

# Rachid Hanna, PhD

Phoenixville, PA 19460 • rachidhanna01@gmail.com • 610-716-8333

---

## Principal Scientist/Entomologist and Director

*Experienced, multi-lingual scientist skilled in fundamental and applied research, and with demonstrated capacity to lead research for development in areas of integrated crop production and protection.*

### — Key Research and Training Qualifications —

- Broad experience in development and implementation of innovative agricultural R&D technologies.
  - Familiarity with global and country-specific issues related to agriculture production, food security and climate risks and adaptations for a number of field, vegetable and tree fruit crops.
  - Extensive experience in graduate student supervision and mentoring (52 PhD and MSc students), and in bench training and extension activities.
  - Skilled in working with stakeholders including agricultural industry, growers, governments, and donors, and strong capacity to build professional networks and collaborations on local, national and international levels. Affiliated with several continental and global scientific societies, on which I served at several capacities.
  - Excellent written and oral communicator. Authored 128 journal articles and 132 book chapters, conference papers and miscellaneous articles, and over 200 oral and poster presentations of broad coverage. Author/co-author of 60 grant programs generating over 50 mil US\$ for my affiliated institutions.
  - Adapts quickly to new environments. Fluent in English, French, and Arabic languages.
- 

## Professional Experience

### ***International Institute of Tropical Agriculture (IITA) – Africa***

#### **Country Representative and Director of Research Center, Cameroon, 02/2010-03/2018**

Facilitated efforts within an International Public Organization (a non-profit research for development institution) that developed agricultural innovations to meet Africa's most pressing challenges of hunger, malnutrition, poverty, and natural resource degradation. Managed, mentored, and coached a team of scientists, national staff, consultants, student and hosted institutions. Instrumental in nurturing international and national relationships and networks committed to the mission of the organization. Led the expansion of the center through strengthening of human resources, addition and improvements of laboratories and other infrastructure, and fostering national and international collaborations.

### ***Congo Basin Institute, Africa***

#### **Co-Executive Director, Cameroon, 06/2015-03/2018**

Co-led efforts to engineer a model for universities, NGOs, and private businesses focused on international development focused on critical issues in developing and developed countries while utilizing interdisciplinary tools and resources. I was instrumental in establishing and advancing CBI partnerships.

***International Institute of Tropical Agriculture (IITA) – Africa***

**Associate Scientist**, Benin, 01/1998-01/2001 | **Senior Scientist**, Benin, 01/2002-12/2008

**Senior Scientist**, Cameroon, 12/2008-05/2016 | **Principal Scientist**, Cameroon, 05/2016-03/2018

Formulated multiple, time-bound, research projects that justified major investments and focused on integrated crop production and crop protection, biological diversity, and climate change risks and adaptations. Collaborated and developed cooperative agreements with local and international research partners, governments, and donors.

***Department of Entomology, University of California, Davis***

**Research Assistant, Teaching Assistant, and Post-Doctoral researcher**, 09/1985-12/1997

Formulated and executed research for PhD dissertation and post-doc employment in collaboration with Dr L. Ted Wilson initially for PhD research, and later with Dr Frank Zalom for completion of my PhD and continuation as post-doc. Collaborated extensively with scientists of several disciplines - including entomologists, soil scientists, viticulturists, and weed and social scientists, cooperative extension advisors, farmers, and funding agencies at both grape industry, state and national level. Brief descriptions of the research can be found below in the following section on research programs. I served also as teaching assistant in the laboratory component of a course on Arthropod Pest Management and served as co-instructor of the course once during my post-doc.

***Research programs and associated projects.***

- **Classical biological control programs - cassava green mite, coconut mite and oriental fruit fly.**
  - ***Africa-wide classical biological control of cassava green mite (CGM) program (1998-2006) – supported with DANIDA and IFAD, and strategic funds.*** This was a large program with numerous collaborators on four continents and was one of the most successful continent-wide classical biological control programs with enormous economic impact and enhancement of capacity in biological control. (1) Explored, screened, and released predatory mites and fungal pathogens for the biological control of cassava green mite in sub-Saharan Africa. (2) Efforts resulted in establishment of two predatory mite species, of which one is now found in at least 21 countries in sub-Saharan Africa, with at least 60% reduction in mite infestations and concomitant ~30% increase in yield. An entomopathogenic fungus (*Neozygites tanajoae*) was established in Benin but requires further follow-up on persistence and impact. (3) Investigated and exploited tri-tropic interactions for enhancing biological control, including the role of cassava tip hairiness in enhancing biological control of cassava green mite. (4) Participated in the description of 60 phytoseiid species, new to science. I was responsible for the research and implementation of this project from 1998 to 2006.
  - ***Classical biological control of the coconut mite (2004-2014) - supported with Austrian and Dutch funds.*** This is a pest of coconut of American origin. (1) Determined distribution and damage and associated natural enemies in Benin and Tanzania. (1) Conducted foreign exploration in Brazil and clarified the identity of several predators. (3) Screened, multiplied and introduced predators one of which (*Neoseiulus baraki*) was established in Benin. Economic impact yet to be determined. Another species (*Neoseiulus paspalivorus*) was found by a graduate student at the University of Amsterdam to be a good predator of bulb mite is presently being developed commercially for the control of the bulb mite in Europe.
  - ***Classical biological control of the Oriental fruit fly *Bactrocera dorsalis* and development of integrated programs for managing tephritid fruit flies on fruits and vegetables in West Africa (2007-2016) – supported with German (BMZ) and strategic funds.*** Conducted diversity, distribution, host range, damage assessment, and long-term population dynamics and developed control methods based on

male annihilation and bait sprays, in Benin and Cameroon – all in collaboration with counterparts at the International Center for Insect Physiology and Ecology (*icipe*). Established a parasitoid for the biological control of the *Bactrocera dorsalis* in Benin and Cameroon.

- **Integrated crop and pest management – cassava (African root and tuber scale, cassava whiteflies, cassava mosaic virus diseases); plantains and bananas (banana bunchy top disease, nematodes and banana weevil); citrus, mango and cucurbits (fruit flies); vegetables – okra and cabbage (aphids, leaf beetles and diamondback moth); maize (fall armyworm and stemborers); and grapes (mites, leafhoppers, mealybugs and weeds).**
  - **Program on development of IPM options for African root and tuber scale (2003-2011) - supported with IFAD, USAID and strategic Funds.** This is an Afrotropical species that has become a major constraint of cassava and very little was known about its biology and ecology. In Cameroon and DR Congo, we determined the genetic diversity, host range; developed tolerant varieties and cultural control methods to reduce its abundance and impact on cassava production; developed a boric acid bait for the control of its tending ants; and collected over 250 morphospecies of ants in forest and agricultural land with at least 6 new species yet to be described.
  - **Integrated management of cassava pests and diseases in West and Central Africa (2006-2011) - supported with IFAD and strategic funds.** Project implemented in Benin, Cameroon, DR Congo and Tanzania. This was an extension of the cassava green mite biocontrol project. (1) Confirmed establishment of *Neozygites tanajoe* and its impact on cassava green mite in Benin. (2) Discovered invasion of severe cassava mosaic disease in Cameroon. (3) Established that cassava tip hairiness is a heritable trait and encouraged breeders to incorporate it in their cassava breeding programs for the conservation of cassava green mite biological control. (4) Collected and characterized 300 accessions of local cassava germplasm in Benin and Cameroon and selected and disseminated over 20 cassava varieties favorable to green mite biocontrol, resistant to cassava mosaic disease, and tolerant to African root and tuber scale. (5) Released and established two spiraling whitefly parasitoids in Tanzania resulting in at substantial declines in whiteflies abundance.
  - **Integrated management of Bemisia tabaci with biological control and host plant resistance (2012-2015) – supported with USAID and CGIAR-RTB funds.** In collaboration with IITA breeders and virologists, determined that (1) oviposition preference by whiteflies for hairy cassava genotype predicts susceptibility to whiteflies and (2) parasitism by hymenopteran parasitoids is density dependent and contributes to at least 30% parasitism of whiteflies. Information from these findings and others on predatory mite preference for hairy varieties are being used by cassava breeders in their cassava selection programs. A parasitoid from Texas (USA) failed to establish.
  - **Biology and management of the banana aphid and epidemiology and management of banana bunchy top disease (since 2008) – supported with CORAF, FAO, CGIAR RTB, and strategic funds.** This work was conducted with national programs in Nigeria, Cameroon, Benin, and Gabon, and with the BBTB Alliance which includes numerous other countries and stakeholders. (1) Established the distribution and seasonal dynamics of the banana aphid on a variety of plantain and banana genotypes. (2) Determined the distribution of BBTB in Cameroon and Gabon and searched for parasitoids (in collaboration with Russell Messing) in South East Asia – the putative origin of the banana aphid but did not find any parasitoids; same in Africa, never found parasitoids associated with the aphid. (3) Screened and identified 42 *Musa* genotypes for resistance to the aphid to BBTB and identified several tolerant genotypes that are being promoted for BBTB management. (4) Carried out eradication efforts in the South of Cameroon (on-going effort) where BBTB is still restricted in its distribution. (5) Identified several endosymbionts in several geographic populations of banana aphid. A PhD student is continuing the research on exploring endosymbiosis for aphid and disease management.

- ***Introduction of pest/disease resistant cassava and maize germplasm for enhancing productivity, food security, nutrition and income generation (since 2014) – supported with MINADER/World Bank, IFAD and strategic funds.*** Purpose was to use previous efforts to improve cassava and productivity in Cameroon. New cassava varieties were selected for multiple uses in addition to their pest and disease resistance. Five million cassava cuttings were multiplied and distributed in Cameroon and Gabon. Three maize varieties were selected, multiplied and distributed. Emergency response for the management of the invasive fall armyworm was initiated in Cameroon (later to be extended to neighboring countries) with studies on distribution, damage, associated natural enemies and efficacy of available pesticides.
  - ***Integrated management of vegetable pests (2011-2014) – supported with German (BMZ) and strategic funds.*** Purpose was to develop sustainable solutions to aphid and other insect pests of okra and cabbage in Cameroon and Kenya in collaboration with *icipe* and KARI in Kenya and AVRDC and IRAD in Cameroon. The project achieved the following: (1) established baseline information of farmer practices and state of insect pest abundance and damage on the two crops; (2) developed knowledge on the seasonality and crop varietal response to pest insects and their associated natural enemies; (3) identified sources of resistance to the cotton aphid on okra; (4) clarified the role of ants in aphid management on okra; and (5) identified entomopathogens for the control of aphids and flea beetles on okra. Project did not continue due to the change in donor and participating partners priorities.
  - ***Biological control of spider mites in California grape vineyards (1986-1992) – supported with funds from the California Raisin Advisory Board, California Table Grape Commission, and UCIPM.*** Primary duties involved PhD dissertation and related research on spatial dynamics, development of sampling plans, biological control, and impact of pest management practices on spider mites in California vineyards. Developed quantitative sampling plans for spider mites and their natural enemies which were integrated into the UC grape pest management guidelines. Determined the effect of pest management practices, especially sulfur, on spider mites and their biological control agents. Contributed to present knowledge on the effect of direct and indirect interactions among spider mites on their population dynamics and biological control by predatory mites; developed a legume/grass cover crop system to promote biological control of spider mites. Tested a grass/legume cover crop system for spider mite and leafhopper management in raising grape vineyards.
  - ***Cover-crop systems for the integrated management of leafhoppers, mealybugs, weeds, vine nutrition, and water use in California vineyards (1992-1997) – supported with funds from USDA-SARE, USDA-NRI, American Vineyard Foundation, and California Table Grape Commission.*** With a team of entomologists, viticulturists, weed biologists, and soil scientists, in collaboration with UC extension personnel, we investigated the multiple ecosystem services of fall-spring grass/legume cover crops in table, raisin and winegrape vineyards. We established that this cover crop system (1) can lead to reduced leafhopper infestations primarily through enhanced spider populations and predation on leafhopper (raisin grapes) and increased water stress in wine grapes; (2) suppression of mealybug infestations in table grapes due to ant attraction away from the vines by the cover crop extrafloral nectaries; (3) can substitute to some extent for fertilizer use (all grape vineyard types) but is not adequate for weed suppression under the vine; and (4) can reduce vine water status only in drip-irrigated wine grapes leading to reduced leafhopper populations and lower vine vigor, but lower grape yields and improved wine quality; and (5) does not affect raisin and table grape yield and quality.
- **Sustainable intensification and interactions and forest conservation – cassava, plantains, maize, and cocoa, and climate smart agriculture.**

- **Promotion of productive and climate-smart cocoa systems to increase profitability and reduce environmental degradation (2014-2017) – supported with Dutch (SNV), German (GIZ) and strategic funds.** With a team of staff and collaborators, (1) characterized cocoa households (614) and production and tree diversity of 120 farms; (2) developed 12 rural centers for propagation and distribution of cocoa and associated plants/trees; (3) established 40 demonstration plots and trained over 8,000 farmers in plantation rehabilitation, integrated crop and pest management, and occupational safety and health; (4) initiated studies on the feasibility of cocoa propagation through tissue culture; (5) optimized use of pheromone traps and identified entomopathogenic fungi for the control of cocoa mirids; and (6) initiated a long-term study on resilience of cocoa plantations to climate change.
- **Intensification of cassava and plantain production for conservation of natural resources around protected areas in Southwest Cameroon (2014-2017) – supported with German (KfW), MINFOF (KfW), and strategic funds.** Aim of the project is to improve agricultural practices to reduce pressure on forest resources around protected areas. In collaboration with plant breeders, agronomists and soil scientists, (1) tested and distributed 8 adapted cassava and plantain varieties for multiple uses and trained farmers on best production practices; (2) tested and established comparative soil fertility enhancement options; (3) established 20 community-based plantain propagation facilities for use in seed gardens, and over 40 improved cassava variety multiplication sites; and (4) conducted impact assessment that revealed ~70% adoption of improved cassava, which resulted in at least 40% increase in yield and income.
- **Modeling of the effects of climate change on cassava, banana, vegetable and fruit pests and their natural enemies (2010-2015) – supported with German (BMZ) and strategic funds.** Used Insect Life Cycle Modelling (ILCYM) developed by CIP to predict the impact of climate change on 5 insects and mites of crops in sub-Saharan Africa. Awaiting software corrections to continue with at least 5 manuscripts and follow up on implementation.

#### **Other professional services**

- **Editorial (examples)**

- Editorial Board of the International Journal of Tropical Insect Science. January 2006 to present.
- Associate editor of the African Journal of Root and Tuber Crops, November 2001 to 2004.
- Nominated by the ESA International Branch President and selected to serve a 4-year term on the nominations committee for the ESA PI-E Section; October 2010 to present.
- Subject editor of the Journal of Integrated Pest Management, January 2010 to December 2014.
- Reviewer of research proposal for the Austrian Science Council (Austrian equivalent of the US National Science Foundation), South African Science Foundation, and International Foundation for Science.
- Reviewer for Annals of Applied Biology, Applied Entomology, Biocontrol Science and Technology, Biological Control, BioControl, Journal of Applied Ecology, Environmental Entomology, Journal of Economic Entomology, Experimental and Applied Acarology, International Journal of Tropical Insect Science, and Pest Management Fact Sheets for the University of California DANR Communication Services.

- **Committees (examples)**

- Member of Steering Committee of AfDB project Projet des Chaines de Valeurs Agricoles.
- At the request of IITA Chairman of the Board, represented IITA staff on the search committee for IITA Director General (November 2010 to April 2011).
- Africa representative on the executive committee of the International Congress of Acarology, 2010 to 2017.

- Inter-Center management committee, IITA-Cameroon; coordination between IITA-Cameroon and two other centers (CIFOR and AVRDC) hosted at the IITA-Cameroon campus.
- Elected member for two, 4-year terms to the executive committee of the International Congress of Acarology, August 2010.
- Ex-Officio and member of the executive committee of the International Society of Root and Tuber Crops-Africa Branch, 1998-2001; 2004 to present.
- Consultation committee to develop IITA strategy for biotechnology and root and tuber systems.
- Panel to review the USAID-funded project on emergency management of the cassava mosaic virus disease in the Democratic Republic of Congo.
- Recruitment panel for eight IITA scientists.
- IITA Procurement Committee, October 2003 to December 2005.
- Information technology committee, IITA-Benin, 1998 to 2005.
- Member of judge panel for paper and poster competition at the ESA Pacific Branch meeting, June 1991.
- Undergraduate curriculum committee, Department of Entomology, University of California, Davis for the 1988/89 and 1989/90 academic years. Committee was responsible for major revisions of the Entomology undergraduate curriculum and for charting a plan to increase undergraduate enrollment.
- Departmental seminar coordination committee, Department of Entomology, University of California, Davis (1993-1997).
- Departmental teaching resource-multimedia center committee, Department of Entomology, University of California, Davis for the 1996/1997 academic year.
- ***Other significant services (examples)***
  - Numerous meetings with Benin and Cameroon officials in conjunction with projects such as PNDRT, PREBAP, PACA, PRFP, PIDMA, etc.).
  - Co-organized multiple IITA exhibits at international and national shows.
  - Numerous media interviews (e.g., voice of America on banana bunch top disease; voice of the farmers on cassava development in Cameroon; R4D review).
  - Numerous guided tours, presentations, and technical support to visitors of IITA's Biological Control Centre for Africa in Cotonou, Benin and IITA's Research Center in Cameroon.
  - Advised national programs in Benin, Cameroon, Democratic Republic of Congo, Ghana, Guinea-Conakry, Kenya, Malawi, Mozambique, Nigeria, Tanzania, Togo, Uganda and Zambia on numerous occasions on the development and implementation of biological control of exotic cassava pests.