

# Trip Report – Ethiopia:

Workshop on the biological control and management of *Parthenium hysterophorus*; review of quarantine facility at Ambo; tour of rearing facilities at Wollenchiti; meeting at Haramaya University

Dec. 11 - 20, 2015



Workshop participants examine the eggs of the *Listronotus weevil* on *Parthenium* at Wollenchiti. Left to right: Virginia Tech Board of Visitors member Dennis Treacy, Samora Macrice, Sintu Alemayehu, Wondi Mersie, Lorraine Strathie, and Muni Muniappan.

This report was written by Miriam Rich.

This trip report accounts for the activities of the following IPM Innovation Lab team members and related Virginia Tech people as follows:

- Muni Muniappan, director of the IPM Innovation Lab, managed by Virginia Tech
- Van Crowder, executive director of the Office of International Research, Education, and Development
- Zara Shortt, financial and program coordinator for the IPM Innovation Lab
- Miriam Rich, director of communications for the Office of International Research, Education, and Development
- Keith Pierce, communications specialist with Outreach and International Affairs
- Dennis Treacy, member of Virginia Tech’s Board of Visitors and Executive Vice President for Sustainability at Smithfield Foods

## **General overview of trip**

The purpose of the trip was to conduct a workshop on the biological control of *Parthenium hysterophorus*, the invasive weed; visit the research station in Ambo where the quarantine facility is sited; travel to Wollenchiti to review the rearing and release of the *Zygogramma* beetle there; and to meet with representatives of Haramaya Agricultural University in Dire Dawa. The IPM Innovation Lab also sought to highlight the valuable work that Virginia Tech is doing internationally by inviting a member of Virginia Tech's governing body, the Board of Visitors.

## **Friday, Dec. 11 and Saturday, Dec. 12 – Travel and Arrival**

Muni Muniappan and Miriam Rich left Blacksburg on Friday, Dec. 11<sup>th</sup>, and arrived at the airport in Addis Ababa late the evening of the 12<sup>th</sup>, where we were taken to the Nexus hotel. Zara Shortt arrived from Alabama on Dec. 12<sup>th</sup> as well.

## **Sunday, Dec. 13 – Muni welcomes board member Dennis Treacy to Ethiopia**

Muni went to the Addis airport early Sunday morning to meet Virginia Tech Board of Visitor member Dennis Treacy. At 10:00 am in the hotel lobby, Muniappan met with Dr. Tadele Tefera from ICIPE who will be leading the IPM Innovation Lab's "Grains IPM for East Africa" project. At 3:00 pm, he met with Dr. Kiros Meles of Mekelle University to discuss the cochineal insect problem on Opuntia cactus.

## **Monday, Dec. 14 – Trip to Ambo cancelled due to strike; impromptu meeting held**

The original plans for this day were to drive to Ambo to visit the quarantine facilities there where scientists are rearing *Zygogramma* (Coleoptera: Chrysomelidae) and other biological control insects to be tested as to their host specificity and effectiveness. However, we were unable to take this trip due to some unrest in the region which had resulted in violence the previous week.

Wondi Mersie, of Virginia State University, the PI for the IPM Innovation Lab's *Parthenium* project, and Lorraine Strathie, of the Agricultural Research Council-Plant Protection Research Institute in South Africa, had travelled to Ambo the previous day, Sunday, to deliver some *Listronotus* weevils to the facility, and had great difficulty returning to Addis due to the strike.

As a result of the disruption, Muniappan hastily arranged an impromptu meeting for the scientists already gathered at the Nexus Hotel.

## **IPM Innovation Lab Programs, presentation by Muni**

The meeting began at 10:30 am.

Participants included Lorraine Strathie, from the Agricultural Research Council-Plant Protection Research Institute in South Africa, Tuvia (Toby) Yaacoby and Baruch Rubin, weed scientists from Israel, Dr. Muo Kasina from KALRO in Kenya, Dr. Samora Macrice, from Sokoine University of Agriculture in Tanzania, Wondi Mersie, Dennis Treacy, Tamado Tana from Haramaya University, Zara Shortt, and Sintu Alemayehu.

### **Muni Muniappan: Overview of the IPM Innovation Lab**

Muni outlined the history of the IPM Innovation Lab. The current program goes through Oct. 2019. We are working in seven countries, as follows:

Asia: Bangladesh, Nepal, Cambodia, Vietnam

Africa: Kenya, Ethiopia, Tanzania

Muniappan reviewed the eight current projects of the IPM Innovation Lab, as well as the major aspects of the program, which have included:

- Development of IPM components and packages for selected crops
- Monitor and develop management technologies for invasive species
- Long-term training
- Short-term training

He reviewed the IPM Innovation Lab package for tomato as well as what we know about *Tuta absoluta*, the South American tomato leafminer. He also reviewed the work on the papaya mealybug.

Finally, he provided an overview on the problem of the invasive weed *Parthenium* in eastern Africa.

### **Wondi Mersie: Biological Control of the Invasive Weed *Parthenium hysterophorus* in East Africa**

Wondi Mersie, with Virginia State University, reviewed the last phase of the *Parthenium* project as well as providing an outline of the next phase, which runs from July 1, 2015 – Nov. 16, 2019. It will operate in Ethiopia, Kenya, South Africa, Tanzania and Uganda. This phase of the project has just begun.

*Parthenium* is native to Central America. It has spread to Africa, Australia, South America and Southern Asia.

The plant is an aggressive invader. It reduces yield, displaces grass necessary for livestock, and is also a threat to biodiversity, as it can replace native plants.

Methods of *Parthenium* management include mechanical and biological control as well as IPM. We have focused on biological control. In order to do biological control, one has to obtain a permit to ensure that it's safe for non-target species, and one has to train staff.

Mersie noted that the project held a workshop on *Parthenium* ten years ago in Ethiopia, and he reviewed that event with photos.

### **Lorraine Strathie: Weed biocontrol quarantine facility at Ethiopian Institute of Agricultural Research PPRC at Ambo**

Strathie spoke about how biological control in Australia has worked. At least, she said, it has really helped. In terms of long-term control, biological control is essential.

She talked about the establishment of the quarantine facility at Ambo. All water exiting the facility is treated with chlorine, so that if any insects get in the water, they'll get killed on their way out. The plants are kept on tables to prevent ants from getting in. Furthermore, there are three doors between the lab and the exterior, to ensure that bugs don't get in or out.

*Smicronyx lutulentus* (Coleoptera: Curculionidae), a type of weevil, was introduced into the Ethiopian Institute of Agricultural Research's quarantine facility at Ambo on Dec. 13, 2015. *Smicronyx* is a tiny weevil that eats *Parthenium* seeds. The weevil is only two millimeters big.

In the post-presentation discussion, Muniappan noted that *Parthenium* also harbors a virus disease that can attack vegetable crops. Jacoby and Rubin talked about the difficulty of bringing in biocontrol agents. Strathie commented that it often takes time to persuade politicians that it's a good thing to do.

Keith Pierce arrived mid-way through the meeting, having come directly from the Addis Ababa airport.

### **Tuesday, Dec. 15 – Group travels to Wollenchiti**

The drive to Wollenchiti was punctuated by a stop at a flower-growing facility—Minaye Flowers. This concern exports 28 million flowers annually to Europe. This gave us exposure to how large-scale agricultural operations are conducted, what pests they deal with, and how they combat them. The place had eight giant greenhouses, and for each greenhouse, our guide said that they have one agricultural degree-holder who oversees it.

We lunched at the Kereyu Hill Resort, our hotel for the night, then in the afternoon, drove to Wollenchiti, the site where they raise the *Zygogramma* beetles used to control *Parthenium*. Keith filmed several interviews with various key people: Million Abebe, Dennis Treacy, and Sintu Alemayehu.

### **Wednesday, Dec. 16 – Group travels to Dire Dawa**

Wednesday was an all-day drive from the Kereyu Hill Resort in Adama (Wollenchiti) to Dire Dawa, in eastern Ethiopia.

### **Thursday, Dec. 17 – Workshop on Parthenium**

This day began the “International Workshop on Biological Control of *Parthenium hysterophorus* in East Africa.”

#### **Opening remarks by Wondi Mersie**

The workshop opened at 9:00, with Wondi Mersie, professor at Virginia State University and the PI for the *Parthenium* project, giving opening remarks. He thanked USAID for their generous support, and enumerated the partners in this project:

- Ethiopian Institute of Agricultural Research
- Ambo University
- Amhara Regional Agricultural Research Institute (ARARI)
- Haramaya University
- ARC-PPRC (in South Africa)

- CABI
- Kenya Agriculture and Livestock Research Organization (KALRO)
- Minister of Agriculture Food Security and Cooperatives (MAFSC) in Tanzania
- National Agricultural Research Organization (NARO) in Uganda

Muni then introduced himself and asked people from the IPM Innovation Lab to introduce themselves: Dennis Treacy, Van Crowder, Miriam Rich, Zara Shortt, Keith Pierce, Brhane Gebrekidan, and Maria Elisa Christie. The rest of the participants then introduced themselves, including Brhane Gebrekidan, who oversees the IPM IL's work in eastern Africa. Chemedha Fininsa, the President of Haramaya University, introduced himself.

Muni then introduced Dennis Treacy, member of the Board of Visitors of Virginia Tech and Executive Vice President and Chief Sustainability Officer at Smithfield Foods.

**Dennis Treacy, member of Virginia Tech's Board of Visitors, addresses group**

Treacy explained the governing body at Virginia Tech—how it works and what they do. He explained how research fits into the mission of the university, and expounded on *Ut Prosim*, the Latin motto that means, “That I may serve,” the guiding principle at Virginia Tech. This means serving the global community as well, he stated.

“There is no question that you care about what you do. At the board level, we care about that. The president has a program called Beyond Boundaries, where the university is exploring what Virginia Tech should be 30-40 years from now,” he said. “All of the work in Ethiopia is valuable and important, and appreciated by us back at Virginia Tech.”

Keith Pierce and Dennis Treacy left to see *Parthenium* in fields, and then headed on to the Dire Dawa airport to begin their travel back to the United States.

**President Chemedha Fininsa of Haramaya University**

Fininsa welcomed everyone. He noted that invasive alien plant species are one of the major threats to agro-pastoral communities in Ethiopia. *Parthenium* has become the worst invasive plant in Ethiopia. It was introduced in 1974 and again in 1980. It is suspected that *Parthenium* seeds were brought into the country with grain that was donated for relief aid.

The weed has dramatically reduced productivity and caused a severe loss of crops. No one gave attention to *Parthenium* in “non-important” land, i.e., marginal, unused land. That is where it took over, and then spread.

“I hope this workshop helps with management options,” Fininsa said. “This workshop is highly relevant in helping us know how to manage the weed.” He mentioned his appreciation for the support of USAID, Virginia Tech, Virginia State University, and Wondi Mersie.

Muniappan, Treacy, and Mersie then presented gifts to President Fininsa.

**Academic Vice President Nigussie Dechassa of Haramaya University**

The academic vice president of Haramaya University, Professor Nigussie Dechassa, welcomed everyone.

**Van Crowder, Executive Director of the Office of International Research, Education, and Development at Virginia Tech**

Crowder gave a short presentation explaining what OIRED does.

**Muniappan presents overview of the IPM Innovation Lab**

Muniappan explained the history of the IPM Innovation Lab; currently, we're in the 5<sup>th</sup> phase of IPM Innovation Lab. He reviewed our current projects (8) that we're implementing in this phase.

**Brhane Gebrekidan, Program Leader for the IPM IL's projects in Eastern Africa**

Gebrekidan presented a history of how we got started with *Parthenium*.

Gebrekidan served as the director of the IPM CRSP (as it was then known) from 1994 – 2002.

We (OIRED) won a project in Ethiopia (AMAREW) that was active from 2002 - 2007. Gebrekidan left the IPM CRSP to become the director of that project.

Wondi Mersie is from the eastern part of country. He has seen the spread of *Parthenium* from year to year. It was thus especially appropriate that he became PI of the "Management of *Parthenium* in Eastern Africa" project. With this project, they focused on biological control.

However, as we know, biological control alone will not do the job. It has to be an IPM strategy that includes biological control. In the last 10 years, we've made some great gains in biocontrol. For example, we established a quarantine facility at Ambo. We have released *Zygogramma* in the country. We need to continue this integrated approach.

**Wondi Mersie, PI of the Parthenium project and Associate Dean and Director of Research at Virginia State University**

Mersie talked about the program, the general problem of *Parthenium*, and a survey that they conducted. He talked about the significance of the problem: health issues (asthma and rashes) and the problems affecting cattle. The health effects seem to be more severe on females—is this because there are more women working with it?

The weed also affects biodiversity. There are many indigenous crops here, so this is a problem. The goal of the project is to abate the spread and impact of *Parthenium* in East Africa using natural enemies.

The methods of *Parthenium* management are mechanical, chemical, and biological.

Mersie reviewed the advantages of biocontrol:

- Relatively inexpensive
- Self-perpetuating / permanent
- Environmentally friendly
- No cost to the farmer
- No pest resistance problem

Among other things, the project wants to obtain permits to release *Zygogramma* and *Listronotus* in Kenya and Uganda. Also, it wants to maintain the quarantine facility, establish collaboration

with farmers, extension agents and local agricultural bureaus, organize meetings, and conduct workshops.

**Maria Elisa Christie: Gender Perspectives in the Implementation of the Parthenium Project in East Africa**

Christie has worked with the IPM CRSP for nine years, but not directly with the *Parthenium* project (yet).

Gender, Christie noted, is a social construction. It's what's expected from men and women in a given culture, context, time, and location. Christie explained the differences in meaning between "sex" and "gender."

Women comprise nearly half the agricultural labor force in developing countries. If women had the same access to assets as men, agricultural production would rise 20 -30%, according to research by the FAO. USAID says the same thing. We could then feed an additional 150 million people. Women are key agents of economic development.

USAID has a requirement that both men and women be equal beneficiaries of projects. Most importantly, Christie asserted, integrating gender makes sense, in addition to our moral and contractual obligations. And women's empowerment, Christie says, is a moral imperative. We have gendered impacts. They affect gender relations and men and women differently.

Some gender observations in development work: minority groups are always the ones who are doing the weeding around the world; there is a disproportionate representation of men in the agricultural sciences.

Women often make decisions relating to food crops. This makes their access to information, seeds, and technology very important. Also, they have specialized knowledge.

What we hope to learn (in this project):

- How is knowledge of *Parthenium* gendered?
- How is the management of *Parthenium* gendered?
- What is impact of *Parthenium* on the daily lives of women and children?
- How much time and labor do women spend weeding, and how does this change over the course of the project?
- Gendered space – whose space is affected by *Parthenium*, and how does this impact livelihoods?
- What are impacts of *Parthenium* on women and men?
- What are the constraints?

Christie says, if you ask only one question (in terms of gender), ask who does what? She also recommended:

- Take measures to ensure women's participation.
- Have a woman interview women.
- Women sometimes need more time to respond.

- Take women's multiple roles into account. E.g., you may have to come on weekends to interview people, not during the week. Come when it's convenient for the *farmer*, not for you.

Christie reviewed how to get women to participate, how to be sensitive to their levels of confidence and education. She also noted that it's important to create space for people to talk. Come with a blank page and let people explain things to you rather than asking them what you have determined is the right question.

### **Emebet Belete Negatu: Role and Contribution of Rural Women in Agriculture and Food Production in Ethiopia**

Negatu is the director for Gender, HIV/AIDS and Special Needs Issues at Haramaya University. She spoke about the importance of highlighting women's role and contributions in agriculture. In all developing countries, agriculture is an agent for growth. 83% of the Ethiopian economy is thanks to agriculture.

Women work between 13 – 17 hours a day (in developing countries). This work is unrecognized and under-valued.

Rural women in Ethiopia are the backbone of food production and are responsible for approximately 40% of agricultural activities.

In the question and answer session, Arne Witt asked how we define work. Christie answered that there is "productive" and "reproductive" work. Productive work has a market value.

### **Baruch Rubin and Tuvia (Toby) Yaacoby: Current Distribution of *Parthenium hysterophorus* in Israel, its Invasiveness and Control**

*Parthenium* invaded Israel from the contamination of imported grains used in a fishpond during the late 70s. The fishpond is in the upper Galilee region. They show a map of Israel and all the places where *Parthenium* has spread. "We are the closest country to Europe that is infested with *Parthenium*," Yaacoby said.

### **Birru Yitaferu: Ethiopian infestation of *Parthenium* in Amhara**

Yitaferu is the director general of the Amhara Regional Agricultural Research Institute (ARARI). Yitaferu gave a brief overview of the Amhara National Regional State and the Amhara Agricultural Research Institute.

Yitaferu noted that crop productivity has improved over the last 20 years thanks to research.

### **Muo Kasina: Impact of *Parthenium* on Kenya's National Parks**

Kasina is the centre director of the Sericulture Station under the Kenya Agricultural Livestock Research Organisation (KALRO).

Kenya and the new constitution (since 2010). The main difference is: There are now two levels of governance—national government, and county government. (There are 47 counties.)



The Kenya Agricultural Research Organisation was created in 2013 by an act of parliament. It was operationalized in 2014.

Kasina said that the way forward for Kenya on *Parthenium* is:

- Economic analyses on the impact of *Parthenium* on the country's economy and people's livelihoods.
- Determine the spread of *Parthenium* in Kenya.
- Model the risk of its spread and colonization densities in 50-100 years.
- Understand why the spread is low/any bioagents affecting it and/or farming systems.
- Set up biocontrol production regimes for sustainable releases.
- It looks like it requires a long-term strategy for biocontrol.

In the question and answer session, Arne Witt noted that *Parthenium* was reported around Arusha about five years ago; it's spread seriously since then. The rate of spread has been rapid. Farmers don't report it as a problem, because they see it as just another weed. To build up allergies in cattle can take 10-20 years.

#### **Arne Witt: Why Not Biocontrol? Opportunities and challenges**

Witt is the director of invasive species for Africa for CABI.

Witt outlined the very serious problem of invasive species: 80 % of people around the world are farmers. The impact of invasive species globally is \$1.4 trillion worldwide. Is manual control going to be cost-effective for large infestations? What about chemical control? No. There are implications of doing that.

Africa only uses 4% of global pesticides, but this is bound to increase. There's a link between pesticides and climate change. The industry that makes pesticides, in the making of them and their transport, contributes to climate change.

Hedges are a major source of invasives throughout the continent.

Biocontrol is cost-effective. One dollar invested in classical biological control (CBC) returns \$250.

But there are obstacles to CBC. What are they?

- little or no awareness
- lack of coordination among sectors
- process to release agents can involve *tons* of bureaucracy

We need to do more cost-benefit analysis, because what influences governments is financial costs. If you can say, "*Parthenium* is costing us \$100 million/year," this will have an impact. Also, we need to publish in international journals. We need governments to support biocontrol, not just donors.

Most countries are signatories to the IPPC – International Plant Protection Convention. This should help exert some pressure on them. But ultimately, we need more awareness. We need to take action *now* to manage invasive species.

**Samora Macrice: Current status of the released *Zygogramma bicolorata* in Tanzania**

Macrice is with Sokoine University of Agriculture, Plant Invasion Biology and Management. He can be reached at [smacrice@suanet.ac.tz](mailto:smacrice@suanet.ac.tz).

*Parthenium* was recorded five years ago, in 2010, in Arusha. It's now causing a lot of havoc in the ecosystems: croplands and rangelands. *Zygogramma* has been released mostly around the Arusha airport. The releases have not been promising so far. This could be because of late rains. Beetles were released on green plants growing along streams and rivers. About two weeks later, there were flash floods, and most of the beetles were washed away. So the timing was unfortunate.

We may need to do a more careful and timely release of *Zygogramma*. We hope to introduce *Listronotus* as well. We plan to monitor and follow up closely.

**Lorraine Strathie: Establishment of *Zygogramma bicolorata* and *Listronotus setosipennis* on *Parthenium hysterophorus* in Australia and South Africa**

Strathie is with the Agricultural Research Council-Plant Protection Research Institute in South Africa.

*Parthenium* is a problem for animal grazing, and causes skin allergies. We are trying to reduce the weed density, not eradicate it, as that's not feasible. In 1993, there was widespread establishment of *Parthenium* in Australia. She gave the example of India. Biocontrol was very effective. Native vegetation was re-established.

In certain cases, establishment was limited. This could have been due to:

- Egg predation
- Parasitism
- Soil type and moisture

Perhaps we need to mass rear, and do larger releases.

*Listronotus* is now widespread (in South Africa). It appears with the first rains. It has established well along river systems, but doesn't spread rapidly.

Last year, South Africa developed a strategy to manage *Parthenium*. The country is now divided into different management zones.

Conclusions:

- Scale up
- Widespread releases
- Strategic use of agents
- Focus more on *Listronotus*.
- Increase biocontrol awareness and set up refugia

- Conduct regular monitoring, evaluation once established
- Research on predation, improved release techniques.

**Million Abebe: Mass rearing of the biocontrol agent, *Zygogramma bicolorata* in Ethiopia**  
Abebe explained the proper way of raising *Zygogramma*.

At 5:05 pm, the meeting adjourned for the day.

### **Friday, Dec. 18 – Workshop on Parthenium, continued**

Wondi opened the second day of the meeting at 8:30 am.

#### **Lorraine Strathie: Host-range evaluation of *Smicronyx lutulentus* under quarantine – a potential new bioagent for Ethiopia**

*Smicronyx lutulentus* is a seed-feeding weevil that originated in Mexico. The larvae feed inside the seeds. It has been tested on crops in Australia and worked fine. They didn't feed or lay eggs on those crops.

In 1980, it was released in Australia. The first release was in January of 2015. We have released 11,500 weevils so far. Rearing and releases are ongoing. It is the fourth agent to be released in South Africa. It's highly host-specific. *Smicronyx* was released to the quarantine facility in Ambo this past Sunday [Dec. 13, 2015]. "It's the most host-specific agent I've ever worked on."

In the question and answer session, Arne Witt noted that one mature *Parthenium* plant can produce 10,000 – 20,000 seeds. "So, is it worth using this agent if it's only 99% effective?" Strathie said yes, it's still worth it. "Because we use it in combination with other things." She noted again that it's easy to rear, and, it's very host-specific.

Baruch Rubin asked what happens if you put *Smicronyx* with *Listronotus*. Is there a problem? Strathie said no, that there's no competition. They are not competing in the same niche. One feeds on flowers and one on seeds, etc.

#### **Wondi Mersie: Scaling up mass rearing of the biological control agents *Zygogramma bicolorata* and *Listronotus* for *Parthenium* in Ethiopia**

Water is absolutely necessary when you establish a rearing facility. It is used to keep the biocontrol agents safe. (Hence the water tank at Wollenchiti.) It's important to have local workers be the ones to work on the rearing, because in this way, they'll be more invested in the process and will take more ownership.

*Zygogramma* took more than eight years in Australia to get established, Mersie noted. So, it's going to be a long-term effort.

#### **Tamado Tana: Collecting baseline data before the release of biocontrol agents: below and above-ground flora**

Tana presented on the topic of collecting data prior to releasing biocontrol agents.

In the question and answer session, Arne Witt noted that impact varies by how long an area has been invaded. Muni Muniappan mentioned the benefits of setting up quadrants and markers to help you monitor what's going on. You'll get an idea of what is there. You'll get spatial as well as temporal data.

Witt also mentioned that livestock is going to have a big impact, and asked if Tana was going to exclude livestock in his trials. Or not? "It's another factor to consider," he said. Finally, Witt said that we need an integrated approach to managing *Parthenium*; we can't just use biocontrol.

#### **Samuel Asafa: Distribution of *Parthenium* in Oromiya**

Asafa presented information he had obtained from the Bureau of Agriculture, which dated from 2012 on the status of *Parthenium* in the region. Out of 18 zones in the region, all are infested. The main impact of *Parthenium* on crops relates to its allelopathic properties.

Crop yield losses have been recorded. The *Parthenium* weed also significantly affects livestock production by affecting grazing land, animal health, milk and meat quality, and the marketing of pasture seeds and feed grain.

Witt wondered if we can measure impacts in a more scientific way. The science is critical in obtaining donor support. E.g. with the milk. "If you can prove it scientifically [that *Parthenium* has a deleterious effect on milk] and then publish it—that's more helpful," he said. "The impacts on honey, for example. Is it a perceived impact or a real impact? We need stronger data to support some of these claims. The donors always ask me—you want money? Show me the experiments."

Brhane Gebrekidan commented that if we can connect *Parthenium* with climate change, maybe there would be a way of getting large resources to tackle this problem.

#### **Zara Shortt: The Financial and Administrative Processes of the IPM Innovation Lab**

Zara Shortt reviewed how the financial side of the program is set up, and what is important in helping it to run smoothly, and in ensuring that projects obtain the funding they need.

#### **General discussion**

Following this, there was a general discussion about a variety of things: gender, gender-related skin rashes, and what *kind* of gender research should be done.

Emebet Negatu asked if there has been any research dealing with [*Parthenium* and] gender. "I haven't seen any." Mersie responded that there has been some research done at Haramaya University.

Christie asked if there were more examples that women are more susceptible to allergies. Witt concurred. "Regarding the skin rashes, we always see photos from India that make the rounds. Why are we not seeing other images – of other people?" Mersie responded that studies on women and gender will look into the amount of time they spend on weeding *Parthenium*, and the impact on their daily lives.

Strathie suggested that along with the ecological research, one could do gender research as well, for example, at Haramaya University.

Witt noted that in terms of *Parthenium* in Ethiopia, they've been doing research on it since 2005; so they're farther along than some other countries.

Muniappan pulled together some general observations based on the discussions. One is: the importance of impact assessment. Is there an economist to do the impact assessment? How is it benefiting the population of the country? We need to look into this.

Then, yesterday, Toby Yaacoby said that some basic information is not available. Some of these issues could be looked into by graduate students.

Witt noted that one could do something in a lab, e.g. re *Zygogramma*, and look at pollen production. One area we should be looking at is a connection between *Parthenium* and malaria.

Van Crowder asked if there was a plan to train extension agents and technicians in dealing with *Parthenium*. What's the link with the university, and how does it engage with that and the Ministry of Agriculture? Does the university have an outreach role?

President Chemedha Fininsa of Haramaya University said that yes, universities play a role. Also, the construction industry has also contributed to the spread of *Parthenium*. Transportation vehicles are major distributing factors.

Witt noted that Ethiopia is facing significant problems as regards invasives; it's not just *Parthenium*. "We need to be aware of the situation so that we don't just control *Parthenium* and then something else takes its place. We want to look at whole ecosystem management plans. We need to have something broad at the policy level. Rangeland management—overgrazing, is a serious problem. We have to do something to improve invasive species in Ethiopia at a policy level. Time is not on our side. I'd like to see things being done about awareness. All of our awareness is focused on the hotspots, but we need to create awareness in areas where it [*Parthenium*] is not yet. We're not really doing that. We need to see how we can control other aspects, not just biocontrol."

Witt continued, noting that CABI has a new initiative. They are focusing on regional problems as well as promoting IPM and classical biocontrol. Ethiopia is going to be part of this whole initiative. "Regions need to start working together. For that, we need biocontrol policies that are similar for all regions, so that we can develop strategies across the region, instead of doing it in isolation."

Mersie thanked everyone for participating in the workshop, and Haramaya University for organizing the workshop. He also thanked Dennis Treacy, Virginia Tech's board member, as well as Dr. Crowder, for coming and being a part of the workshop. "I can't say enough about Muni. Without him, we couldn't have done all our work. I'm grateful for all he's done for us." Mersie also thanked Brhane.

Muniappan thanked Wondi Mersie for organizing the workshop. He noted that six countries participated in this meeting. He closed the meeting by thanking everyone for participating.

The workshop closed at 11:30 am.

### **Afternoon trip to Haramaya University**

In the afternoon, a group of workshop attendees traveled out to Haramaya University to tour the rearing facility they had there for the biocontrol agents: *Zygogramma*, *Listronotus*, and *Smicronyx*.

A number of us (Muniappan, Shortt, Strathie, Rubin, Ibrahim, a grad student, and myself) had a private audience with the president of the university.

And, we received a welcome surprise: The President announced that he gave a grant from the university in the amount of 100,000 Birr (roughly \$20,000) to our project to study the biocontrol of *Parthenium*. This represented a vote of support for the work that we are doing, and was a fitting way to end the trip.

### **Saturday, Dec.19 – Return travel to the United States**

On this day, Muni, Zara, and I went to the Dire Dawa airport to begin our return travel. Muni and I arrived back in Blacksburg on Sunday afternoon, Dec. 20<sup>th</sup>.