Pakistan-U.S. Science and Technology Cooperation Program
Annual Technical Report Form

Reports should be prepared jointly by the Pakistani and U.S. principal investigators and should cover all project-related activities carried out during the reporting period on both sides. Please expand the boxes below to accommodate all the information you need to include.

Project Title: INVENTORY OF THE PLANTS OF PAKISTAN	
Pakistani Principal Investigator: **S. I. Ali**	**U.S. Principal Investigator:** **Peter C. Hoch**
Reporting Period: October 1, 2011 – September 30, 2012	

Summary of Activities During Reporting Period: Please describe what has been accomplished under your grant during the reporting period, outlining the activities that were undertaken and specifically discussing achievements in relation to the milestones or targets set in the original work plan. For project-related events such as workshops, conferences, exchange visits, etc., please be sure to include exact dates and locations.

The primary goal of this project is completion of a comprehensive inventory of the plants of Pakistan. There are two parts: completion of the remaining family treatments for the published Flora of Pakistan (mainly in Pakistan; treatment of pteridophytes [ferns and allies] in St. Louis), and completion of a web-based searchable relational database of all the plant species of Pakistan (mainly in St. Louis). The Missouri Botanical Garden requested funds to affect the transfer of information in the current on-line Pakistan Plant Database from its existing platform (eFloras) to TROPICOS, the Garden's primary database system with greater access, capabilities, and interactivity.

The primary transfer of the data into the TROPICOS database was completed in YR 1 of this grant; the website can be viewed at http://www.tropicos.org/Project/Pakistan. During the current year, we have added recent FoP treatments (v. 218 Asteraceae III and v. 219 Myrtaceae) to the database; added/improved linkages between the Pakistan project and other parts of the TROPICOS system (especially Flora of China and Flora of North America projects); added a Pakistani scientist (A. Ali, Karachi) as a TROPICOS user in order to facilitate editing of on-line treatments from Pakistan; begun an editorial process on the Pakistan database to correct errors from original publication and especially from the OCR scanning process, and to make revisions based on the most recent systematic research; and begun a project to provide coordinates for all specimens cited in FoP treatments, which will enable mapping of all species distributions.

Work on the treatment of pteridophytes (ferns and fern allies) has been initiated, as a collaboration between Drs. George Yatskievych (St. Louis), M. Christenhusz (Helsinki), and C. R. Fraser-Jenkins (London and Katmandu); an additional collaborator in Pakisan was intended and might still be added, but funding for that position was cut from the Pakistani budget. Using notes compiled by Fraser-Jenkins as part of his extensive work on the ferns of South Asia, some of which were gathered during visits to many regional Pakistani herbaria over several decades, Yatskievych has begun to organize the material into descriptions and to digitize specimen localities and add them to the TROPICOS system.

Co-PI S. I. Ali and his colleagues have focused primarily in YR 2 on completion of the published volumes of the *Flora of Pakistan* (due to some delays in the funding process, the

project and funding in Pakistan was delayed approximately six months compared to the US part of the project). They published Vol. 218: Asteraceae III – Senecioneae & Mutisieae, M. Qaiser & Rubina Abid (84 pp, 15 genera, 48 species; 28 Sep 2011) and Vol. 219: Myrtaceae, Abdul Ghafoor (45 pp., 7 genera, 26 species; 5 Mar 2012) during their YR 1. The following is an account of the next several anticipated volumes

1) Asteraceae IV. Cichoriae (approx. 250 pp, 25 genera, 190 species) – currently in the editorial process.
2) Rosaceae II (approx.. 21 genera, 85 species; still in preparation, with accounts of 9 large genera complete; most of this work is being completed at the herbarium at Kew (England) by Renata Borosova and Joanna Osborne; Vol. 216 Rosaceae I – Potentilleae & Roseae, S. Landrien et al. (138 pp; 6 genera, 75 species) appeared 25 Apr 2009.
3) Scrophulariaceae (approx.. 40 genera, 200 species; this is a large treatment of a very complex group of plants, and involves numerous collaborators in Pakistan and abroad, but much progress has been made, and the first drafts of most generic treatments are complete).

Educational Impacts: Please provide information on the numbers of students and other junior collaborators (graduate and undergraduate students, healthcare workers, laboratory technicians, data collectors, etc.) involved in the projects, and discuss new courses or degree programs created (if any) or changes to existing course curricula as a result of your project.

The *Flora of Pakistan* Project, using funding from the USDA under the PL-480 Program for well over 25 years, provided training for many students in Pakistan. The original proposal to this cooperation program included funds for one Research Officer (Ph.D. student) and one Research Fellow (M. Phil student) for three years, but this component was not approved. Hence no students are currently being trained.

During the tenure of an earlier grant (from USDA), Mr. Abrar Ali was trained in St. Louis for work on the Pakistan Plant Database project. Currently he is working on part time contractual basis and recently has been trained and designated as a TROPICOS user, able to edit and revise the database directly on behalf of Pakistani participants.

In St. Louis, Dr. George Yatskievych is currently working with a volunteer to train her in initial preparation and databasing of notes and specimen citations (including geo-referencing them) for the treatment of pteridophytes of Pakistan. The Missouri Botanical Garden successfully incorporates many volunteers in our research program, and they provide excellent service to many projects.

Infrastructure Development: Please list any equipment acquired during this reporting period with grant funds and discuss the impact the new equipment will have on research and educational activities.

No equipment was requested or acquired for the US participation in this project.

Publications: Please provide citations for any papers published or conference presentations made as a result of your project.

Bano, R., & M. Qaiser. 2011. A taxonomic revision of the genus *Lactuca* L. (Cichorieae, Asteraceae) from Pakistan and Kashmir, Pak. J. Bot. 43(5); 2259-2263.

Ghafoor, A. 2012. Myrtaceae. *In* Ali, S. I. & M. Qaiser (eds.), *Flora of Pakistan* 219: 1-45.

Qaiser, M. & R. Abid. 2011. Asteraceae (III) Senecioneae & Mutisieae. *In* Ali, S. I. & M. Qaiser (eds.), *Flora of Pakistan* 218: 1-84.

No publications resulted from work on this project in St. Louis; however, the web-site for the Pakistan Plant Database (http://www.tropicos.org/Project/Pakistan) is certainly the equivalent of a publication. It includes introductory information about Pakistan, the history of the Flora of Pakistan project, and the full searchable database of the plants of Pakistan, embedded within the larger TROPICOS database of the Missouri Botanical Garden.

Additional Funding: Please list any additional funding applied for or received to help support your project during this reporting period.

No other funding has been applied for or received for this project during the reporting period. The Pakistani and American Co-PIs are attempting to identify alternative sources of funding for the work on plant treatments in Pakistan, especially to fund a graduate student to work with the authors of the proposed Pteridophyte volume. We will notify all agencies involved if and when we make any other grant submission.

Linkages with Government or Private Industry: Please describe any linkages developed with government agencies or companies interested in implementing the results of your project.

As noted in the previous Annual Report for this grant, discussions are in progress to explore possible collaboration between the Flora of Pakistan/ Pakistan Plant Database project and a new project for an online, illustrated flora to be prepared in collaboration with the Pakistan Botanic Garden Network (gcubotanicgarden@yahoo.com). Dr. Mary Barkworth (Utah State University; Mary.Barkworth@usu.edu), is working with that Network to develop a proposal to connect this online flora to our database in TROPICOS in order to get the valid plant names, descriptions, etc., linked to vouchered photographs of Pakistani plants. If this plan goes forward, a proposal will be made to some funding agency to bring several Pakistani scientists to the United States for training in construction and maintenance of the appropriate databases, as well as additional botanical training.

As also noted in the 2011 Annual Report, we have had contact with Carol R. Johnson Associates in MA, a landscape architectural contractor working on the expanding US Embassy in Kabul, Afghanistan, regarding for information, sources or contacts for procuring temperate shade trees for work in Afghanistan. We have not had success identifying a commercial source for trees in Pakistan, but continue to pursue this, since it could lead to productive business collaborations.

A recent international collaborative effort is underway to develop a new on-line World Flora, and recently an organizational meeting in St. Louis began the process. As the only complete and modern flora of southern Asia, the Flora/Database of Pakistan project will play an important role in the development of the World Flora, and the project PIs are currently exploring how our project will interact with this international effort.

Problems Encountered: Please provide information on any problems you may have encountered in making progress on your project objectives and describe steps you are taking to resolve the problems.

Some challenges arose in the funding for the Pakistani collaborators. The start date

for their side of the project was delayed about 6 months compared to the US side. Because their funds were reduced substantially, several positions were eliminated, including student trainees. This may adversely affect the proposed collaborative work on Pteridophytes at Missouri and may slow down progress on the project as a whole.

Plans for Activities During the Coming Year: Please provide details on project activities during the next year, including planned exchange visits, training events, and ongoing research efforts.

In St. Louis, development and maintenance of the Pakistan Plant Database will continue, any new published treatments will be incorporated, editing of the on-line treatments will continue both in Karachi and St. Louis, and work will continue to develop an automated gazetteer in order enable geo-referencing of specimens already cited and included in the database.

George Yatskievych (St. Louis), in collaboration with colleagues, plans to produce a full draft of the pteridophyte volume for Flora of Pakistan during the first half of 2013, including a visit to herbaria in the UK, particularly those at Kew, the British Museum, and probably Edinburgh, in order to examine type specimens and to review the holdings of these large institutions, which hold particularly rich collections from South Asia. He is planning to have a nearly complete manuscript on the Pteridophytes by the end of Yr 3 and the conclusion of the grant.

In Pakistan, it is hoped that several or all of the manuscripts in progress will be ready for submission. Asteraceae IV – Cichorieae is currently being edited by Abdul Ghafoor. Pending completion of treatments of several remaining small genera, the volume on Scrophulariaceae will be complete and editing can commence by Ghulam Rasool. And the Rosaceae II volume should be near completion by the end of the current funding year, prepared and edited by Renata Borosova and Joanna Osborne, working at Kew. The only major treatments remaining concern the remainder of the family Asteraceae, the largest plant family in the world and in the Flora of Pakistan, and Co-PI Ali and his colleagues remain focused on completion of those as soon as possible.

Supplementary Information: If applicable, please attach copies of project-related workshop or conference agendas, course curricula developed, summaries of research data collected in the course of the project, or articles about the project appearing in newspapers, journals, or Web sites. **Please note that your report will be posted on the program Web site, so please do not include any data you do not wish to make publicly available at this point in your research.**

Indicators	Reporting Period:
1. Number of higher education partnerships between Pakistani and U.S. institutions (see note below)	1 + 2
2. Number of journal articles, technical reports, books, or book chapters (published or accepted for publication) resulting from your project during the reporting period	4
3. Number conference presentations resulting from your project during the reporting period	0
4. Number of training events (courses, workshops, seminars, conferences, stakeholders' meetings) conducted on your project during the reporting period	0
5. Total number of Pakistanis making exchange visits on your project during the reporting period	0

Number of women	0
Number of men	0
6. Total number of Americans making exchange visits on your project during the reporting period	0
Number of women	0
Number of men	0
7. Total number of exchange visits overall during the reporting period	0
8. Total number of Pakistani PhD students involved in the project	0
Number of women	0
Number of men	0
9. Total number of American PhD students involved in the project	0
Number of women	0
Number of men	0
10. Total number of all other Pakistanis not listed above who participated in your project during the reporting period (Include in this total those who were involved as researchers, MS or undergraduate students, technicians, or data collectors, as well as those who received formal training in workshops or courses or participated in conferences or stakeholders' meetings organized as part of the project.)	5
Number of women	2
Number of men	3
11. Total number of all other Americans not listed above who participated in your project during the reporting period (Include in this total those who were involved as researchers, MS or undergraduate students, technicians, or data collectors, as well as those who received formal training in workshops or courses or participated in conferences or stakeholders' meetings organized as part of the project.)	4
Number of women	1
Number of men	3

Note on Question 1: For the number of higher education partnerships, please count the partnership between your institution and your Pakistani counterpart's institution as <u>one</u>. If your project also involves collaboration with other Pakistani institutions / US institutions (universities, research institutes, government agencies, or non-governmental organizations), please add each such additional institution to your total.