants.

Whom do you envision as the audience for your work? In what ways do you think that it will be an improvement upon existing works?

In general, we believe that the book will be used by both professionals in botany, horticulture, and silviculture as well as by amateurs. Botanists will use the written keys and the illustrative discussion of the variability and relationships given for each species. Others may find more useful the visual keys, the morphological illustrations, or the accounts of the cultivars. We hope many people will be captivated by the beauty of the dendroflora. The work is intended to be an improvement in keys and in the discussion of the introduction of the woody plants. It will also be more consistent in its descriptions and more systematically illustrated than other works. Except for a few historical plates, all the illustrations are original.

What do you see as the major hurdles to finishing the project on schedule, time or money?

Time! If we had enough money . . . Of course more funds are needed for the *Atlas*, particularly for field trips, which is the only way to speed up the accumulation of data and photographs. It is also crucial to build a working relationship with some institution outside of Europe, perhaps in North America, to house our duplicate specimens, our working archives, and our reference materials. This would make it possible to have our scientific documentation preserved in more than one place and would allow other scientists easier access to our material.