Department of Botany & the U.S. National Herbarium

The Plant Press

Smithsonian
National Museum of Natural History

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Botany Profile

150 Years of Thistles, Daisies, and Sunflowers

By Vicki A. Funk

The US National Herbarium has an active research and collecting program in the flowering plant family Compositae (Asteraceae). Recent accomplishments include the Helianthe-ae treatment for *Flora of Ecuador*, a supertree for the entire family, a new international organization and website, and the near completion of the mono-graph on the Espeletiinae by José Cuatrecasas.

The Compositae (Asteraceae) contains the largest number of described species of any plant family, 24,000—with estimates of total species ranging up to 35,000—distributed in 1,600 – 2,000 genera occurring on all continents except Antarctica. Estimates vary, but assuming that there are 200,000 – 300,000 species of flowering plants, then one out of every 8 – 12 species of flowering plants is in the Compositae (about 10 percent). The family is monophyletic, characterized by florets arranged on a receptacle in centripetal heads and surrounded by bracts, by anthers fused in a ring with the pollen pushed or brushed out by the style, and by the presence of achenes (cypselas) often with a pappus (see figure on Page 9). Although the family is well-defined, there is a great deal of variation among the members: the habit varies from annual and perennial herbs to shrubs, vines, or trees, although few are true epiphytes; the heads can have one to more than 1,000 florets; chromosome numbers range from n = 2 to high level polyploidy with n = 114; and species grow in just about every type of habitat from forests to high elevation grasslands, however they are less common in tropical wet forests and more common in open areas.

The general perception of this family as "weedy" is only partially correct. Certainly there are members that benefit from disturbance but most species have a restricted distribution, and just about every "at risk" habitat in the world contains members of this family that are an important part of the flora. In fact, the *1997 IUCN Red List of Threatened Plants* (Walter and Gillett 1997) has 2,553 species of Compositae on its list.

It is an important family not only because it is pervasive in many ecosys-tems but also because members of the family dominate our gardens (about 260 species in the U.S.), provide a number of invasive species (i.e., *Chromolena, Cirsi-um, Taraxicum*), produce secondary plant products that are used in traditional and homeopathic medicines (ca. 500 in China alone) and in pesticides, and provide food (i.e., dandelions, sunflowers, artichokes, lettuce).

The US National Herbarium houses approximately 500,000 specimens of Compositae and 8,500 recorded types and although it has global represen-tation it is strongest in the Neotropical Compositae, perhaps the best in the world. There are no doubt many speci-mens in the general herbarium that should be in the type collection but have not yet been identified as such or they are duplicate material that was, until recently, kept in the main herbarium. This large collection was assembled over the history of the herbarium but mostly during the last 100 years. A series of synanther-ologists (see photos on Page 10) have enhanced the herbarium by their collecting efforts and their willingness to identify Compositae from throughout the world. I think it is safe to say that anyone wanting to work in Neotropical Compositae must visit or borrow the collections at US.

The first people who made major contributions to the Compositae collection were Asa Gray and Benjamin L. Robinson, both synantherologists from Harvard. Gray identified the plants housed in the U.S. National Herbarium that were collected during early U.S. expeditions, Plantae wrightianae texano-neo-mexicanae, the boundary survey, published in Smithsonian Contributions to Knowledge 3, Art. 5. 1852 and 5 (Art 6). 1853 and the United States Explor-ing Expedition under the command of Charles Wilkes, published 1854 and 1856. Likewise, Robinson identified many specimens from US including the material from Hitchcock, Killip and Smith, Pringle, A.C. Smith, and Rose.

Sidney Fay Blake, a student of Robinson, was one of the foremost Compositae workers of the 20th century. In between his master's and his Ph.D. he was perhaps one of our first "interns" because he spent the summer of 1913 arranging plants at the Smithsonian. Upon the completion of his Ph.D. Blake was offered jobs at both the Smithsoni-an and the Department of Agriculture. He took the USDA job because the pay

Continued on page 9

Visitors

Michael Nee, New York Botanical Garden; Solanaceae and Cucurbitaceae (10/4).

Marisol Toledo, Missouri Botanical Garden; Bolivian Meliaceae (10/4).

Janice Dern, Independent researcher; volunteer interview (10/5).

Patricia Gomez Bustamante, Independent researcher; volunteer interview (10/5).

H. David Clarke, University of North Carolina, Asheville; Identification of Guyana plant collections (10/6-10/9).

Chad Hasby, Florida International University; Equisetaceae (10/14).

Steve Glenn and **Gerry Moore**, Brooklyn Botanical Garden; Woody plants for New York Metropolitan Project <http://www.bbg.org> (10/19-10/21).

Richard Olmstead, University of Washington; Morphology of Lamiales (10/19-4/20).

L. Alan Prather, Michigan State University; Lamiaceae and Polemoniaceae. (10/26-10/29).

German Carnevali, Independent researcher; Flora de Guaramacal (Orchidaceae) (10/27-11/3).

Richard Clinebell, Missouri Botanical Garden; Onagraceae pollination evolution (11/2-11/6).

Ralph and **Pat Dixon**, Legacy Society of Smithsonian Institution; Present gift of 1924 scrapbook of wildflowers along C&O Towpath (11/2).

Peter Hoch, Missouri Botanical Garden; Onagraceae (11/2-11/6).

Rachel Levin, Amherst College; Onagraceae (11/2-11/6).

Robert Raguso, University of South Carolina at Columbia; Onagraceae pollinator systems (11/4-11/7).

Ken Sytsma, University of Wisconsin at Madison; Onagraceae (11/4-11/6).

Steve Junak, Santa Barbara Botanic Garden; Flora of Channel Islands, California (11/16-11/18).

David Rhode, Desert Research Institute, Neveda; Death Valley Expedition (Coville & Funston) (11/16-11/17).

Birgit Gemeinholzer, Botanischer Garten und Botanisches Museum Berlin-Dahlem, Germany; Phylogeny of Tribe Lactuceae (Compositae) (11/19-11/22).

Robert Bye, Universidad Nacional Autónoma de México, Instituto de Biologia; Flora of northern Mexico and Edward Palmer collections (11/22).

Alison Colwell, US Geological Survey, Western Fisheries Research Center; *Orobanche*, *Platanthera*, *Plagiobothrys* from Yosemite National Park (11/22).

Roger Troutman, Independent researcher; *Liatris* (Asteraceae) E.S. Steele collections (11/22-12/13).

Gorky Villa, Pontificia Universidad Católica del Ecuador; Trees of Yasuni Forest Dynamics Project, Ecuador (11/29-12/27).

Continued on page 8

The Plant Press

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Web site: http://www.nmnh.si.edu/botany

Travel

Mark Littler, **Diane Littler** and **Barrett Brooks** traveled to Panama (9/14 – 9/30) to continue their work on the "Marine Flora of the Caribbean and Pacific Panama" project.

Rusty Russell traveled to the University of California Reserve-Deep Canyon outside Palm Desert, California (9/23 – 9/27) to meet with colleagues from the Bureau of Land Management, University of California Riverside, University of Redlands and Riverside Municipal Museum on developing GIS tools that incorporate historical specimen data; and to Seattle, Washington (10/31 – 11/2) to present a special symposium, "The Botanical Legacy of the Lewis & Clark Expedition" at the annual meeting of the Crop Science Society of America.

Paula DePriest traveled to Raleigh, North Carolina (10/21 – 10/22) to participate in the Ph.D. defense of Rebecca Yahr at Duke University.

Alice Tangerini traveled to Pittsburgh, Pennsylvania (10/21 – 10/24) to attend a meeting of the American Society of Botanical Artists at the Hunt Institute for Botanical Documentation; and to Kauai, Hawaii (11/18 – 12/4) to work on the Flora of the Marquesas Islands.

W. John Kress and **Mike Bordelon** traveled to Yangon, Myanmar (11/3 – 11/20) to collect Zingiberales and other flowering plants.

Lawrence Skog traveled to Toronto, Canada (11/12 – 11/15) to present an invited lecture, "Looking Back at *Gesneria*," to the Toronto Gesneriad Society and to visit the Botany Department at the University of Toronto; and to Philadelphia, Pennsylvania (11/21 – 11/24) to study and record specimens of Gesneriaceae at the herbarium of the Academy of Natural Sciences.

Maria Faust traveled to Florida Keys, Florida (11/14 – 11/18) to collect harmful dinoflagellates.

Dan Nicolson traveled to Kuching, Sarawak in Malaysia (11/19 – 11/27) to attend the 9th International Aroid Symposium; and to the Royal Botanic Gardens, Kew in London, U.K. (11/27 – 12/4) to work on the *Taxonomic Literature, edition 2 (TL-2)*.

Plants Will Talk with *Plant Talk*

The Convention on Biological Diversity (CBD) initiated at the Earth Summit in Rio de Janeiro in 1992 focused the nations of the world on the environmental crisis affecting the entire planet. The treaty set the stage for an international effort to document, use, and conserve biodiversity, with many countries implementing rules and regulations directed at their national natural heritage. However, it was not until ten years after Rio in 2002 that a major step was taken to specifically protect the world's plant species. Following a series of discussions, meetings, and declarations by major botanical and biodiversity institutions, such as Botanic Gardens Conservation International, Royal Botanic Gardens at Kew and Edinburgh, Missouri Botanical Gardens, IUCN Species Survival Commission, Instituto Alexander von Humboldt, and the Smithsonian among many others, the Global Strategy for Plant Conservation (GSPC; see http://www.biodiv.org/decisions/) was officially adopted during the 6th Conference of the Parties in The Hague, Netherlands. This action was a monumental achievement for a number of important reasons.

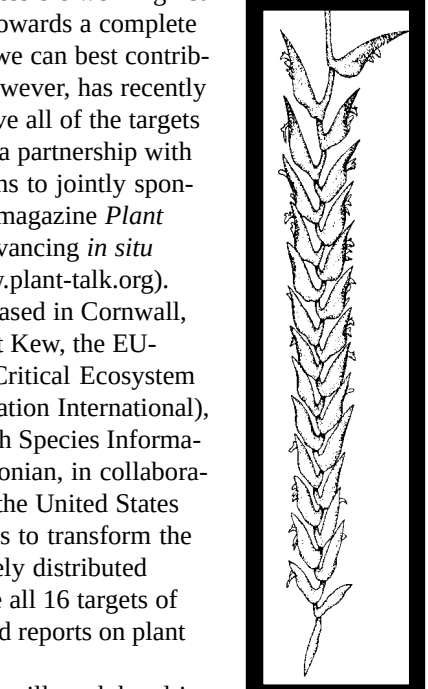
First of all, the Global Strategy for Plant Conservation put the Earth's plants at the forefront of conservation efforts. Previously "panda-envy" was common among plant conservationists who were unsuccessfully trying to interest the general public in setting the same priorities and providing the same level of protection for photosynthetic species as they were for various large and furry or feathered animals. The basic ecological function that plants provide as the cornerstone of both terrestrial and many marine ecosystems was being overlooked in favor of the charismatic and endangered large mammals and birds. The GSPC changed that perspective by providing the first global conservation strategy for a specific group of organisms recognized by the Convention on Biological Diversity.

Second, and most important, the Global Strategy for Plant Conservation is a pioneering plan adopted by the CBD that provides concrete targets and activities that are to be achieved within a given period of time. Although the CBD had previously set up a broad framework for using and conserving biodiversity, the GSPC is the first international plan that includes concrete targets for the sustainable use and protection of the world's plants by a specific date: the year 2010. The strategy and targets put forward by the group of plant conservation activists that crafted the GSPC was radical enough, but the most startling event was that the strategy was actually embraced and adopted by the CBD Conference of the Parties.

What is in the Global Strategy that makes it so significant? The plan is divided into five sections with specific targets listed under each section: 1) understanding and documenting plant diversity; 2) conserving plant diversity; 3) using plant diversity sustainably; 4) promoting education and awareness about plant diversity; and 5) building capacity for the conservation of plant diversity. Within these broad categories are 16 specific targets to be achieved in the next five years, such as, "Target 4: at least 10% of each of the world's ecological regions effectively conserved;" "Target 7: 60% of the world's threatened species conserved *in situ*;" "Target 9: 70% of the genetic diversity of crops and other major socio-economicaly valuable plant species conserved, and associated indigenous and local knowledge maintained;" and "Target 12: 30% of plant-based products derived form sources that are sustainably managed." These goals are not trivial and will take international efforts to achieve in the next five years.

As natural history museum scientists, we can take part in furthering each of these targets. Perhaps Target 1, to produce "a widely accessible working list of known plant species, as a step towards a complete world flora," is the goal to which we can best contribute. The Department of Botany, however, has recently taken a large step in helping achieve all of the targets of the Global Strategy by forming a partnership with four other plant-based organizations to jointly sponsor and promote the international magazine *Plant Talk*, a publication dedicated to advancing *in situ* plant conservation (see http://www.plant-talk.org). Together with The Eden Project (based in Cornwall, UK), the Royal Botanic Gardens at Kew, the EU-based Plantlife International, the Critical Ecosystem Partnership Fund (part of Conservation International), and the Artdatabanken (the Swedish Species Information Center), Botany at the Smithsonian, in collaboration with our partner on the Mall, the United States Botanic Garden, have joined forces to transform the ten-year old *Plant Talk* into a widely distributed magazine that will seek to advance all 16 targets of the GSPC through news, views, and reports on plant conservation around the world.

The new *Plant Talk* consortium will work hand-in-hand with our own Plant Conservation Unit as well as scientists in the Department of Botany at the Smithsonian to understand and conserve the immense plant diversity of our planet.



Chair With A View — W. John Kress

Staff Research & Activities

On 3 November, **W. John Kress** and **Mike Bordelon** traveled to Yangon, Myanmar to collect Zingiberales and other flowering plants. While in Myanmar, Kress presented a training workshop on pollination biology and plant taxonomy to a group of students at the University of Yangon. On 18 November, returning via Bangkok, Thailand, Kress and Bordelon attended the 3rd IUCN World Conservation Congress and assist with a Smithsonian Institution poster presentation by Leonard Hirsch, Senior Policy Advisor.

From 19 November to 4 December, **Dan Nicolson** traveled to Kuching, Sarawak in Malaysia and the Royal Botanic Gardens, Kew in London, U.K. In Kuching, Nicolson attended the 9th International Aroid Symposium, where he chaired two sessions and presented the final lecture, "Aroid Seekers in the Great Forests of Malesia." On the final day, Nicolson spoke to botany students at the University of Malaysia (Unimas), where he talked about the "Roots of a Botanist," as an encouragement for them to find their passion. Nicolson also had the opportunity to climb Matang Hill where he first collected *Schismatoglottis nicolsonii* over 40 years ago. On his return trip, he stopped for a week at the Royal Botanic Gardens, Kew, to work the *Taxonomic Literature edition 2 (TL-2)*, checking their reprint files.

On October 29, **Paul Peterson** gave an invited lecture at the United States Botanic Garden entitled "Grasses and Other Plants of the Sierra Tarahumara." The research of Peterson and other Botany staff is featured in the current USBG exhibit "Going Where They Grow: Exploring the Front Lines of Botany."

On 18 November **Alice Tangerini** traveled to the island of Kauai to work on the Flora of the Marquesas Islands as part of a grant secured by **Warren Wagner**. Illustrating in the setting of the beautiful National Tropical Botanical Garden was inspiring and productive. Under the direction of Wagner and collaborator, David Lorence, curator at NTBG, Tangerini was able to illustrate, in pencil, eleven species with nine of them being described as new. Although the majority of the plants were dried specimens, Wagner and Lorence provided excellent color images of living material to aid in the reconstruction. The staff was friendly and helpful; Tim Flynn looked for additional plant material and provided work space and any small tools that Tangerini needed for dissecting; the NTBG front office helped with any photocopying problems that arose and were patient as Tangerini spread out the numerous unmounted collections all over the floor of the photocopy room. Tangerini was introduced to two famous plant collectors: Ken Wood and Steve Perlman, who provided many of the specimens. The grounds of NTBG were extensive and even after a tour given by Lorence late one afternoon there was just not enough time to even see it all.

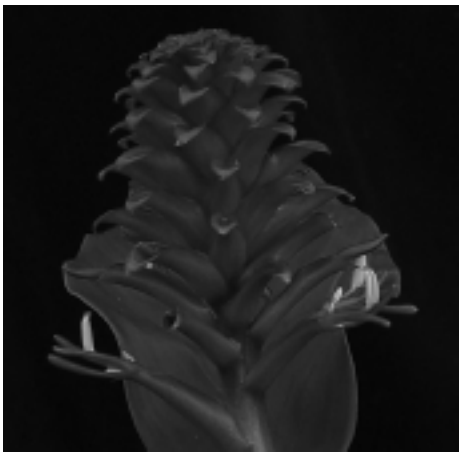
Alain Touwaide delivered a paper, "Medicine Across Cultures: 600-1600," at the 19th Barnard Medieval and Renaissance Conference at Barnard College, Columbia University, on 4 December. Touwaide delivered another paper, "The Greeks and the Irrational Revisited," at Johns Hopkins University in Baltimore, Maryland, on 7 December.

Warren Wagner gave a talk entitled "The Surprising Fate of Hawaiian Lineages" at the National Tropical Botanical Garden for the 'Science in the Garden' series in Kalaheo, Kauai on September 29, and a talk entitled "Understanding Extinction in Hawaii" for the Kauai Native Plant Society in Lihue, Kauai on November 20.

Awards & Grants

Botany curator **Robert Faden** and his wife, Smithsonian Behind the Scenes Volunteer Audrey Faden, were given an Award of Merit by the North American Rock Garden Society (NARGS) for service to the local Potomac Valley Chapter of NARGS, which is based in the Washington, DC area. Bob Faden was chairman of the chapter for four years and chaired the 2002 Eastern Winter Study Weekend, which the local chapter organized on behalf of NARGS. Audrey Faden has been involved in the chapter in many capacities, including organizing the plant propagation and sales during the 2002 meeting. She has volunteered in the Botany Research Greenhouse for more than 24 years where she helps maintain the Commelinaceae collections.

W. John Kress and colleagues Jiang Yun Gao and Qing-Jun Li, both at Xishaungbanna Tropical Botanical Garden in Yunnan, China, have received a two-year $25,000 grant from the Chinese Natural Science Foundation for their project "Research on the Effects of Floral Longevity on Male and Female Fitness and its Evolutionary Implications in *Hedychium* (Zingiberaceae)." Members of *Hedychium* display many different floral characteristics from other genera in the Zingiberaceae, such as conspicuous longer floral longevity, asymmetrical flower and unique structure of sexual flowering organs. These unique floral characteristics indicate that *Hedychium* plants have a rather unique pollination mechanism and breeding system. The project is designed to conduct research on floral biology, pollination ecology and mating system of four *Hedychium* species and varieties, which show different floral longevity and are all distributed in South Yunnan, China. The research also includes a series of manipulation experiments to compare the effects of floral longevity on male and female fitness.



***Hedychium bordelonianum* from Southeast Asia**

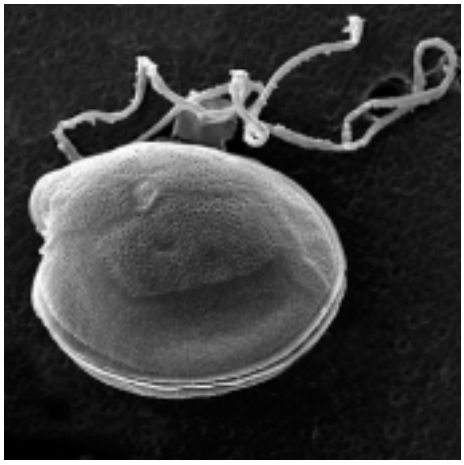
Study of Dinoflagellates Connected to Harmful Toxins

Marine dinoflagellates (also known as phytoplankton) are microscopic, single celled organisms that drift with the ocean currents and are responsible for the majority of the flux of organic matter to both higher tropic levels and the ocean interior. The community structure and ecological function of contemporary marine ecosystems are critically dependent upon these organisms. Their morphology and ecology are virtually unknown.

Many dinoflagellate species synthesize harmful toxins and are responsible for ciguatera fish poisoning which affects higher life forms in marine environments. Worldwide ciguatera poisoning causes more death and illness to humans than all other harmful algal toxins combined.

Smithsonian scientists have been conducting ongoing research within the coral reef – mangroves at Carrie Bow Cay in Belize to study the ecological morphology and taxonomy of dinoflagellates. Using medical molecular biology applications, scanning electron microscopy (SEM) and other cutting edge techniques, they hope to establish a foundation for understanding the biodiversity of tropical coastal waters.

During November, **Maria A. Faust** joined Karen A. Steidinger, FIO-Florida Marine Research Institute, St. Petersburg, Fl; Mark W. Vandersea and William Holland, Center for Coastal Fisheries and Habitat Research, NOAA, Beaufort, NC; and other members of the Harmful Algal Bloom Project to collect tropical dinoflagellates in the Florida Keys that produce ciguatoxins to better understand their ecology, biodiversity, and toxicology. Samples yielded rich flora of dinoflagellates representing great topological diversity in the phytoplankton, patch reefs, sea grass beds, sand, and various species of macroalgae. Using a combination of species taxonomy and genetic sequencing techniques, molecular assays are being developed to advance the study of the ecology, biodiversity, and distribution of these toxin producing organisms.



SEM image of *Gambierdiscus toxicus*, a ciguatoxin-producing dinoflagellate [100 um long x 80 um wide] (Adachi and Fukuyo 1979).

15-16 April 2005
NATIONAL MUSEUM OF NATURAL HISTORY
In collaboration with the United States Botanic Garden
Sponsored by the International Association for Plant Taxonomy

Smithsonian Botanical Symposium

"The Future of Floras: New Frameworks, New Technologies, New Uses"

For centuries botanists have created regional floras for the purposes of inventory, identification, description, and classification. But what will the floras of the future look like? Will there be a need for floras when a Web-based "Encyclopedia of Life" becomes a reality? What will field taxonomists be doing in 20 years? New technologies are now being developed to facilitate the coupling of field work with ready access of plant data that exist in biodiversity institutions. The development of electronic field guides and image identification systems, as well as DNA barcoding methods to identify species in the field, have great potential to augment if not completely replace the traditional paper-based flora.

Some scientists are concerned that new technologies that further the inventory and classification of life may also threaten the field of taxonomy. Will new technologies replace taxonomists who work directly with specimens? Will new techniques provide faulty identifications? Proponents of the new technologies believe that the easier it is for end-users to employ good taxonomic data for identification, the more taxonomists will be appreciated for their skills and knowledge. As the debate continues, floras built on Web-, image-, and DNA-based products are fulfilling new functions that paper-based floras have not been able to attain. All of these topics focusing on the floras of the future will be discussed and debated at the symposium.

Information and registration at: http://persoon.si.edu/sbs/
Fax: 202-786-2563 – e-mail: sbs@si.edu

"***Vernonia salviniæ***, Hemsl." (Tab. 41)
in ***Biologia Centrali-Americana, Botany***,
Vol. V (1879-1888)
by William B. Hemsley
[Image Courtesy Smithsonian Institution Libraries]

New Species of *Mortoniodendron* is Described

Laurence Dorr and his colleague, Tom Wendt from the University of Texas at Austin, describe the taxonomic history of the genus *Mortoniodendron* in the latest issue of *Lundellia* (7: 44-52. 2004). The genus was named in honor of Conrad V. Morton (1905-1972) who served for many years as a curator in Botany. Characters that define *M. pentagonum*, a species known from a limited area in Guatemala, are elaborated in the paper. A closely related, but distinct species from Veracruz, Mexico, *M. uxpanapense* Dorr & T. Wendt, is described for the first time and is accompanied by illustrations by **Alice Tangerini**. The new species is considered to be Critically Endangered (CR) under the IUCN Red List classification for endangered species.

Cover of *Lundellia* with photograph of *Mortoniodendron uxpanapense*.

Greenhouse Donates African Plants to USBG

The Botany Research Greenhouse donated two African woody plants grown from seed collected by **Robert Faden** to the United States Botanic Garden for educationl purposes. *Entandrophragma angolense* (Meliaceae), an African mahogany, was grown from a seed collected around the stump of an illegally cut tree on the slopes of Étinde (Little Mount Cameroon), Cameroon in 1986. Seeds of *Psychotria riparia* (Rubiaceae), a red-fruited shrub or small tree in one of the largest genera of the coffee family, were collected in the Taita Hills, Kenya in 1985 when Faden participated in the National Museums of Kenya Taita Hills Expedition.

Botany Receives Historic Watercolor

By Dan H. Nicolson

On 18 November, Frederick 'Ted' Bayer, Curator of Invertebrate Zoology for more than 40 years, made a gift to Botany—a small, original watercolor, annotated in pencil, "*Bauhinia*: Yellow Ebony Vine, Biak, near Sarido - 11 April [19]45." Bayer was then stationed on Biak, an island off the back of the "bird's head" of New Guinea.

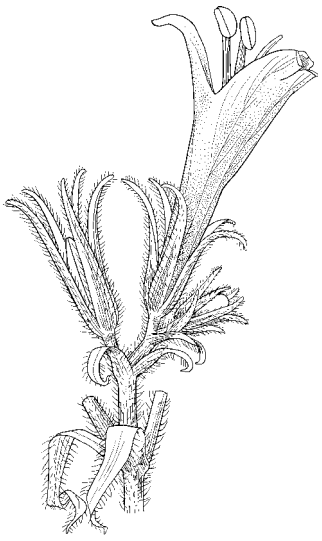
The gift included two letters. One was dated 3 June 1945 from W. M. Buswell (Coral Gables, Florida), which said, "I received the *Bauhinia* specimen but haven't been able to name it yet." The other letter, dated 27 July 1946, is to Bayer (then living in Florida) from E. D. Merrill (then at the Arnold Arboretum):

> "Dr. Walker of the Smithsonian Institution has sent me a very nice photographic print of your sketch of the New Guinea plant [that] I determined for Prof. Buswell as *Bauhinia lingua* DC. The latter was described from specimens collected on Amboina Island, and we have one collection of it from Amboina; yours was the first record from New Guinea, and the first record of the species from outside of the small island of Amboina which is not far from the west end of New Guinea.
>
> "This photograph will be placed with the specimen in our herbarium, for Prof. Buswell kindly gave us the latter."

Seeing all this, **Dan Nicolson** checked the herbarium and, sure enough, Egbert Walker (former curator of Old World botany) had mounted the photograph (Neg. 37411-C), annotated the black and white photo with color notes. Nicolson found that the Smithsonian also had only one specimen of the species, a collection made in Amboina in 1913 by C.B. Robinson, who was killed there, but that is another story.

Touwaide and Appetiti Join Botany

Alain Touwaide and **Emanuela Appetiti** have joined Botany as new temporary trust fund staff funded by a four-year grant from the National Institutes of Health. They have both been in Botany for a number of years as volunteer Research Associates working with **Dan Nicolson** and **W. John Kress** on ancient botany and medicinal plants. The grant will provide the resources to allow them to continue their work on a computerized database of medicinal plants used between the 5th century B.C. and the 2nd century A.D., a priority project recognized by the NIH. The relevant texts, many of which are in Touwaide's library, will be read in the original Greek and translated into English for entry into the database.

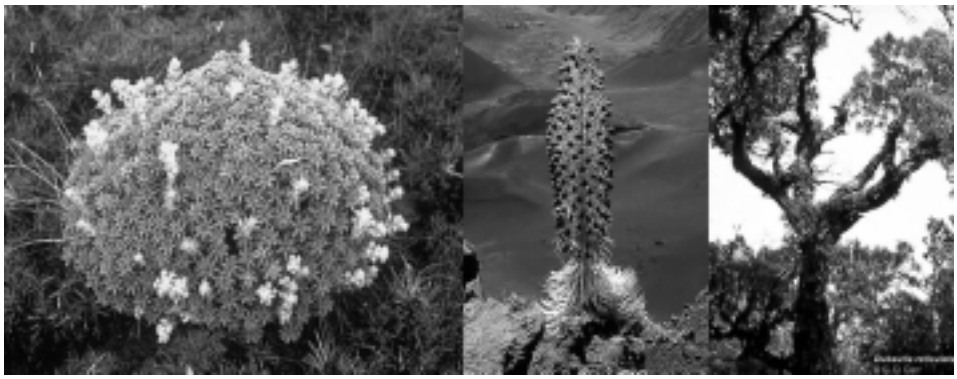


Speculations about Speciation

Why do some plants diversify through the process of speciation? **Jonathan Price** and **Warren Wagner** attempt to answer this question in a study published in the October issue of *Evolution*, "Speciation in Hawaiian angiosperm lineages: cause, consequence, and mode" (58: 2185-2200. 2004). The Hawaiian flora provides an ideal opportunity to pose questions about speciation thanks to its extreme isolation, self-contained geologic history and highly unique flora. All Hawaiian plant species are descended from a limited and identifiable set of original colonists. Some of these, such as the famous Silversword alliance, diversified into many distinct species, while others remained a single species. By comparing such features as how species are pollinated and dispersed, and what range of islands and habitats they occupy, Price and Wagner were able test weather certain ecological characters drive the diversification process.

Dispersal appeared to be the most important feature in speciation. Price and Wagner believe on the one hand the lineages with poor dispersal ability (those with large seeds, or those that depend on floatation) had few species because they tended not to colonize very many islands and thus could not readily establish isolated populations that begin the speciation process. On the other hand, lineages with highly dispersible fruits (especially those sought out and ingested by birds) also have on average few species because they colonize many different islands but disperse too much permitting gene flow between populations. Those that are dispersed by external adhesion to birds (with barbs or sticky surfaces, or with tiny seeds that become embedded on bird's feet) had more species than those with other modes of dispersal. This may be because they disperse enough to colonize all major islands, but not so much that populations continue to interbreed.

Despite all of this, in many cases and especially species-rich groups, the type of dispersal or pollination shifted, often through the evolution of unique, specialized features. For example, in eleven lineages there was a shift toward bird pollination, evidenced by red tubular flowers that differ from those of their presumed ancestor. More dramatically, in four lineages a capsular fruit has evolved into a fleshy fruit that is used as a food source for dispersing birds. These shifts underscore the reciprocal relationship between evolution and ecology and caution against drawing too many conclusions about cause and effect.



Various members of the Hawaiian silversword alliance.

Correction

In the 2004 special Symposium Issue of the *Plant Press* (Vol. 7 – No. 3), an inaccurate summary of a talk by Wybe Kuitert was included. To provide a better description of his paper, Kuitert's abstract is as follows:

Wybe Kuitert
Kyoto University of Art and Design

"Political Change and Cultural Values of Plants: Origins of Cherry Hybridization in Medieval Japan"

Humans played a dramatic role in the evolution of Japan's flowering cherries. In the 5th century, a wave of immigrants arrived from the continent. Accommodating the new population meant clearing forests, which gave new opportunities for light-loving plants, like flowering cherries, to flourish. In 834 AD, the plum tree (*Prunus mume*), traditionally planted with citrus trees in front of the imperial palace in the capital city (present Kyoto), was replaced by the Mountain Cherry (*P. serrulata* var. *spontanea* Lindley). This tree was brought from the mountainsides of Yoshino, close to Nara, an earlier capital city. Over the course of the 13th century, large numbers of cherries were brought from Yoshino, and planted at Arashiyama in the outskirts of Kyoto.

With changing political winds, warlords from eastern Japan occupied the capital in 1336 and installed their own emperor. Well-aware of the cultural values of the flowering cherry—seen as a sign of civilization—they planted their own cherry in the imperial palace in Kyoto in 1357, replacing the Mountain Cherry. This new imperial cherry was a form of the Oshima Cherry (*P. serrulate* var. *speciosa*), native to regions about 400 kilometers to the east of Kyoto, proving that cherries were transported over long distances. Hitherto, isolated plant material of the highly variable Oshima Cherry was brought to Kyoto from the east, while the Mountain Cherry had been brought to the city a century earlier from Yoshino in the south. Cherry populations that had developed separate identities over the course of their evolution were brought together and could start to hybridize, a process that would lead to a number of distinctly different garden forms in the succeeding centuries.

From the end of the 17th century, cherries have been recorded in the written history of Ninna-ji, still famous for its classic garden forms and the Hirano Shrine. The region of Ninna-ji and Hirano Shrine, in between Arashiyama, with its Japanese Mountain Cherries from Yoshino and the center of the city, must have been an increasingly interesting cherry-hybrid area beginning in the 14th century when Oshima Cherries were planted in the imperial palace. Their hybrids, the historic garden forms of Ninna-ji and Hirano Shrine are indeed spectacular garden plants that have stood the ages.

The Heart of the Herbarium

By Heijia L. Wheeler, Volunteer

In a brightly lit room, two volunteers quietly study the pressed plant specimens they are about to mount. They are two of the eleven volunteers who use their skills and artistic senses to help Katherine "Kat" Rankin take the dried specimens that arrive in their plebian newspaper wrappings and turn them into works of art. These beautifully mounted specimens make up the heart of the U.S. National Herbarium. Even as researchers are using current technologies such as DNA barcoding, electronic field guides, and digital imaging, they still rely on the physical plant sample for detailed study of glands, hairs, cellular structures, anatomy and chemical analysis. It would be futile to toss a digital image or a photographic slide into a test tube for a chemical analysis of floral fragrances, no matter how beautiful the image.

The environment in which these volunteers work is organized and quiet, away from their other worlds of responsibility. The volunteers are aware of the value of their contribution and they are a part of the family of Botany and the Smithsonian Institution. It is little wonder that so many of them have been volunteering for so long. Mary Starr, Mary Ellen Wiser, and Gwen Petitjean have been volunteering since the mid 1980s. They have a combined total of 60 years of volunteer service to this project. Margaret Schweitzer has been a volunteer for 15 years and the newer volunteers, Joan Lorr, Jo Ann McCann, Larry Owens, Pat Trisdorfer, Cate Puzo, Anne Datko, and Silvia Domenge are just as loyal and dedicated. They range from retirees as old as 87 years to working individuals as young as 45 years, all of them determined to make a contribution. The proof is in the years of loyal hard work they have given, and the thousands of specimens they have mounted. One gentleman was so adamant to remain a volunteer when he had to move away from the DC area last year that he continues to mount specimens from his home in Pennsylvania. Last year the volunteers mounted 20 percent of the annual total, working, on average, 185 hours per month. This has helped to fill the shortage of staff to handle the tremendous backlog and influx of specimens needing to be processed.

Volunteer Larry Owens mounting a specimen at the US National Herbarium. (Photo by Deborah Bell)

The Herbarium has over 4.7 million specimens of which 96,000 are type specimens of all plant groups. Every day new specimens arrive at the Herbarium from collectors all over the world. These are donated by scientists from Alabama to Australia. The researchers at the Smithsonian also bring back specimens related to their research projects from the world over. All of these specimens are carefully dried, recorded and sent to Rankin's group who turn them into permanent vouchers to be placed in their proper spot in the Herbarium.

The mounting process is very precise. They use the strapping and stitching method rather than simply gluing the plant to the mounting paper. The U.S. National Herbarium is one of the few herbaria that use this method for plant mounting. All the mounters get fundamental instructions and rules in their training. Once they are confident and understand the basics, their judgment is respected for many aspects of the mounting task. They are quite independent and know what needs to be done and how to do it. There is continued oversight, but there is a trust between volunteer mounter and supervisor that constantly develops and grows, and the resulting mounted specimens are esthetically pleasing. This is a synergistic relationship. The Herbarium's gain is obvious. Last year the volunteers mounted over 3,500 specimens. The volunteers in turn gained a sense of accomplishment and the pleasure of each others company.

Visitors

Continued from page 2

Curt Pueschel, State University of New York at Binghamton; Algal Collection (12/2).

Ihsan Al-Shehbaz, Missouri Botanical Garden; *Arabis* (Brassicaceae) Flora North America (12/6-12/8).

USDA Graduate School class, U.S. Department of Agriculture Graduate School, Woody Plant Identification Class; Herbarium tour (12/6; 12/20).

Qing-Jun Li, Xishguangbanna Tropical Botanical Garden, Chinese Academy of Sciences; *Alpinia* (Zingiberaceae) flowering (12/15-2/28).

Andrew Henderson, New York Botanical Garden; Arecaceae (12/27).

Profile

Continued from page 1

at the Smithsonian was "inadequate;" however, he spent a great deal of time working with material from US and doing field work. A search on IPNI finds his name associated with 4,159 plant names, about 3,000 of which are in the Compositae. He worked in the DC area from 1917-1959 and he added many specimens to the US collection. It is to Blake we owe the wonderful collection of photos of types from Europe that we all enjoy. He spent 42 years of his life producing 300 botanical papers, mostly on the sunflowers and mostly in his spare time and he died at his desk on 31 December 1959 (age 67). After his death, his personal herbarium and library were purchased by Lundell and ended up at the University of Texas Plant Resource Center in Austin.

Blake overlapped with José Cuatrecasas who worked in the US herbarium until a few days before his death at the age of 93. His career extended from his studies in Barcelona and Madrid (1924-1931), graduate work in Berlin (1930-31) where he knew Adolph Engler, Directorship of the Sección de Flora Tropical del Jardin Botánico de Madrid (1933- 39), the years in Colombia (1939-47), in Chicago (1947-1955) to his 41 years in Washington (1955-1996). Although Cuatrecasas (1903-1996) worked on many families his concentration was on the Compositae of the northern Andes. He did a large amount of field work, mostly in Colombia. He was an author or coauthor of two subtribes and over 20 genera in five tribes. A quick check of IPNI shows that 1,307 records from Cuatrecasas are in the Compositae. At the time of a 1985 festschrift, Cuatrecasas was listed with Robinson, Blake, Angel L. Cabrera, and Hermann Merxmüller, as individuals who had made truly constructive and insightful contributions to the study of the Compositae in the first three quarters of the 20th century: three of the top five synantherologists had worked at or with the collections from US. Cuatrecasas' specimens, research materials and photographs remain at the Smithsonian Institution; his library is in Barcelona.

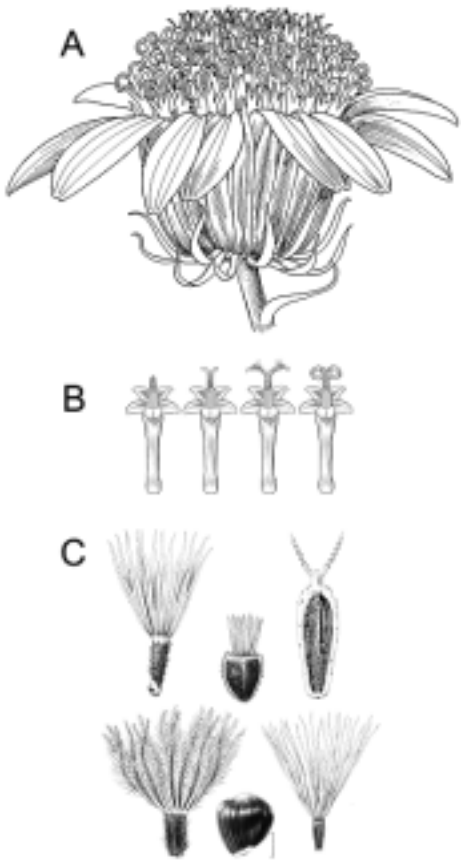
Kitty Parker (1910-1994), a student of Lyman Benson in Arizona, came to the Washington area in 1953 and was a professor at George Washington University. She worked in the Helenieae and did many identifications especially in the years immediately following the death of Blake. She was the advisor of two taxonomists that were eventually hired at US.

Robert M. King (1929-), a professor at Catonsville Community College, came to the Washington area in 1962. During his time in the DC area he made many field trips that resulted in numerous collections for US. He collaborated with Harold Robinson in the work on the Eupatorieae. King left the Washington area in 1997. One of King's major contributions to Compositae systematics was introducing Harold Robinson to the family.

Harold Robinson came to US in 1962 as a bryologist and moved over to working on the Compositae in 1964, applying bryological techniques to a group that had previously had inadequate anatomical study. Although he has rarely collected in the family, he has identified more than 30,000 specimens that he has received as a "gift for determination" and is the author or coauthor on over 600 papers dealing with the family. His most recent accomplishments include the Heliantheae for the *Flora of Ecuador.* He is currently finishing the monograph on the Espeletiinae by Cuatrecasas.

The 1873 treatment by George Bentham divided the family into 13 tribes (the most frequently used suprageneric rank) which remained more or less the same until the 1980s. Many of the tribes had a large genus that provided the central focus for the tribe: *Senecio* of the Senecioneae, *Eupatorium* of the Eupatorieae, *Aster* of the Astereae, and *Vernonia* of the Vernonieae. These genera remained largely unchanged having only a few satellite genera removed from them. Beginning with his work on the Eupatorieae, Robinson has tackled one large genera after another. While his Eupatorieae work was done with King, subsequent work has been done by himself or with others. His detailed work resulted in the break up of several of these large genera. Each time the work was resisted because others liked the convenience of a very few generic names that could be used for most specimens without concern for relationships or the identity of thousands of species concepts that were included. Time and subsequent molecular work, however, have largely supported Robinson's work. Robinson has done generic level revisions of the Eupatorieae (with King), Liabeae, Heliantheae, and Vernonieae. More recently he has helped implement the presentation of a similar work of Guy Nesom in the Astereae. He has revised tribal limits and described new tribes and subtribes. The Liabeae had traditionally been recognized as one unnatural core genus with three other genera, all in separate tribes, Senecioneae, Heliantheae, Helenieae and Mutisieae. The Eupatorieae and Vernonieae, traditionally placed together, were shown to be only distantly related. It can safely be said that the work of H. Robinson has changed the way we do Compositae systematics. One particular series of results was the dismissal of the Cronquist view that the Rubiaceae were the closest relatives of the Compositae and that the Heliantheae were the primitive core

Continued on page 10



A. Head showing ray and disc florets, B. Disc floret showing pollen presentation, C. Achene (cypsela) showing pappus. (Drawings by Alice Tangerini)

Compositae

Continued from page 9

group, a concept referred to by Robinson as the "Heliocentric Theory of the Compositae."

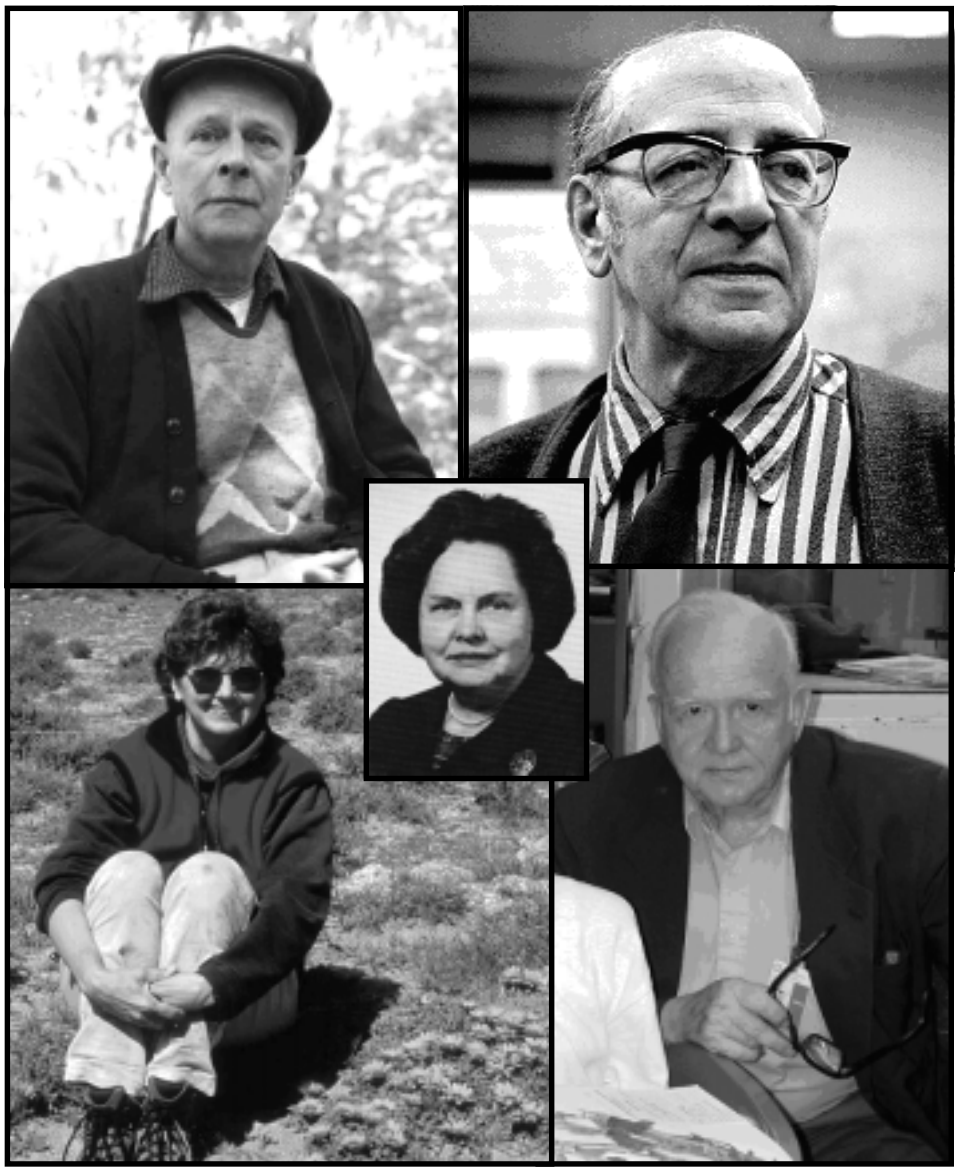
In 1980 the newest member of the Compositae crew joined the Smithsonian. Vicki A. Funk currently specializes in some of the tribes near the base or mid-level of the phylogeny of the family: Mutisieae, Liabeae, and Arctoteae. She has an interest in phylogenetics and biogeography and coordinates the supertree of the family. She does identifications in her areas of interest and has collected extensively in Mexico, the Andes, and South Africa.

Through the years a number of synantherologists have passed through the herbarium and the collections have benefited from their stay. Some have stayed long enough or visited often enough to annotate a number of specimens, including Walter Holmes, Rogers McVaugh, John Pruski, and Gisela Sancho. In addition, some curators at US, such as Conrad Morton and Warren L. Wagner, have shown an interest in the family even through it was not their area of specialization.

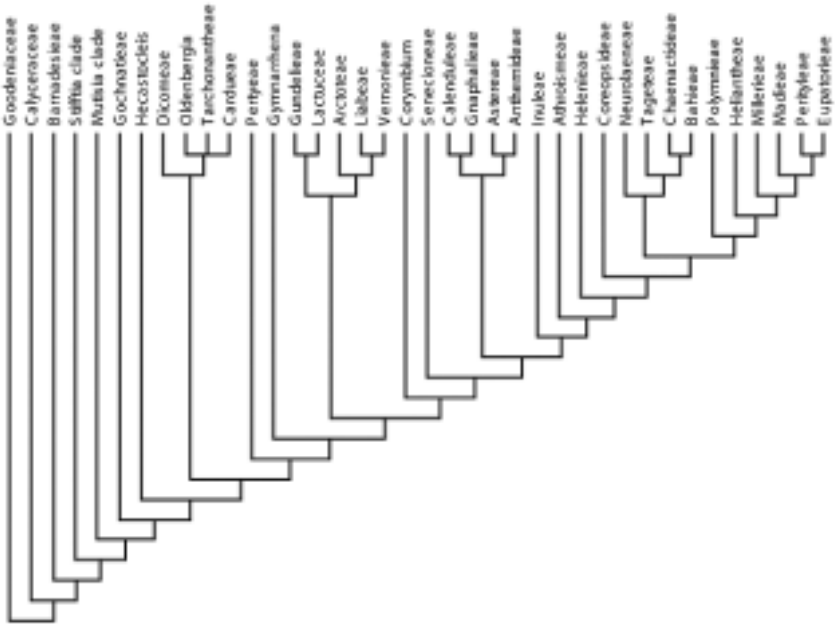
Molecular data came to Compositae systematics in the late 1980s and early 1990s and it was based on the work by Robert Jansen (TEX) and his collaborators. These individuals have literally turned the Compositae phylogeny upside down, showing that elements previously placed in the Mutisieae were a basal branch of the family and that the tribe Heliantheae *s.l.* was nested far up in the tree. Furthermore, their work confirmed that the Vernonieae and Eupatorieae were actually in separate parts of the tree. Bruce Baldwin (UC) and his collaborators have proposed new suprageneric ranks for the Heliantheae *s.l.* and Jose Panero (TEX) and Funk have done the same for the base of the tree. Harold Robinson has proposed two supertribes for the Asteroideae.

More recently Funk (along with 11 co-authors) has created a supertree for the family that includes approximately 500 genera. The authors used a published tree for the backbone or base tree of the family and grafted onto the base tree the published and unpublished trees for individual clades (usually tribes). This type of a supertree is a meta-tree, a "tree of trees," and it illustrates the current thinking about the relationships among the major tribes and subfamilies in the Compositae. The basal group, which is monophyletic and the sister-group to the rest of the family, is the distinctive subfamily Barnadesioideae which contains less than 1 percent of the species in the family. Also monophyletic is the highly nested subfamily Asteroideae, which contains ca. 65 percent of the species in the family. Between the two monophyletic subfamilies are groups that used to be included in the now paraphyletic subfamily Cichorioideae (ca. 35 percent of the species in the family). The new classifications recognize 10 subfamilies and 35 tribes, some new and some previously described; it remains to be seen whether or not this new classification will be accepted by the Compositae community.

The supertree makes it possible to look at the family as a whole and to try to discern its origin and history as well as gain insights on character evolution (the figure below is a reduced version of the supertree). It is also an excellent method



Synantherologists at the US National Herbarium (clockwise from upper left): Sidney F. Blake (date unknown, photo from the Washington Biologists Field Club Archives); José Cuatrecasas (date unknown, photo from the Botany Department Archives); Kitty Parker (1973; photo from the NMNH Archives); Harold Robinson (2003; photo by M. Sangrey); Vicki Funk in Namaqualand, South Africa with *Gazania* (2002; photo by M. Koekemoer, PRE).



The reduced Compositae supertree showing tribes and a few other taxa.

for determining critical areas of the tree for future work. The creation of the supertree was an outgrowth of a new organization "The International Compositae Alliance" (TICA) that had its first international meeting in Pretoria, January 2003, and the second meeting is to be held in June 2006, in Barcelona, Spain (hosted by Alfonso Susanna and Nuria Garcia-Jacas). The organization is supported by its website <http://www.compositae.org>, hosted by Torsten Eriksson from Bergius Botanical Garden (Stockholm) and uses *The Compositae Newsletter* (edited by Bertil Nordenstam, S) as a venue for publishing abstracts, and other documents. The goal of the 2006 meeting is to produce a multi-volume work on the family. Scientists from around the world are expected to participate and contribute to the publication. TICA is run as an email society and anyone can join by sending a message to funkv@si.edu.

We are often asked, "Why is the Compositae so large and successful while its most closely related families, Calyceraceae and Goodeneacea, are small with restricted distributions?" Well, it is most likely the same old story: the Comps are the new kid on the block. They are comparatively recently evolved (ca. 50 million years ago), overly big (with genera and species), opportunistic (often growing in open areas), highly poisonous (in its chemistry), fecund (not picky about pollinators and have high seed set), and agile (adapt to new edaphic conditions rapidly). As a result they are disgustingly successful and have conquered the world. The size and complexity of the family often result in taxonomists avoiding them. They are often maligned by those who do not study them; but maybe those who study other plant families are just jealous.

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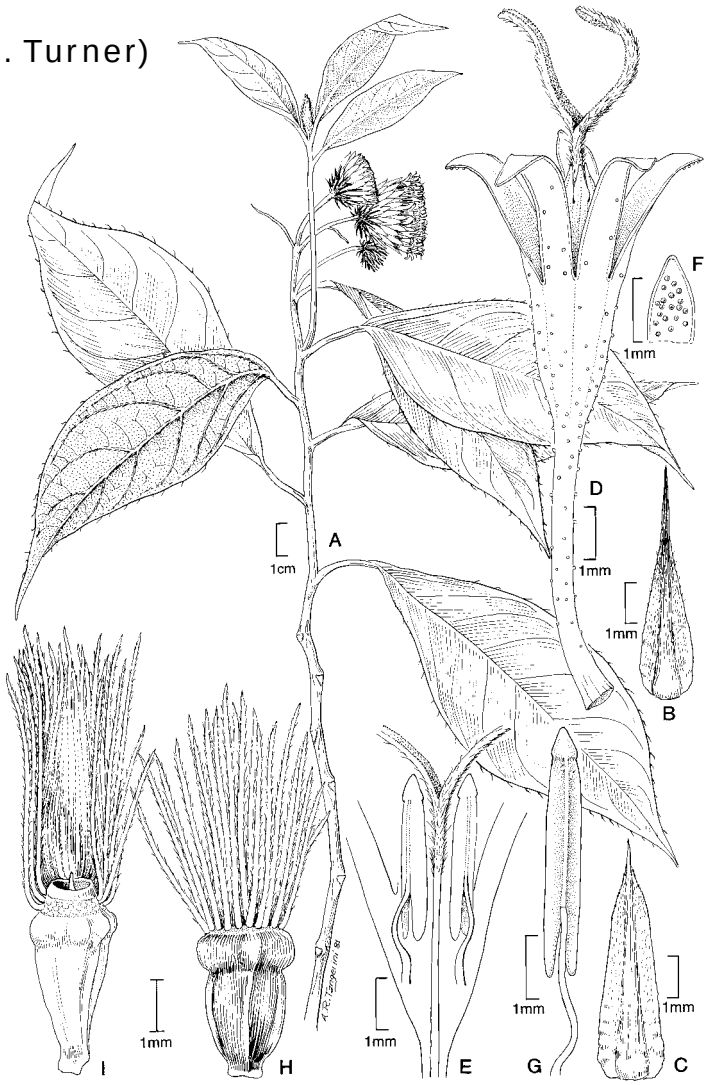
Art by Alice Tangerini

Stramentopappus pooleae (B. Turner) H. Robinson & V. Funk

The genus *Stramentopappus* was described by Robinson and Funk (*Bot. Jahrb. Systematic* 108: 213-228. 1987) based on its lack of a sclerified pappus base and the reduction of the outer ring of callus. The genus has the unusual chromosome number of n = 19 (most new world Vernonieae have chromosome counts of n = 17). This count was later found to be present in the two most closely related genera *Leoboldia* and *Lepidonia*.



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