WEED SEED INVIABILITY CAUSED BY POST-EMERGENCE HERBICIDES

P. K. KASERA and D. N. SEN
Botany Department, University of Jodhpur,
Jodhpur 342001, India.

SOME work on the use of herbicides for weed control and their effects on crop growth and metabolism has been carried out in this arid tract[1-3]. However, no attention has been paid on the herbicidal effects on seeds and tubers (underground propagules), which in fact, are means of dissemination of weeds. The severity of any weed in the forthcoming season depends upon the production and survival of the propagules. Hence, the selection of different herbicides for inhibiting the growth of weeds, their seed germination and seedling is of utmost importance. The present investigation aims at studying the effect of post-emergence application of different herbicides on the seed viability and germination of two important weeds: *Borreria articularis* (Linn) F N Will and *Trianthema portulacastrum* Linn which cause tremendous loss to agriculture[1,4].

Three herbicides viz Weedone (2,4-dichlorophenoxy ethyl ether), Weedazol (3 amino-1,2,4 triazole), Stomp 330 E (1-ethyl propyl) 3,4-dimethyl 1,2,6-dinitrobenzamine) (at 2.5 lit/ha, 2.5 lit/ha and 1kg/ha, respectively) were tested for crop weed management in the Kharif season of 1985. *B. articularis and T. portulacastrum* were the target weeds. *T. portulacastrum* plants were associated with the bajra crop which received irrigation, as and when required. The seeds of the two weed species, both from control (no herbicide) and treated plots were collected, and the seed weight and germination were studied. Germination studies were performed in petridishes at 28 ± 2°C in continuous light (1000 Lx). Viability was tested in 0.1 % solution of TTC (2,4,5 triphenyl tetrazolium chloride)[5].

Table 1 presents the data on the weight and viability of seeds in control and that of the three herbicides treated plants. The weight of seeds of both the species showed reduction due to herbicide treatment. Similarly the viability of seeds in herbicide treated plants was also reduced. Interestingly, Stomp 330 E had no effect on the viability of seeds of *B. articularis*, but it reduced the viability to 40% in *T. portulacastrum*.

The data on germination per cent of the seeds of two species are presented in table 2. The three herbicides reduced the germination percentage of the seeds of both the species. The reduction was greater (50 %) in Weedone and Weedazol treated plants and less in Stomp 330 E.

The present results prove that the post-emergence application of herbicides not only inhibits the growth of the plants (or kills) but also has inhibitory effect on the seeds produced. In the case of *B. articularis*, Weedone and Weedazol reduced the viability and thus the germinability of seeds. The reduction in viability and germination of seeds due to herbicidal spray has a

Table 1 *Effect of three post-emergence herbicides on viability (Viab) and weight (100 seeds mg) of seeds of Borreria articularis and Trianthema portulacastrum.*

	Control		Weedone		Weedazol		Stomp 330 E	
Weed species	Viab.	Weight	Viab.	Weight	Viab.	Weight	Viab.	Weight
Borreria articularis	100 ± 0	292.0 ± 7.0	60 ± 10	281.3 ± 2.3	90 ± 10	280.0 ± 2	100 ± 0	286.0 ± 2
Trianthema portulacastrum	70 ± 10	66.0 ± 5.29	50 ± 10	64.0 ± 2.0	50 ± 10	65.66 ± 3.05	40 ± 10	58.0 ± 2

Table 2 *Effect of three post-emergence herbicides on germination percentage of seeds of B. articularis and T. portulacastrum (observation taken at the end of 7 days)*

Weed species	Control	Weedone	Weedazol	Stomp 330 E
Borreria articularis	80 ± 10	40 ± 17.32	43.33 ± 5.77	73.66 ± 6.35
Trianthema portulacastrum	26.66 ± 2.08	20 ± 0	16.66 ± 5.77	23.33 ± 5.77

direct correlation with reduced weed infestation. This study further confirms earlier findings with regard to the reduced germination of the seeds of different species, being more in the case of Weedazol and Weedone treated plants[6].

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ENDOSPERM IN *HYDROLEA ZEYLANICA* VAHL (HYDROPHYLLACEAE)—A REINVESTIGATION

H. G. VIJAY GOPALRAJ URS
Department of Botany, University of Mysore, Manasagangotri, Mysore 570 006, India.

ENDOSPERM development in Hydrophyllaceae is recorded to be cellular, nuclear and of an intermediate type[1–5]. The occurrence of a chalazal haustorium in endosperm has been observed in species of *Phacelia* and *Nemophila insignis*[2], while a micropylar haustorium has been recorded in *Hydrolea spinosa*[3]. Both chalazal and micropylar haustoria in the same endosperm have been noted in *Nemophila aurita*[2]. On the other hand, a total absence of haustorium has been recorded for *Hydrolea zeylanica*[4] and *Romanzoffia sitchensis*[2]. The present study is a reinvestigation of the endosperm development in *Hydrolea zeylanica* and is based on material collected from plants growing at the water margins of a pond in Aloka near Mysore city. It was undertaken to verify the absence of endosperm haustoria in the taxon since other species of the genus investigated[3] organizes a micropylar haustorium.

Fertilization is porogamous. The first division of the endosperm mother cell is transverse and delimits two approximately equal chambers. Of the two, the lower primary chalazal chamber does not divide further but directly functions as the chalazal haustorium. It gradually elongates, and assumes a club-shape. Meanwhile, the upper primary micropylar chamber undergoes a transverse division producing two superposed daughter cells, the upper portion of which organizes the micropylar haustorium while the lower portion functions as the initial cell of the endosperm proper. The cell destined to organize the micropylar haustorium elongates initially. It soon enlarges destroying the surrounding integumentary cells and becomes bulbous. Its nucleus becomes hypertrophied (figure 1A). Short tubular extensions arise from the bulbous haustorium and ramify through the integumentary tissue destroying cells along their path (figure 1B). A few of these establish contact with the vascular strand of the developing seed. This haustorium remains single-celled and uninucleate throughout its period of activity.

Simultaneously, the initial cell of the endosperm proper undergoes repeated transverse divisions. Further divisions in the resulting cells are both transverse and longitudinal and consequently a massive homogenous endosperm tissue is organized.

The chalazal haustorium ceases its activity quite early during seed development. As the haustorial nucleus shows signs of degeneration an endosperm cell located towards the narrow end of the sac abutting the chalazal haustorium and just above it begins to enlarge and acquires dense contents (figure 1C). Its nucleus becomes hypertrophied. Soon a short lateral caecum is formed from the cell and extends towards the vascular strand of the developing seed destroying cells on its path (figure 1D). This secondary chalazal haustorium remains single-celled and uninucleate. Its activity, however, ceases along with that of the micropylar haustorium, by about the time the embryo assumes a globular shape.

The above observations clearly establish that both micropylar and chalazal haustoria do differentiate in *Hydrolea zeylanica*, contrary to the earlier report on the same taxon[4]. It is thus evident that the mode of initial endosperm organization in *Hydrolea zeylanica*, described here, is similar to that in *Nemophila aurita*[2]. The haustoria are aggressive in both the taxa and the chalazal haustorium, in later stages, is similar in both. It is, therefore, surmised that a secondary haustorial development may also take place in *Nemophila* but this needs reinvestigation. Further, another species of *Hydrolea*, *H. spinosa*, investigated by Svensson[2] who failed to notice any haustoria, was later shown to possess a micropylar haustorium on reinvestigation by