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Title: Biological control of tamarisk: Establishment, population increase, and impacts of *Diorhabda* spp. at experimental release sites in the western US.

Abstract:

An experimental release program for *Diorhabda elongata sensu lato*, a leaf beetle that is the first biological control agent for tamarisk, was approved in late 1998. The Fukang (China) and Chilik (Kazakhstan) ecotypes of *D. elongata* were first released in field cages starting in 1999 at 10 sites in California, Colorado, Nevada, Texas, Utah and Wyoming. Open field releases were first made in 2001 at 7 of the 10 sites. Additional experimental release sites have been added since 2001 in some of the latter states as well as Montana, New Mexico, and Oregon. Results to date have been extremely variable, ranging from failure of the beetles to establish viable populations outside of the field cages to spectacular outbreak populations that have defoliated tens of thousands of hectares of tamarisk. The long critical photoperiod for induction of reproductive diapause of the Fukang ecotype appears to have limited its ability to establish in southern locations. Ecotypes of *D. elongata* from Turpan (China), Greece, Uzbekistan and Tunisia have shorter critical photoperiods and some open field releases of 3 of these ecotypes in southern locations show signs of preliminary success. One northern California site where the Fukang ecotype failed to establish is dominated by *Tamarix parviflora*, a less suitable host plant of the Fukang ecotype. An alternate *D. elongata* ecotype from Crete, Greece appears to have established and increased in numbers at this site. Predation, by birds and a large suite of generalist arthropod predators, is also hypothesized to be a major cause of establishment failure or limited population growth. Research on new tamarisk biological control agents is focusing on species that are less susceptible to generalist predators. Where populations of the Fukang and Chilic ecotypes are established, increasing dramatically in numbers, and repeatedly defoliating the same tamarisk plants, the impacts on tamarisk include increased branch mortality, decreased flower and seed production, and some instances of apparent whole-plant mortality. No direct impacts on nontarget plants by *D. elongata* have been observed at these locations.