

**Notes from a Rogue entomologist****Grasshoppers and the mystery of the Rocky Mountain locust**

BY RICHARD J. HILTON

What do the American bison, passenger pigeon and Rocky Mountain locust have in common? Two hundred years ago, they roamed the central part of North America in huge herds, flocks and swarms, but by the end of the 19<sup>th</sup> century they were all on the verge of extinction. While hunting played a role in the extinction of the passenger pigeon and the near extinction of the American bison, the disappearance of the Rocky Mountain locust seems to have been the result of massive habitat change that occurred in North America during the 19<sup>th</sup> century when the continent was populated by new settlers who significantly altered the environment.

The forests of the east were cleared and the open prairie was fenced and plowed. Lewis and Clark made their journey across the Rocky Mountains to the Pacific in 1804-06. By 1869 the first transcontinental railroad was completed and the Lincoln Highway, the first road to span the continent, is celebrating its 100<sup>th</sup> anniversary this year. The change was so rapid and overwhelming that it is no surprise that many species were not able to adapt to the new reality.

However, the example of the Rocky Mountain locust is truly remarkable. This species of grasshopper has two "claims to fame" that seem hard to juxtapose. First, a swarm of these insects in 1875 was listed by the *Guinness Book of World Records* as the largest concentration of animals ever observed; it is estimated that the swarm was comprised of 3.5 trillion grasshoppers. Yet, in 1902, the last live specimen of this insect was collected, making it the only insect

pest that is known to have gone extinct.

The Rocky Mountain locust was technically a grasshopper. The term locust refers to a type of grasshopper that swarms, and it is this swarming form, which is physically different from the normal morph, that is called a locust. These dense aggregations or swarms can be incredibly destructive to crops and are one of the classic biblical plagues. Many stories from pioneers, including a famous one written by Laura Ingalls Wilder, recount the tale of a farm being blanketed by a swarm of locusts that devoured every green thing in sight, leaving only devastation (and a lot of insect frass) in its wake.

The morphing of grasshopper to locust has been extensively studied and seems to be a response to crowding. When the population increases and becomes dense, the locust morph starts to predominate. These insects are programmed to aggregate and move, which results in the swarming behavior. The locusts also eat and breed at a greater rate than their normal grasshopper form. Interestingly, the physiological basis of this change is due to an increase in serotonin level, which makes the grasshoppers aggregate even more, thereby creating a positive feedback loop.

It should be noted that only a few grasshopper species have an associated locust form. Although most grasshopper species are benign, if the population is high enough they can be serious pests, particularly in rangeland. According to the Oregon Department of Agriculture (ODA), which regularly does a grasshopper population survey in eastern Oregon, a grasshopper density greater than eight per

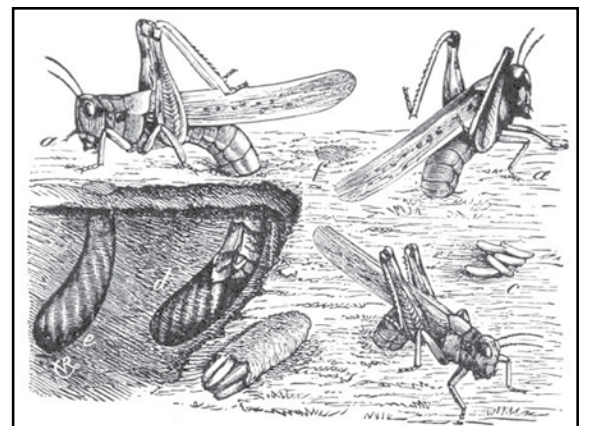
square yard is considered to be an economic infestation. In 2012, 3.5 million acres were surveyed and over a third of the acres had an economic infestation level. In the Klamath marsh, the ODA participated in one program last year where over 8,000 acres were treated to control grasshoppers.

Jeffrey Lockwood is a grasshopper guru (his book *Locust* is a comprehensive look at the Rocky Mountain locust) and he relates the story of when he first began to study grasshoppers and decided to videotape them to quantify how grasshoppers spend their time, e.g., eating, molting, mating, laying eggs. However, after watching them for many, many hours, he did not have to analyze the tape, he already knew what grasshoppers did most of the time...nothing. Instead of maximizing their fitness by eating and reproducing as much as possible, they spent most of their time just sitting and doing nothing, hence the title of his first book, *Grasshopper Dreaming*.

There are many local grasshoppers to keep an eye, and ear, out for. The band-winged grasshoppers are very distinctive and noisy. This sub-family of grasshoppers can make a loud snapping noise when they fly—I heard a very loud one up at Crater Lake last year at the top of Watchman Peak and encountered another on Pilot Rock this summer. These insects blend into the rocks and ground when they are at rest, but



A band-winged grasshopper. Photo: Kathy Keatley Garvey, <http://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=5887>.



Rocky Mountain locust laying eggs. Illustration by C.V. Riley, 1877, <http://bugguide.net/node/view/380281>.

when they take flight their brightly colored hind wings unfold and they can let out a raucous and telltale staccato, which will not only get your attention, but also serves to attract the attention of the opposite sex.

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