



Studies of the Biodiversity of Jordan

دراسة التنوع الحيوي في الأردن

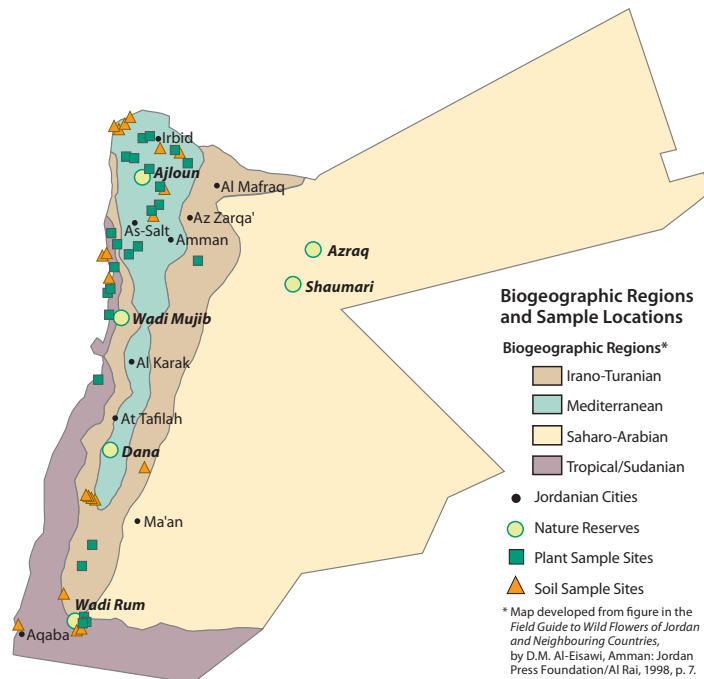
RTI International has been collaborating with a team of Jordanian scientists on a research project that has the potential to make a positive impact on Jordan through the discovery of new medicines. Important aspects of this pursuit focus on assessing the country's under-studied biodiversity and transferring cutting-edge technology to a cadre of Jordanian scientists, which will enhance Jordan's research capacity and infrastructure.

The Hashemite Kingdom of Jordan's habitat is unique in that the intersection of dense forest, arid desert, and tropical geography endows the country with a rich variety of plants and microorganisms that can be studied efficiently in a relatively small land area. More than 2,500 wild plant species from 700 genera exist; of these, there are approximately 100 endemic species, 250 rare species, and 125 very rare species.

In 2003, RTI received a planning grant from the U.S. National Institutes of Health's International Cooperative Biodiversity Groups (ICBG) program to promote sustainable economic growth, biodiversity conservation, and training and education in Jordan through drug discovery from both plant and microbial sources. These studies are unique in that very few Jordanian plants have been explored for pharmaceutical leads, especially plants from extreme environments such as the desert and near the Dead Sea.

RTI's team:

- Jordan University of Science & Technology (JUST)
- The National Center for Agriculture Research & Technology Transfer, Jordan
- University of North Carolina—North Carolina Botanical Garden
- Virginia Polytechnic Institute & State University (VA Tech)



Drug Discovery and Biodiversity

The team investigated plants and predator bacteria in Jordan as possible sources for new drug leads, focusing on compounds acting as anticancer agents, antibiotics, and/or modulators of the central nervous system (potentially for diseases that affect the brain). Per a negotiated research agreement with the government of Jordan, the team collected over 120 plant samples, roughly 25 to 30 from each of the four biogeographic regions of Jordan. Many of the collected samples displayed promising biological activities, and these are being studied further as well as forming a baseline to design future collection efforts.

In addition, the research team collected more than 30 soil samples. Predator bacteria have been found in every soil sample examined to date. Interestingly, the diversity of these organisms in Jordanian soil varies from several dozen to only a few. The most promising organisms have been isolated and grown on a larger scale and are being pursued for new antibiotic compounds.

Capacity Building and Economic Development

An important part of this project has been its focus on knowledge transfer and capacity building of Jordanian scientists. The U.S. partners trained researchers and students from Jordan in advanced chemical, pharmacological, and molecular genetic techniques in the laboratories at RTI, VA Tech, and JUST. This has expanded the project's impact by transferring skills to Jordanian scientists, who have since

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A *Colchicum ritchii* collected from Petra is one of the plants studied for anticancer activity.

English name:
Autumn crocus

Arabic name:
Lahlah- الحلاح

taught them to fellow investigators and students. A secure data transfer function on the project website (in Arabic and English) also has allowed researchers in Jordan to use remotely several state-of-the-art instruments housed at RTI's North Carolina offices (<http://icbg.rti.org/>).

A formal agreement with the Jordanian Minister of Planning granted permission for the research team to conduct studies throughout the country. This agreement is very important because it specifies that royalties and other monies generated via future discoveries (e.g., from patentable inventions) are to be divided equally among team institutions and reinvested to benefit the people of Jordan. Protection of such resources now will ensure the future collection of promising samples, especially within or near national parks; raise awareness of the value and importance of preservation; and reinforce the importance of science in education.

Looking Ahead

Natural products research has served as the backbone for supporting and integrating the project's goals. RTI, home to the discovery of the anticancer drugs Taxol® and Camptothecin™, has a unique perspective to offer, both in the development of new natural-product-based drugs and in the training, education, and capacity building of natural products research. Similarly, RTI is the only firm in the world studying predator bacteria as a source for new antibiotics, and the variability in climate and soil types—especially extreme soils—presents areas ripe for the discovery of these fascinating organisms.

Natural product chemistry has already contributed to 60% of all anticancer drugs and antibiotics. Fully 25% of all drugs in use today originated from sources in nature.

To date, three manuscripts on this research have been published in international, peer-reviewed journals, and several papers have been presented at international conferences. Each of these research publications describes some of the team's initial findings from the exploration of plants of the genus *Colchicum* for anticancer activity. The currency of scientific achievement, these peer-reviewed journals and publications serve to raise awareness about the drug discovery potential in Jordan and to elevate the scientific stature of all the scientists involved, especially those from Jordan.

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