Chiapas from San Cristobal de las Casas to the Lagos de Monte Bello. Every stem, even close to the road, was loaded from the crown to the earth surface with the magnificent white stars of *T. magnusiana.* When I returned to the same place in 1987, almost all tillandsias were gone. I assume they were collected; only very few were still growing in the crowns of the pines.

In the region of Fortin de la Flores (Estado Vera Cruz), I encountered American nursery collectors with big trucks, loaded with thousands of *T. ionantha* and *T. argentea.* In Guatemala, I made similar observations of *T. xerographica, T. magnusiana,* and *T. matudai.* In 1983, I visited the dry valley of El Rancho (Guatemala). The crowns of the trees were white with the rosettes of *T. xerographica*; in 1989, I observed only three individual plants in the same region. All the other plants had been collected. In tillandsia nurseries in Guatemala City, I saw several thousand *T. xerographica* plants piled on tables exposed to full sunlight and rain. About 50% of these beautiful slow-growing tillandsias had rotted, due to exposure. According to my view, this robbery is a crime on nature. Interesting communities of epiphytic plants are being destroyed.

One way to preserve and protect the endangered tillandsias in the wild is to propagate them by seed. This has been shown to be possible 30 years ago by the tillandsia collector, Dr. Richard Oeser, in Germany. However, it takes longer (3–5 years) to get a marketable plant for sale from seed. Seed-grown plants thus cost more than wild-collected ones, though they are much cleaner and have a better chance to survive in cultivation. I am convinced that the public would pay higher prices for better quality plants. Seed-cultured plants could be available in greater abundance with selected genetic characteristics.

Fortunately, some of the tillandsia "farmers" have already recognized the situation and are starting to change their growing methods. The orchid- and cactus-growers have long recognized this situation and propagate rare species by seed or meristem-tissue culture.

The export and import of wild-collected orchids and cacti are heavily controlled, and possible only with the presentation of permits from CITES. Why not enforce the same process with the rare tillandsias before it is too late? Naturally, it is not necessary to protect all bromeliads and list them as endangered species. Therefore, as I have done some years ago, I propose to protect only the rare, the most desired, and the most endangered species and to list them on APPENDIX I of the Washington Convention to control the export of these species and to force the farmers to propagate them by seed. It may soon be possible to propagate tillandsias by meristem cultures.

I propose to place the following species into APPENDIX I of the Washington Convention: *Tillandsia andreana* (Colombia), *T. argentea* (Mexico, Guatemala), *T. atroviridipetala* (Mexico), *T. edithae* (Bolivia), *T. filifolia* (Mexico, Costa Rica), *T. matudai* (Mexico, Guatemala), *T. mauryana* (Mexico), *T. plumosa* (Mexico), and *T. velickiana* (Guatemala). Particularly important are all species of small tillandsias of the Organ Mountains in Brazil such as *T. brachyphylla, T. grazielae, T. rosea, T. sprengeliana,* and *T. sucrei.* This list is not definitive; it can be shortened or expanded as more data on wild populations and commercial demand become available. Without rapid action, the prospects for survival of wild populations of rare tillandsias look very poor.

REVIEWER'S NOTE

A proposal to list the genus *Tillandsia* (ca. 600 species) under APPENDIX II of CITES was withdrawn due to lack of supporting data. The German proposal to list under APPENDIX II the following seven species was adopted at the Kyoto conference in March, 1992.

Tillandsia harrisii R. Ehlers (Guatemala); *T. kammii* Rauh (Honduras); *T. kautskyi* E. Pereira (Brazil); *T. mauryana* L. B. Smith (Mexico); *T. sprengeliana* Klotzsch ex Mez (Brazil); *T. sucrei* E. Pereira (Brazil); and *T. xerographica* Rohweder (Mexico, El Salvador, and Guatemala).

[Submitted by H. E. Luther, Curator of Bromeliaceae and Director of the Mulford B. Foster Bromeliad Identification Center, The Marie Selby Botanical Gardens.]

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THE CONSERVATION OF EPIPHYTES AND THEIR HABITATS: SUMMARY OF A DISCUSSION AT THE INTERNATIONAL SYMPOSIUM ON THE BIOLOGY AND CONSERVATION OF EPIPHYTES

NALINI M. NADKARNI

The Marie Selby Botanical Gardens, 811 South Palm Avenue,
Sarasota, Florida 34236 U.S.A.
Current address: The Evergreen State College,
Olympia, Washington 98505 U.S.A.

ABSTRACT. A one-day round-table discussion using the small-group nominal process was held in conjunction with the Symposium on the Biology and Conservation of Epiphytes in May 1991 at The Marie Selby Botanical Gardens. Botanists, horticulturists, and conservationists participated in the effort to formulate concrete and creative suggestions to answer the question: how can epiphytes and their habitats be conserved in the future? Small groups "brain-stormed" and then prioritized their suggestions into viable solutions to six aspects of this question, and then presented them for discussion to the entire group. Four major trends were noted in the proposed solutions: 1) directly and indirectly involve institutions, scientists, and lay people in tropical countries; 2) develop active communication between researchers and lay people; 3) increase participation and commitment from the governments of countries where epiphytes occur and where research and education is being carried out, especially in regard to regulations for collecting and transporting plants across international borders, and 4) increase funding from private and government sources for research, education, and direct protection of epiphytic plants and their habitats. It was concluded that the growing body of botanical, ecological, and horticultural knowledge about these plants will aid in their conservation.

INTRODUCTION

The importance of epiphytes and their habitats is now established in the scientific literature. At the recent international Symposium on The Biology and Conservation of Epiphytes (5–9 May 1991, Sarasota, Florida), epiphytes were shown to affect many aspects of the ecosystems they inhabit. Epiphytes were documented to: 1) contribute substantially to ecosystem diversity, production, and nutrient cycles; 2) provide appreciable nutrient and energy sources to associated organisms such as pollinating birds and mutualistic ants; 3) act as global indicators for climate change; 4) provide humans with materials of horticultural, medicinal, and economic value; and 5) create an arena for observational and experimental studies on a wide range of biological questions including systematics, plant interactions, ecophysiology, and mechanisms of evolutionary change.

There is a growing recognition that the survival and maintenance of many epiphyte populations are increasingly threatened. In formal presentations and informal discussions, Symposium participants articulated the growing threats to epiphytes themselves and to the habitats in which they dwell. Causes for epiphyte extirpation and population reduction are both direct (e.g., over-collecting of horticulturally valuable species for commercial exploitation) and indirect (e.g., loss or degradation of epiphyte habitats due to activities such as removal and fragmentation of forests for permanent conversion to pasture). These forces have extremely complex roots in political, social, economic, and cultural patterns around the world.

A major goal of the Symposium was to create a forum for botanists, horticulturists, and conservationists to suggest means to preserve epiphytes and their habitats. The Symposium was an unprecedented opportunity to incorporate many viewpoints and approaches from individuals of diverse disciplines, geographical locations, nationalities, and experiences. The basic question addressed was: how can epiphytes and their habitats be conserved in the future?

METHODS

The complexity of the issues and the large number of participants (ca. 150 individuals) demanded a formalized structure. Our goals were to: a) incorporate the ideas and beliefs of as many individuals as possible; b) allow discussions of proposed solutions among all participants; and c) produce a prioritized list of "doable" solutions to the scientific community and to the general public.

We used the "nominal small group process," which was introduced by J. Miller and J. Morris (New College, Sarasota, Florida). They instructed group leaders and recorders on the day previous to the discussion. During the Symposium, the convenors developed six specific questions that addressed particular aspects of epiphyte conservation. These were presented for feedback to the entire group of Symposium participants two days prior to the conservation discussion. Several of the questions were modified following suggestions from the participants.

On the third and final day of the Symposium, case studies of epiphyte conservation were presented in a plenary session. In the afternoon, the large group was divided into six arbitrary groups. In each small group (20–24 people), a group leader presented one of the six questions and elicited responses without "editorial comment." A recorder transcribed the responses verbatim (no interpreting or abbreviating of the original suggestion) to large sheets of white paper hung on the walls. Each participant was asked for a suggestion, and if time permitted, further suggestions were collected from the group. Open discussion followed for approximately 20 minutes, which included clarification of the suggestions and discussion on the relative merits of the proposed solutions.

Each participant was given three "stick-on" dots, and after the discussion, each person placed a dot on his/her choices for the three suggestions he/she considered the best. The "votes" were tallied, and the four solutions which received the most votes were selected as the "most viable suggestions." The entire Symposium group then reconvened, and each of the six group leaders presented these most viable suggestions to the entire group. Comments and discussion of each question and their solutions followed each group presentation.

These most viable suggestions are presented in the Results. The complete set of suggestions from all groups are in the archives of The Marie Selby Botanical Gardens, and are available from the Director of Research at Selby Gardens.

Results

Question 1. How can the tendency of people to want to save nature be developed into effective preservation of epiphyte habitats and single species (in situ)?

1. Rely on indigenous knowledge; aid and support collection of indigenous knowledge.
2. Involve local populations into in situ protection projects, including a) local teacher training programs; b) education; c) awareness programs; d) managing/monitoring.
3. Chapters of conservation organizations should adopt a field station or conservation area in a tropical country as a special project, supporting it with financial aid and with other resources.
4. Support indigenous researchers and institutions in countries where epiphytes and their habitats are native.

Question 2. What can be done to make national and international legislation and regulations effective for conservation of epiphytes?

1. Facilitate and standardize permits for harvesting limited numbers of plant specimens for scientific, horticultural and conservation purposes.
2. Design regulations to be understandable, enforceable, and user-friendly.
3. Government needs to make greater efforts to obtain comments on proposed legislation.
4. Make international control regulations uniform.

Question 3. How can those who grow plants [gardeners, epiphyte hobbyists, professionals (commercial and non-commercial)] contribute to conservation of epiphytes?

1. Create an international computer-based exchange program for seeds and propagules.
2. Encourage massive reproduction of native species in the country of origin for commercial export and conservation.
3. Develop and publicize the impact of extinction of individual species.
4. Provide access to the research work of biologists, especially for host countries.
5. Provide for immediate and continued survival of "significant" plants on the owner's incapacity or death.

Question 4. How can we motivate the general public to support epiphyte conservation?

1. Provide outreach that is active instead of passive (examples; film, sculpture, "ninja epiphytes" and "epiphyte growing kits" for school children).
2. Solicit public support, both institutional and financial, for interpreters who would serve as a liaison between the scientific community and the general public (examples; science writers, educators, plant shop and display people).
3. Put scientists into the community by teaching them how to relate to the general public.
4. Foster stewardship of conservation policies by setting and promoting good examples, such

as "these tillandsias were not collected in the wild."

Question 5. Over the next 10 years, what specific and tangible activities can scientists undertake to enhance conservation of epiphytes?

1. Create informative bulletins on information and investigations.
2. Direct research interests toward conservation and management issues.
3. Develop curricula for environmental education.
4. Get information into popular literature.

Question 6. How can institutions and organizations in temperate regions contribute to conservation of tropical epiphytes?

1. Purchase private reserves and research centers in the tropics.
2. Encourage greater conservation-mindedness on the part of the World Bank and U.S. A.I.D. policies.
3. Increase funding for collecting and floristics.
4. Help to improve rulings for trade of artificially propagated plants.

Discussion

This topic and process produced a positive response of creative suggestions for solutions. The method worked to elicit responses from all participants, allowed discussion and "negotiation" among participants, and prioritized the most viable suggestions.

Some general trends became apparent during the process. First, directly and indirectly involving institutions, scientists, and lay people in tropical countries was deemed extremely important. Steps to reverse past patterns of including only those from the developed and over-developed countries were suggested in many groups. Second, the need for communication between researchers and lay people was emphasized. The urgent problems of epiphyte and habitat conservation demand that those involved in "basic" research must expend some of their energy and resources into outreach, educational, and interpretive programs, either directly or through the public media or educational institutions such as science museums and botanical gardens. Third, there is a strong need for participation and commitment from the governments of countries where epiphytes occur and where research and education are being carried out, especially with respect to attention to regulations for collecting and transporting plants across international borders. Fourth, the need for increased funding from private and government sources is high for research, education, and direct protection of epiphytic plants and their habitats.

The discussions brought out both the pessimistic and the optimistic sides of the current situation. On the pessimistic side, threats to epiphytes and their habitats are increasing rapidly and their causes are complex and difficult to change because of strong economic, political, and social pressures. On the other hand, there appears to be some reason for optimism, as many of the examples presented earlier in the Symposium can be viewed as case studies for effective conservation of particular epiphytes and/or habitats. It was concluded that the growing body of botanical, ecological, and horticultural knowledge about these plants will aid in their conservation.

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