Mormon Crickets: A Brighter Side

Charles MacVean

In a recent appraisal of Mormon crickets (*Anabrus simplex* Haldeman), Raffelson (1989) reminds us that these insects are a subject of great concern and dislike among Western ranchers and farmers. Dating to the early encounter in 1848 between hordes of this insect and Mormon settlers in the Salt Lake Valley, sporadic outbreaks of crickets have indeed caused severe damage to crops, especially wheat and alfalfa (Cowan 1929, Wakeland 1959). However, on open rangelands, where most cricket populations are found and where most control efforts have been and continue to be focused, damage to forage plants has been difficult to assess. Serious losses were documented only during the "dust bowl" era of the 1930's in a few, localized sites which suffered from drought and overgrazing in addition to high cricket densities (Swain 1944).

In northwestern Colorado and northeastern Utah, bands of crickets are again present in the high-density, "gregarious" phase. My studies (MacVean 1989) suggest that Mormon crickets are inflicting little harm to range forage plants. In response to Raffelson's (1989) welcome challenge to researchers of insect pests, I offer an informal summary of recent findings concerning damage to rangeland by Mormon crickets, and the use of natural parasites for control of these insects. Together, they suggest that the threat posed by Mormon crickets is not as great as many would fear.

As noted by Raffelson (1989), Mormon crickets are omnivorous insects, feeding on over 400 species of food plants (Swain 1944). Crickets are known to prefer succulent forbs to grasses, which partly explains why cultivated crops such as alfalfa are more vulnerable than rangeland plants (Cowan 1929, Swain 1944). Bands of crickets travel long distances by walking, feeding as they go, and thus do not usually occupy any given rangeland site for more than 3–4 days. Individuals within the band pause to eat while others move on. This process continues in a sort of leapfrog manner so that feeding is spread out over large acreages, on many different species of plants.

To determine which plants were most important in the insects' diet, I examined the gut contents of crickets collected in various stages of development, from early nymphs (immature stages) to mature adults, in the vicinity of Dinosaur National Monument (Colorado and Utah). The results were both surprising and encouraging. In rangelands containing a mixture of grasses, forbs, and shrubs, grasses were a minor component of the nymphal diet, accounting for less than 20% of the food eaten by the average individual. Most of the ingested food consisted of forbs, a finding that agreed with previous observations reported in the literature. However, examination of the gut of adult crickets revealed an unexpected dietary switch during the early adult stage from forbs to big sagebrush. Over 90% of the adults' diet was made up of sagebrush, with only traces of grasses, forbs, or other crickets. Thus, the adult insects, which are potentially the most damaging (Cowan and Shipman 1947), fed on one of the least desirable plants. These results imply that crickets should not compete seriously with domestic livestock for forage.

To judge the economic impact of crickets on rangelands, an estimate of forage consumption is necessary. The monetary value of forage lost in a given area can then be compared to the costs of controlling the insects to provide a cost/benefit ratio. I obtained such estimates of consumption in northwestern Colorado by measuring the dry weight biomass in experimental plots in which known numbers of crickets had fed for a known length of time and comparing it to the biomass of paired plots without crickets. The predominant grasses in the study area were western wheatgrass, needle-and-thread, Sandberg bluegrass, and bottlebrush squirreltail, while the dominant forb was arrowleaf balsamroot. Over the course of a field season, crickets confined to the experimental plots consumed about 25% of the available forage. However, most areas are only visited by bands of crickets for a few days each year (Swain 1944), and a realistic estimate of damage must be scaled accordingly. The predictions from the data are that a typical band of Mormon crickets (present for 4 days at a density of 10 insects/m^2) would remove approximately 5% of the available grass forage, and 4% of the arrowleaf balsamroot. The plant suffering the worst defoliation is a minor forb, western groundsel, with a 16% loss in dry-weight biomass.

These levels of damage are far lower than those predicted in the Mormon cricket literature, such as 90% removal of available forage by crickets occurring at 12 insects/m^2 (Cowan and Shipman 1947, Raffelson 1989). While such estimates of catastrophic damage were commonly made during the 1930's and 1940's, they were rarely based on quantitative field methods for assessing biomass losses or cricket abundance. Consequently, useful laboratory estimates of consumption (Cowan and Shipman 1947) were misapplied to field situations, resulting in misleading predictions of damage in areas currently infested by Mormon crickets (MacVean 1989).

The current value of federal rangelands is often below one dollar per acre (estimated by leasing costs), whereas insect control measures represent several dollars per acre (Torrell and Huddleston 1987); therefore, the losses revealed by my studies are insignificant and do not warrant control campaigns. However, it must be borne in mind that under different range conditions (e.g., drought or sparsely vegetated areas), the percentage of available forage removed by crickets could be higher. Moreover, despite such low levels of impact, it is to be expected that pressures for Mormon cricket control will persist, and therefore, so will the need for rational control measures.

Raffelson (1989) suggests that "there must be a control method that does not depend on expensive sprays or waiting for Mother Nature." Indeed, there is. I have tested a new species of parasite (*Vairimorpha* n. sp.) which occurs naturally in Mormon cricket populations. It appears to be specific to these insects and causes high mortality in early nymphs if infected at high dosages. This parasite (awaiting formal taxonomic description by Drs. John Henry and Doug Street of the USDA/ARS Rangeland Insect Laboratory, Bozeman, Mont.) is a unicellular organism which attacks the gut of Mormon crickets when spores are ingested in their food (such as a bran bait). Infection then spreads to other tissues, depleting energy reserves, retarding nymphal development, or killing the insect. I measured a 60% reduction in nymphal survival in a field experiment within 2–3 weeks after treatment with a wheat-bran bait containing spores of the parasite. This is not as high as the mortality produced by chemical agents (80–90%), but is highly significant for a biological agent which does not threaten non-target insects, wildlife, water sources, or human safety. Also, since rangeland constitutes a low-value resource (Capinera 1987) which can tolerate a significant degree of insect feeding without economic losses, a 60% reduction in Mormon cricket density is ample to dampen population peaks which might otherwise reach economic injury levels.

This discussion refers to open rangeland, not croplands. In the latter areas, considerable damage by Mormon crickets can occur in a matter of days, leaving chemical control agents as the only tactic which can prevent damage in a timely manner. However, most cricket populations confine themselves to their native rangeland habitat, where feeding activity is "diluted" over large areas.

It appears, then, that the reputation that Mormon crickets have earned as "predators of the range" (Raffelson 1989) stems more from inaccuracies in the literature and historical legend than from current facts. We must remember that these insects are native to North American rangelands and have coexisted successfully with range plants for centuries. It is only when primary productivity is curtailed by factors such as drought or overgrazing that crickets and domestic livestock are bound to compete for limited forage.

Literature Cited

Capinera, J.L. 1987. An overview of the western grasslands. p. 1-8. *In:* Capinera, J.L. (ed.) Integrated pest management on rangeland: a shortgrass prairie perspective. Westview Press.

Cowan, F.T. 1929. Life history, habits, and control of the Mormon cricket. USDA Tech. Bull. 161.

Cowan, F.T., and H.J. Shipman. 1947. Quantity of food consumed by Mormon crickets. J. Econ. Entomol. 40:825-828.

MacVean, C.M. 1987. Ecology and management of Mormon cricket, *Anabrus simplex* Haldeman. p. 116-136. *In:* Capinera, J.L. (ed.) Integrated pest management on rangeland: a shortgrass prairie perspective. Westview Press.

MacVean, C.M. 1989. Microbial control, diet composition, and damage potential of the Mormon cricket. Ph.D. Diss. Colorado State University.

Raffelson, J.J. 1989. Predators of the range. Rangelands 11:26-27.

Swain, R.B. 1944. Nature and extent of Mormon cricket damage to crop and range plants. USDA Tech. Bull. 866.

Torell, L.A., and E.W. Huddleston. 1987. Factors affecting the economic threshold for control of rangeland grasshoppers. p. 377-396. *In:* Capinera, J.L. (ed.) Integrated pest management on rangeland: a shortgrass prairie perspective. Westview Press.

Wakeland, C. 1959. Mormon crickets in North America. USDA Tech. Bull. 1202.