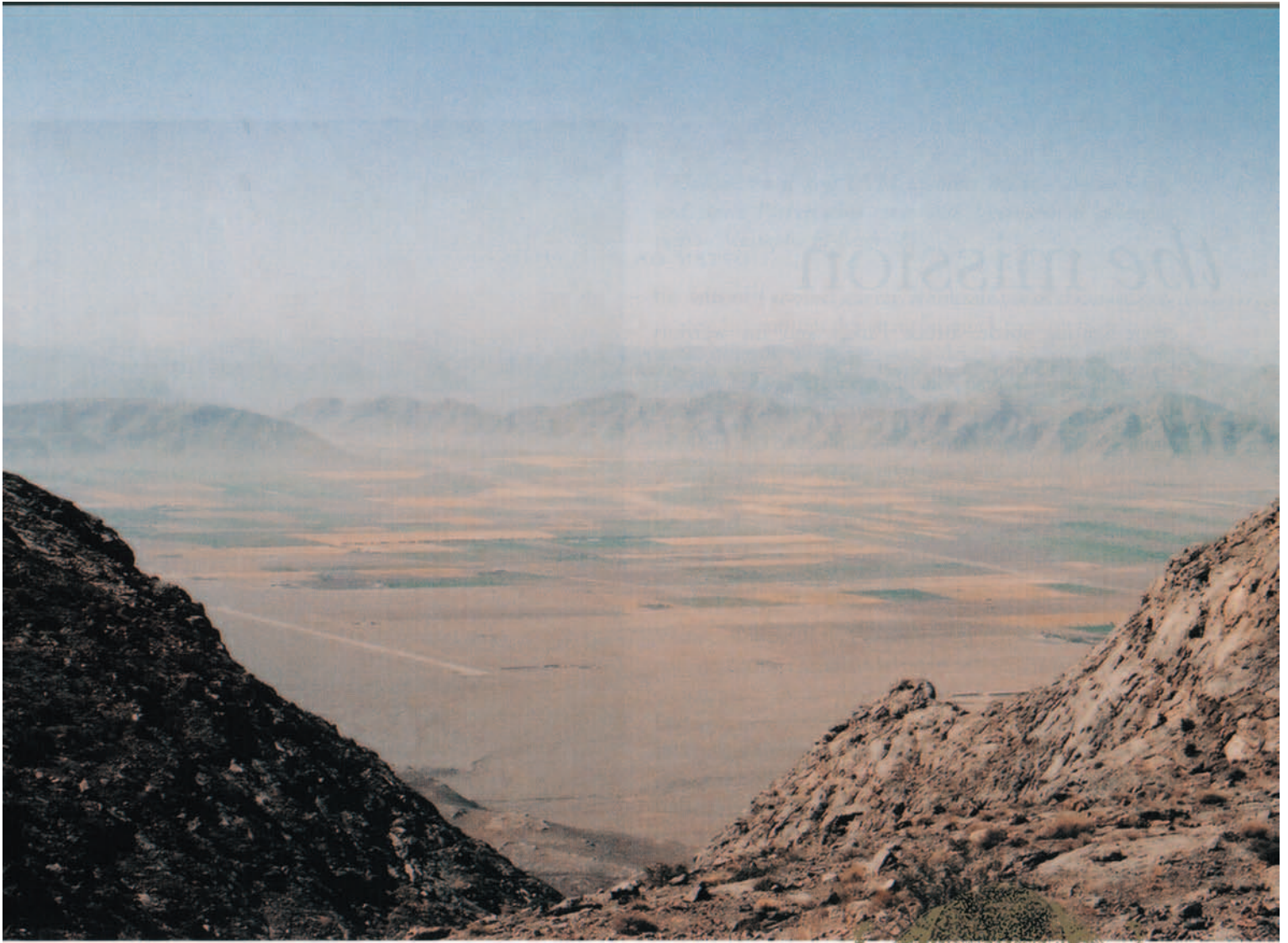


One of the world's foot soldiers, who may well be on his way to making General in the war against biological invaders, Bruce Parker says, "We feel our work has put UVM on the map from North Africa to the former states of the Soviet Union. People there know about the University of Vermont." The putative General's army is small and handpicked. But, despite the range and power of their many opponents, he and his troops are formidable front-liners in the battle against insect pests that threaten food supplies and fledgling export economies in countries of desperate need.

*In the field or at UVM home base, Professor Bruce Parker leads UVM Entomology Lab work that stretches around the globe from the sugarbushes of Vermont to the arid plains of Iran.*





# Enemies *from* Within



*by* LEE GRIFFIN

*photography by* ROSE MCNULTY

# the mission

OFTEN ON THE ROAD — more likely, in the air — on yet another biological crime-fighting sortie, Bruce Parker and his warriors regroup regularly in UVM's Entomology Lab on Spear Street. Where, despite the constant hustle that their schedules and grant-getting demand, these otherwise peaceable souls willingly emerge from their paper-stacked, refrigerator-carton cubbies to talk about the Middle East, Africa, pesticides, and other topics near and dear to them. Toss out a question, and you might take their voluble, overlapped responses for competition. You'd be wrong. What Parker, Margaret Skinner, and Michael Brownbridge value most is teamwork. If they cut off one another in mid-sentence on occasion, it's to finish the thought, add an anecdote, or pump-up the response with a passionate stance about the places they've seen, the people they've met, and the insect terrors they're after.

Of late, their work has brought the researchers to the Middle East and Africa, where seemingly endless news of strife and hunger casts ironic shadows on the historical significance of these lands as the fertile cradles of civilization and agriculture. The enemies are multiple, each one compounding the problem, each one complicating the solution. And, some of the lowliest enemies can be the toughest. To an outsider, the problems seem overwhelming.

"The first time I went to Ethiopia," says Brownbridge, a Briton by birth, "I wondered 'How the hell can I make a difference?' You see how poor these people are first-hand, and you see every fifth truck filled with U.S. grain. What does it matter what I'm doing?" But, with subsequent visits, you get past that, he says. "In order to get sustainable development...it's got to be internal...not me going in, doing something, then coming out."

The researchers abiding commitment to improving international agriculture, Skinner says, includes their work abroad, collaborations with other scientists, and mentoring students from UVM and other countries. She understands how life-changing working or studying in another country can be. As an undergraduate at Ohio Wesleyan, the Vermont native had to change her major from art to sociology in order to study in Beirut. It was the defining moment of her undergraduate education and just the beginning of international work for Skinner, who also spent eleven years, three of them in Northern Ireland, working with mentally ill people.

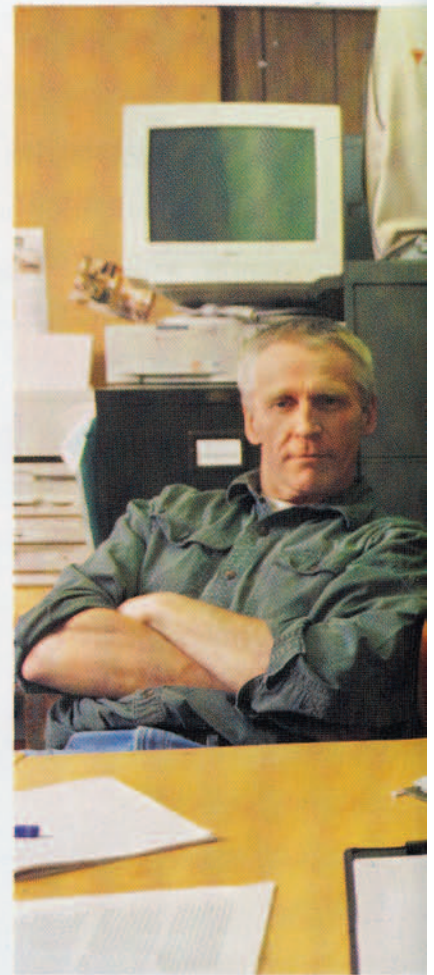
Parker's Pied-Piper-with-attitude M.O. overcomes an initial curmudgeonly impression. His global connections

and unabashed passion for the work have enticed professionals like Brownbridge and Skinner to join the team and have influenced a host of students to take the plunge into other worlds. He occasionally revs up conversations with coach-like enthusiasms, such as, "We are a dynamic, innovative group with a very positive, can-do attitude. We don't wait around — we go for it."

## THE ENEMY

The team also excels in another part of its mission — collaboration with other scientists. They currently are working with colleagues in countries of great need to dismantle a core problem — staple crop devastation by insect pests. The order is tall, the collaborations spectacularly refined, and the good guys are gaining.

For the past eight years, working in Syria, Iran, Central Asia, and, recently, in Afghanistan, the entomologists have set their caps to undo the Sunn pest. Only a half-inch long, the dun-colored insect is a formidable and — for farmers trying to combat it — a mortal enemy. The Sunn pest damages cereal crops, especially wheat, by feeding on all parts of the plant, but the greatest impact occurs when it feeds on the developing grains. To enhance its digestive ability, it injects an enzyme through its saliva that breaks down the grain's gluten, which, if the grain were milled, would render the flour unusable for baking.





*Collaboration is key: UVM scientists Michael Brownbridge and Bruce Parker often team with international colleagues such as Mustapha El Bouhssini.*

has attracted another enemy, wholesale use of chemical pesticides. In countries desperate for quick fixes on these problems, officials often see pesticides as magical cures and because the government usually pays for the cure, the farmer willingly uses the chemicals. "You have to do it (spray) every year," El Bouhssini says, and the chemicals "kill bees, pollute water." Skinner adds, "Using insecticides on the Sunn pest has disrupted the natural enemy complex, because they also are killed. ...And, Sunn pest can develop resistance to pesticides."

#### THE WEAPON

The skirmishes in which the UVM trio engages pit naturally occurring enemies like fungi against insect pests, a key component in a process known as Integrated Pest Management. They and the other ten scientists and graduate students in the Spear Street lab develop effective biological agents to control or destroy insect aggressors in agriculture, forests, and greenhouses. As the name suggests, IPM uses a variety of approaches, but the goal is to control the damaging pest without damaging anything else and to develop those controls so that farmers, foresters, and growers can use them, economically, and in a way that is environmentally sound and sustainable.

Their research on fungal pathogens as part of an IPM approach has pitted them against such enemies as the hemlock wooly adelgid, which originated in the Far East and traveled westward, without any natural enemy to keep it in check; the pear thrips, which severely damaged sugar maple trees in Vermont in 1988 and 1990; and the western flower thrips, which is a pest of global significance in flower and vegetable crops.

Parker and Co.'s investigation into pear thrips is a model of the IPM approach. The researchers studied the pest in its origins and sought and identified pathogenic fungi that worked against the thrips. Then they developed a way to mass-produce the fungi using old maple leaves, thus arming Vermont sugar makers with grow-their-own, low-tech ammunition. The scientists' international reputation is a direct outgrowth of their continuing work to aid Vermont and other U.S. farmers, foresters, and growers.

Brownbridge currently is wrapping up work on two USAID projects in Africa. He worked with Kenyans to develop a sustainable IPM program that small farmers with few resources could use to defeat the African armyworm, a

"We're not talking about something incidental," Parker says of the Sunn pest, which he notes is expanding its range and is now also on the border of Pakistan, a country of 153 million. "We're talking about a major, major problem, a major reducer of yield, of quality in wheat primarily, but also barley."

Longtime colleague Mustapha El Bouhssini, an entomologist from Morocco who lives and works in Syria, says, "If as little as 2 or 3 percent of the grain in a crop has been affected [by the Sunn pest], the grain is unusable for baking." The Sunn pest (*Eurygaster integriceps*) affects about 37 million acres annually, and the bill for using chemical insecticides against it each year is more than \$40 million, he says.

The implications for a country like Afghanistan are enormous. In addition to its natural hazards of drought, earthquake, and lack of potable water, 25 million people depend on the 12 percent of arable land, and the pest is eating its staple crop. Syria's landmass is primarily desert. Slightly larger than North Dakota, it must feed 18 million people. Twenty-six percent of its land is arable.

And, in the category of the cure is worse than the disease, eradication of the Sunn pest and other serious pests



## The Sunn pest threatens cereal crops in a region that can scarcely stand another hit on limited food supplies.

migratory pest that ranks second only to the voracious locust in the level of damage it causes in staple food crops and arable grazing land. He's also completing work with the Ethiopian Agriculture Research Association to train citrus growers in the use of biological controls and to assist the fledgling greenhouse industry.

For the past eight years, the entomologists have dedicated their vast experience and knowledge of IPM practices to eradicating the Sunn pest. Phase one of the project took about three years, during which the researchers collected fungi that occurred in the pest's overwintering sites throughout its whole range — Syria, Turkey, Iran, Uzbekistan, and Kazakhstan. "The insect lives probably nine months of the year in...the foothills of the fields, under litter," (dead leaves and twigs), Skinner says. They found some fungi on the cadavers of the Sunn pest, but lab tests were needed to determine if the fungi killed the pest or were merely opportunistic.

When the lab results proved positive, it was back to the field, where — if the fungi didn't disappoint — the scientists would devise a way to apply it. "One advantage of using the overwintering site for treatment," Skinner says, is that there is time for it to work, as opposed to using it in the wheat fields, when the damage may already be done. At first, Skinner and Parker took dry fungal spores, mixed them with water and sprayed the mixture on the Sunn pest's overwintering sites. Local residents were quick to teach them a lesson that Skinner translates into American vernacular: "Hey you guys, we're in the Middle East. We don't have a lot of water."

They focused instead on using a nutrient-based granular formulation, which means, Skinner explains, "growing the fungus on a solid substrate like rice or millet." Population is in an abundant supply, so these countries "can pay someone to throw the inoculated base around the sites," she says. The biggest question was whether the formula would penetrate the litter to where the insects snoozed.

Within a year, they had the answer. The fungi had grown all over the litter and — despite a rainy winter and a summer with 115-degree temperatures — the fungi continued to grow and kill the Sunn pest. Parker says getting the fungus to persist is all-important. "Next season, new insects will go there and will be killed, and what you've got is sustainable."

### THE COALITION

Parker, Skinner, and Brownbridge are not danger junkies, but they don't share the fears many of us might have in traveling abroad, particularly in the Middle East. They're also not alone. "We are very well taken care of," Parker says. "We work with one of the finest international institutions in the world. He adds: "I had my family there [Syria] for a whole year during sabbatical. I was in Lebanon during 9-11. We work in Iran — we're 100 percent supported from the time we reach the Iranian airport. We were well taken care of in Afghanistan," he says, where he and Skinner worked just south of its politically unstable capital, Kabul, this past year. However, the hotel they stayed in was bombed recently, he concedes.

The lubrication for such smooth sailing in potentially troubled waters is ICARDA, an overarching international organization dedicated to improving the welfare of people in the dry areas of the developing world through research and training to increase local productivity. The International Center for Agricultural Research in the Dry Areas, its full name, is headquartered in Aleppo, Syria. "This isn't a dinky place," Parker emphasizes. "It's a huge facility with expertise from all over the world." El Bouhssini says about 45 nationalities are represented among 70 or so scientists and grad students from all over the world. "We have about 500 support staff and thousands of dailies that help on the farm."

El Bouhssini, one of ICARDA's senior scientists, has worked with UVM's entomologists for eight years. He also spent the fall semester at UVM deepening his knowledge of IPM. "When we started this association, the concept of IPM was completely new in the region, so a very interesting area for us," he says. Of the Sunn pest project, he says, "I am amazed at the progress in a relatively short time."

Referring to ICARDA, Parker says, "All the scientists there are working on a single goal — to improve the quantity and quality of crops in the developing world to feed hungry people. ...Our little niche is IPM, and we're part of the scientific staff when we're there. We know the institution and region, and before we go, it's outlined exactly what we're going to do."

What they do is fairly intensive. Former graduate stu-



*Entomologist Margaret Skinner and colleagues write and spread the gospel of pest management approaches that are both environmentally sound and economically sustainable.*

“There were about 25 men at the conference,” Parker says, “and they all cracked up.”

#### **THE VICTORY**

With world population doubling every forty years, no end in sight of civil strife and war, and the United States pushing chemical insecticides throughout the world, the ICARDA and UVM scientists won't soon be out of challenges. But, the four find many reasons to be optimistic and encouraged about their mission.

Skinner, angry as she is at the deception of the pesticides-cure-all approach, sees hope for reversing that and for a more peaceful world

through international experience. “People don't understand that Syria is made up of...real nice people, not dangerous terrorists. ...The more interactions we have, the more we're going to get along.”

dent Jane Stewart, who worked in Syria with Parker and Skinner, says fourteen-hour days in the lab and the field were the standard. The group had only five days off in the six weeks she was there. Her memories, like all the UVM researchers, return often to the people. “Everyday they (the local people with whom she worked in the field) would invite me to eat with them and offer clothing when the temperatures dropped. It snowed a couple of days while we were in the field, and all the women had on their feet were plastic shoes, kind of like jellies. ...I had on gloves and boots and a good rain jacket. They tried to give me clothing. The women were amazingly tough and smart.”

Brownbridge believes the strict rules set by the European Union on the way agricultural imports are produced will have a salutary effect in emerging export countries like Ethiopia. Growers there will benefit from rules on “fewer pesticides, mandatory safety equipment, minimum salary requirements, better housing standards, and access to health care,” he says. “The positive effects ripple out to the whole community. A farm I went to employs 2,000 people, each married, with kids...there are the contractors and suppliers and their families.”

El Bouhssini doesn't have to look farther than the farmers he works with and for as confirmation of all their work. “Farmers are changing, participating, are adopting new technologies,” he says. And the best news of all, he says, “This new approach is working and is better than the old.”

Skinner, often the only woman in a working group, echoes Stewart's sentiments. “People are so nice in the Middle East. I haven't had any bad experiences. They don't like what's going on with Bush, but they are friendly, curious, and like American style...the fact that we're appreciative and we treat people like people, not on a class basis.”

Parker believes they're close to winning the Sunn pest wars. “We're looking at potentially nine months to a year now when we've got this part of the problem licked, which is fantastic.”

In respect for different cultural mores, Skinner says, she wears clothing appropriate to each country. “In Syria, you can wear anything you want. I wear more than I'd wear at home, no shorts or short sleeves, and I wear a skirt or pants. In Iran, I wear pants and a headscarf at all times. I wear a jacket or coat that comes down to below my knees.” At a conference last year in Iran, Skinner, the only woman, unwittingly tested Middle Eastern tolerance for liberated Western women. While she was presenting, her headscarf slipped off. Her expletive (deleted) was decidedly not within the culture's mores for women, but it broke the ice.

There won't be a “Mission Accomplished” banner hanging on their lab, and the entomologists will remain anonymous to almost all their benefactors. But the effects of this collaborative project will ripple through many countries and will be a victory on the magnitude of a world war détente.

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**VQ**