SEED LONGEVITY AND PERIODICITY OF EMERGENCE OF MILKWEED (*EUPHORBIA HETEROPHYLLA*)

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Summary. Milkweed is an herbaceous annual with a pan-tropical distribution. It is present in south-east Queensland and along the East coast where it is a weed both in and out of crops. An in-ground pot trial was established to examine the effect of various treatments on seedling emergence. The four treatments assessed were (1) seeds on the soil surface, (2) seeds on the soil surface covered by mulch, (3) seeds buried at 1-3 cm, and (4) seeds buried at 5-10 cm. The trial showed that seeds established best when left on the soil surface, particularly when covered by mulch. Milkweed seed has no dormancy and germinates in response to sufficient water.

INTRODUCTION

Milkweed, *Euphorbia heterophylla*, has a pan-tropical distribution and is native to tropical America (4). The weed has been established in south-east Queensland for nearly two decades (Queensland Herbarium records) and is now distributed along the eastern coast of Queensland as far north as Cooktown. There has been a noticeable increase in the size and number of infestations in North Queensland recently. It is mainly a weed of crops such as sugar cane, cereals, cotton, peanuts, and other legumes (2,4), but can be a problem in non-crop situations too.

Milkweed is a short-lived herbaceous annual with milky sap which can grow to 2 m tall. Large numbers of seeds are produced which are released explosively from the plant when mature. The seeds are approximately 2 mm long and probably have little dormancy in Queensland (2).

This project examined the factors affecting the longevity of seedling emergence in milkweed. Milkweed seeds have been found to have significant dormancy when thrown from the fruits in the U.S.A. (1), but seeds collected under similar conditions in the tropics are not dormant (4). Also, buried seeds may have dormancy imposed upon them, only to have it released when they are exposed by cultivation. The presence or otherwise of dormancy is important in considering new infestations in a district. Is eradication achievable, or can we only aim for control of a population which will persist?

METHODS

An in-ground pot trial was started in April, 1988, at the Tropical Weeds Research Centre, Charters Towers. Milkweed seed was collected near Ayr during February to March 1988 and stored in an open building at normal air temperature. Soil was also obtained from near Ayr from a site free of milkweed. The soil was a heavy cracking clay (Baratta clay).

The seeds (300 per pot) and soil were put in 250 mm diameter pots in a shallow pit. The pit was backfilled around the pots so that the soil level in the pots was the same as the surrounding ground. The whole pit was covered by wire mesh to prevent animals and birds interfering with the pots. Rainfall was supplemented by fully wetting the pots when less than 25 mm of rain fell in a month. This was done to avoid significant drought periods.

There were four treatments assessed:-

(1) seeds on the soil surface
(2) seeds on the soil surface covered by mulch (wood wool 25 mm thick)
(3) seeds buried at 1-3 cm below the surface
(4) seeds buried at 5-10 cm below the surface.

The number of viable seeds remaining were assessed by recovering four replicates at the end of year 1 and the remaining four at the end of year 2. Seeds were recovered by crushing the soil into 50 mm lumps and then soaking it in water for one hour. The resulting slurry was sieved to recover seeds which were sorted with tweezers. Any apparently viable seeds were tested by sowing them in sand and putting them into a growth tunnel. Viability was taken as seedling emergence.

The seeds used were tested for viability at the start of the experiment. From four replicates of 100 seeds/ petri dish, 95% of seeds emerged after three days under constant light at 25°C.

RESULTS AND DISCUSSION

The number of seedlings emerged and the viable seeds remaining after one year are shown in Table 1.

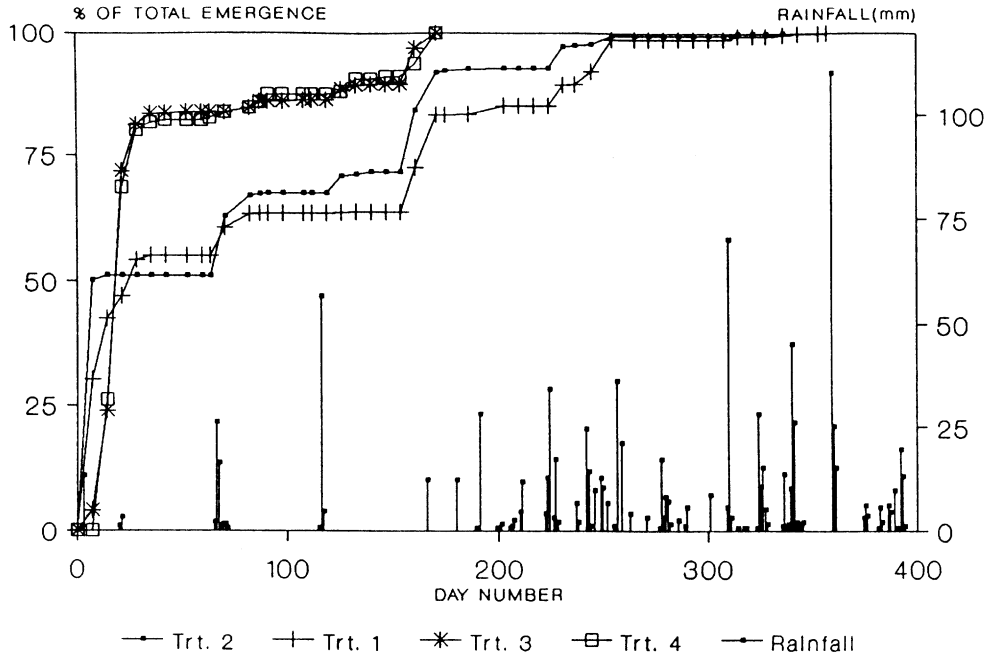
Table 1. Number of milkweed (*Euphorbia heterophylla*) seedlings emerged and viable seeds recovered per pot after one year. (means of 8 and 4 replicates, respectively, 300 seeds sown/pot).

	Treatment	Seedling Emergence (No./pot)	Viable Seeds (No./pot)
(1)	Seeds on the soil surface	105.0	0
(2)	Seeds on the soil surface covered by mulch	159.9	0
(3)	Seeds buried at 1-3 cm	61.0	0
(4)	seeds buried at 5-10 cm	23.9	0
	l.s.d. (P=0.05)	29.8	---

Seedling emergence was significantly different between all treatments. Seed germinated best on the soil surface, and mulching enhanced the effect by retaining moisture. Burying seeds reduced emergence and emergence decreased with increasing depth. Many of the seedlings from buried seed treatment pots emerged from cracks in the soil surface and particularly from the gap between the soil and the pot sides which develops as the soil dries. Therefore the number of seedlings emerged for treatments three and four may be an overestimate of what occurs under normal field conditions. Only one seedling emerged in the second year of the experiment. This was in Treatment 2, 378 days after the beginning of the experiment. No viable seeds were recovered after the second year.

Initial tests showed upwards of 97% of the seeds used in the experiment were viable (no pre-treatment of seeds). There was thus no innate dormancy of seeds under the (tropical) field conditions. The proportion of emerged seedlings for treatments one to four were 35%, 53%, 20% and 8% respectively. While sifting through the remaining seeds after one year, the vast majority of seeds tested for apparent viability by squeezing them with tweezers proved to be empty seed coats. This indicates that most of the remaining seeds did germinate but failed to establish; a small fraction were found to be rotten.

Figure 1 shows the periodicity of emergence in relation to rainfall and supplementary watering of the pots. Over 50% of the total emergence for all treatments occurred within one month of starting the experiment, and that supplementary watering of the pots triggered the main emergence responses. High rainfall events did cause emergence to a lesser extent (e.g., 56.5 mm on day 116).



Supplementary watering on days 0,63,154.

Figure 1. Periodicity of milkweed seedling emergence. (Means of 8 replicates).

The data from this trial suggests that milkweed seeds should germinate as soon as sufficient soil moisture is available. Apparent dormancy imposed on the seeds by burial or even scattering on the soil surface is probably due to insufficient water availablity to the seeds through soil physical properties (3). Watering the soil to saturation always gave better germination than natural rainfall in this trial. Buried seeds germinated readily, i.e. with little imposed dormancy, at both planting depths. Other workers (R. Johnson, pers. comm., 1990) have reported milkweed emergence from 12 cm depth, with longer-lived seeds in dry field conditions. This data thus confirms the other work in the tropics, where dormancy was not found. The data from the U.S.A. is anomalous, perhaps because dormancy is required for overwintering in temperate climates (4). Another possibility is that the milkweed is indeed a heterogenious species, with several biotypes; it certainly has several synonyms throughout the world (4). This could also explain the widely reported differences in herbicide susceptibility in various countries.

The data from this trial show that complete eradication of milkweed from a site is a possibility, provided that no new seeds are allowed to be set. This means controlling milkweed present at the site every 6 weeks. Indeed this was found to be the case around Proserpine, where milkweed infestations have been eradicated by diligent cane farmers (2).

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