

Reproduction and population expansion of thorny weeds in pasture

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By

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Abstract

Expansion of spiny annual and perennial weeds (thistles) in natural pastures impairs the production and quality of the forage. Thistles are generally not consumed by the cattle and, therefore, the carrying capacity and quality of the herd are spoiled. The occurrence and damage caused by annual weeds depend on the quality and size of the seed reservoir in the soil (seed bank) at the beginning of the rain season. Processes associated with the expansion and persistency of thistles in natural pasture zones have been little studied, particularly in Israel. This study deals with the following questions: What is the influence of grazing on the expansion of thistles in pasture areas? Which environmental conditions are permissive for thistles germination? Which type of seed bank (transient vs. persistent) characterize the dominant thistles? This information is necessary to develop wise management strategies for the prevention of thistle expansion and for their reduction in pastures.

The study goals were:

- 1) Examining the influence of grazing on thistles outburst and expansion.
- 2) Studying the biology of seed production, dispersal and granivory in dominant thistles.
- 3) Examining seed persistency and decay of the seed bank in the soil.
- 4) Defining environmental conditions and soil factors controlling seed germination.

The study was carried out in the experimental farm of the Ministry of Agriculture at "Karey Deshe" and at the Faculty of Agricultural Sciences, Rehovot. "Karey Deshe" is located between the southernmost section of the Hula Valley and the northern beach of the Sea of Galilee, Israel. Plant surveys were carried out at Karey Deshe using the Step-Point method during the summers of 2004 and 2005, and compared with spring surveys that are performed since 1994 (Sternberg et al., 2000). Thistles are late flowering species that reach their peak in mid-summer. Carrying the surveys at summer provided the maximal respond of thistles to grazing treatments. The purpose of the surveys was to estimate the influence of different grazing pressures on thistle cover in the pasture. Management grazing treatments were: (1) Without grazing (Control). (2) Continued grazing – high to moderate in pressure; 9 dunams/cow (9C)

and 18 dunams/ cow (18C), respectively. (3) Early grazing – high pressure 9 dunams/cow (9E), entrance at February. (4) Late grazing – high pressure 9 dunams/cow (9L), entrance at April. (5) Early grazing – very high pressure- 4.5 dunams/cow (4.5E), entrance at February and (6) Late grazing – high pressure- 4.5 dunams/cow (4.5E), entrance at April.

Among the thistles present with high frequency in the natural pasture at Karey Deshe are both perennial and annual species. The annual species are: *Scolymus maculatus*, *Carthamus glaucus*, *Silybum marianum* and *Centaurea iberica*. The perennial species are: *Echinops adenocaulos*, *Gundelia tournefortii*, *Eryngium creticum*. Comparison of the summer and spring surveys revealed that the spring surveys give a truly estimation of the thistles population in the pasture. As for the influence of grazing treatment, it appears that rising grazing pressure and early entrance of cows into the pasture causes a subsequent rise in the cover of *Scolymus maculatus*. In contrast, cover of *Carthamus glaucus* is not influenced by grazing. However, total cover of annual thistles in plots where a moderate and continued grazing pressure was applied, and where high grazing pressure is associated with onset of grazing.

Echinops adenocaulos combines a relatively high potential for seed production with the ability to reproduce vegetatively, thus not depending on seed distribution only. Annual thistles lack vegetative reproduction. Their persistency is restricted by seed production and seed survival, both depending upon biotic and a-biotic factors. Damaged capitula and seeds in thistles reduce the reproduction potential, as well as granivory by the harvester ant. The seed bank characteristics of the dominant thistles were examined in pot experiments in a net-house at the Faculty of Agriculture, Rehovot and at "Karey Deshe" (*Scolymus maculatus*, *Carthamus glaucus*, *Silybum marianum* and *Echinops adenocaulos*). Seed germination of these thistles was affected by soil characteristics, and by the environmental conditions among the different sites. In spite of the difference in seeds' germination and in the reduction rate of both sites, the type of the seed bank for each species have not changed: transient seed bank in *Echinops adenocaulos* and a short-life seed bank in *Scolymus maculatus*, *Silybum marianum* and *Carthamus glaucus*.

The conditions required for germination in these species were examined in germination chambers at the Faculty of Agriculture. *Echinops adenocaulos* has a very wide range of germination temperature- most of the seeds germinate in the light and in

the dark between 10-35°C. The three annual thistles require light for their germination, but *Scolymus maculatus* has a wider temperature range and is able to germinate even in darkness at 10°C. In contrast to the hypothesis claiming that nitrophyl thistles are influenced by the N-level in the soil, germinating seeds in ammonia and nitrate solutes did not increase germination.

The results of the current study support the assumption that via various agro-technical activities, such as cutting down the thistles before seed maturation and dispersal, usage of natural enemies against thistles seeds or by chemical control (not recommended because of environmental influences) will enable both: (1) reduction of the thistles seed production potential and (2) reduction of the potential seed bank. Combination of several agro-technical treatments for the prevention of seed production and distribution with moderate grazing will improve the grazing conditions and might solve the problem of thistle expansion.