GERMINATION BEHAVIOUR OF *CROTON LOBATUS* L., *EMILIA SONCHIFOLIA* L. AND *S. ANTHELMIA* L.

Chukwu, M.N.
School of Science and Technology National Open University of Nigeria
14 /16 Ahmadu Bello way, Victoria Island, Lagos
Phone : 08033079536
E-mail : zodokventure@yahoo.com

ABSTRACT

Studies on germination of *C. lobatus*, *E. sonchifolia*, and *S. anthelmia* were carried out in the laboratory. The influence of 12hour L – D photoperiod and continuous darkness, soaking in water, soil moisture, water soluble extracts of plants' leaves and temperature on the germination of the seeds of the weed species were examined. Light enhanced the germination of *E. sonchifolia* seeds, but inhibited those of *C. lobatus* and *S. anthelmia* seeds. Soaking increased the percentage germination of *S. anthelmia* seeds while aqueous extracts of their leaves inhibited or enhanced the germination of their seeds. Their percentage germination increased with decreasing soil moisture regime 20 % soil moisture being the most favorable for germination.

INTRODUCTION

Ecological and physiological study of weeds is necessary for understanding the relationship between crop and the weed flora. The knowledge of germination has extreme importance to the understanding of weed dynamics as well as to aid and complement information in weed management programmes. Biotic and abiotic factors affect the germination process and therefore the ecological adaptability of the weed species in the agrosystem. Light may either inhibit or promote germination in seeds of many weed species (Guyme and Murray, 1985b; Benvenuti *et al.,* 2001; Khan and Gluzar, 2003; Zhou *et al.*, 2008). The importance of water as a basic requirement for germination cannot be Over-emphasized. No seed germination can occur if water is unavailable; for seeds imbibe water to activate growth enzymes whose activities preceeds germination. Availability of moisture in the soil is a critical factor in seed germination and subsequent establishment of seedlings (Crutwell, 1972; Clewis, 2005; Oriega and Nasca, 2005; Haran *et al.,* 2008; Bhagirath and David, 2010).

Environmental temperature plays a significant role in germination of weed species. Seasonal temperature changes are important in determining the state of seeds in the soil (Baskin and Baskin, 1989; Singh and Sharma, 2008; Tang and pork, 2008;Tang *et al.*, 2012). A knowledge of temperature required for a seed to germinate is essential because different species have their different optimum temperature for their germination. Extracts of many plants have been shown to contain germination and growth inhibitors which are organic chemical substances released into the environment in various ways (Rice, 1979; Xuan and Tsuzuki, 2001; Kamal *et al.*, 2008; Joshi *et al.*, 2009; Saeed, 2011). The knowledge of weed species germination behaviour could have an implication for developing the integrated weed management strategies. However, there is not much literature on the germination responses of these species in different environmental conditions. Based on this, the present study is aimed at evaluating the germination of weed species in response to light, soaking, temperature treatments and water soluble extracts of the different species.

MATERIALS AND METHODS

Effect of Light on seed germination: twenty seeds each of the three weed species were placed in a Petri dish already fitted with 9 cm No. 1 filter paper initially moistened with 5 ml of distilled water. Eight replicates were prepared, four of these were placed on a laboratory bench to ensure light – dark photoperiod, that is 12 hr alternating light and dark and the other four in a cupboard depicting continuous darkness. Germination counts were taken every two days for a period of two weeks. Seeds were regarded to have germinated when they had produced a radical and a plumule.

Effect of Soaking on seed germination: Two hundred seeds each of the three weed species were soaked in distilled water for 2, 12, 48 and 96 hours respectively to account for different amount of water available at different localities during the growing season. Only viable seeds were used for this experiment, at the end of each period of soaking , twenty seeds of each of the three weed species were placed in a Petri dish already fitted with 9 cm No. 1 filter paper initially moistened with 5 ml of distilled water. Eight replicates were prepared for each treatment. Four were subjected to 12 hr alternating light and dark and the other four to continuous darkness. Germination counts were taken every two days for a period of two weeks.

Effect of Water Soluble Extracts on seed germination: Twenty seeds each of the three weed species were placed in a Petri dish already fitted with 9 cm No. 1 filter paper. Extract of each species used as a medium for growth was applied to the seeds of each of the weed species on the filter papers. Each treatment was prepared in four replicates and placed on the laboratory bench. Control was prepared by placing twenty seeds each of the three weed species on filter papers moistened with 5 ml of distilled water in a Petri dish also in four replicates. Germination counts were taken as earlier described for two weeks.

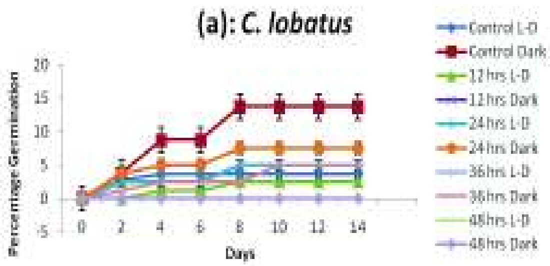
Effect of Soil Moisture on seed germination: Ten seeds of each of the three weed species were each sown in a 7.5 cm diameter plastic container three – quarter filled with 450 g of oven dried sandy loam soil at 100 %, 80 %, 60 %, 40 %, and 20 % soil moisture regimes; 100 % representing water – logged condition. Each treatment was prepared in four replicates and placed on the laboratory bench. Germination counts were taken for two weeks.

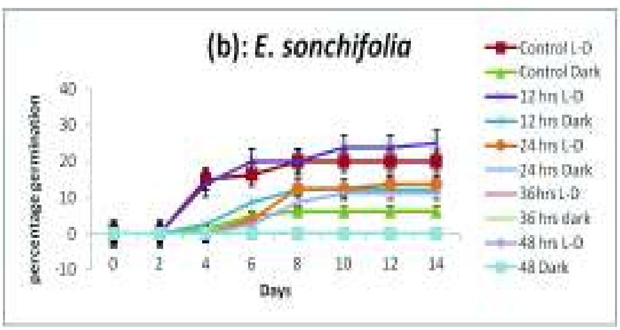
Effect of Temperature on seed germination: Two hundred seeds of each of the weed species were subjected to temperature treatments at 45°C, 60°C, and 75 °C for 24 hours before being distributed in batches of twenty on moist filter papers in petri dishes. Eight replicates were prepared for each species four of which were subjected to 12 hr alternating light and dark condition and the other four to continuous darkness as in the first experiment. Germination counts were taken for two weeks.

RESULTS

Effect of soaking on seed germination

The results obtained showed that the rates of germination of *C. lobatus* seeds under 12 hr L – D photoperiod was fairly uniform (Figure 1a). Maximum germination was attained in eight days at all soaking periods apart from 36 and 48 hrs soaking periods where there was no germination. In continuous darkness however, the highest germination rate was recorded on the fourth day in the control experiment, and the least at 36 hrs soaking period. *C. lobatus* had lower germination percentages in 12 hr L - D photoperiod than in continuous darkness. There were significant differences in the germination of *C. lobatus* when grown in 12 hr L – D photoperiod and in continuous darkness at different soaking periods (F = 2.92, P < 0.05).





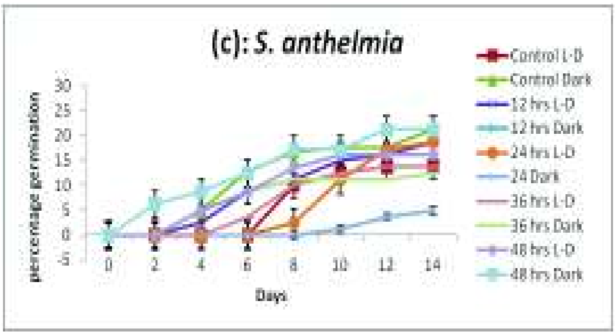


Fig 1a-c : Percentage germination of seeds of C. iobatus, E. sonchifolia and S.anthelmia in 12 hr L-D and continuous darkness at four soaking periods. Values shown are Mean ± SE

E. sonchifolia seeds recorded their maximum percentage germination in 12 hr L – D photoperiod at the control experiment on the fourth day (Figure 1b). In continuous darkness however, the highest germination percentage was recorded at 12 hr soaking period on the Eighth day. There was no germination at 36 and 48 hrs soaking periods in both 12 hr L – D photoperiod and continuous darkness. Seeds of *S. anthelmia* under 12 hr L – D photoperiod attained maximum germination between eight and fourteen days. The highest mean germination percentage for *S. anthelmia* was recorded at 48 hr soaking period on the eighth day. *S. anthelmia* had uniform germination percentages in 12 hr L –D photoperiod at all but 96 hr soaking period where no germination was recorded (Figure 1c).

Effect of Water Soluble Extracts on seed germination

Extracts of the three weed species enhanced the germination of *C. lobatus* seeds by increasing their mean germination percentage (Figure 2a). There were significant differences in the mean percentage germination of *C. lobatus* seeds when grown in *C. lobatus* and *S. anthelmia* extracts ($P < 0.05$). The mean percentage germination of *E. sonchifolia* seeds was significantly increased by *C. lobatus* extracts, but significantly reduced by *S. anthelmia* extracts ($P < 0.05$, Figure 2b) The mean germination percentage of *S. anthelmia* seeds was significantly increased by *E. sonchifolia* and *S. anthelmia* extracts while *C. lobatus* extracts reduced the mean germination percentage of *S. anthelmia* seeds ($P < 0.05$, Figure 2c).

Effect of Soil Moisture on seed germination

Percentage germination increased with decreasing soil moisture with the highest percentage at 20 % soil moisture regime. There were significant differences in the mean percentage germination of *C. lobatus* seeds grown in different soil moisture regimes ($P < 0.05$, Figure 3a).

Effect of Temperature on seed germination

Seeds of *E. sonchifolia* and *S. anthelmia* attained maximum germination at 60 ° C temperature treatment in 12 hr L – D photoperiod (Figure 4). There was a significant difference in the germination of *E. sonchifolia* seeds subjected to different temperature treatments and grown in 12 hr L – D photoperiod ($P < 0.05$).

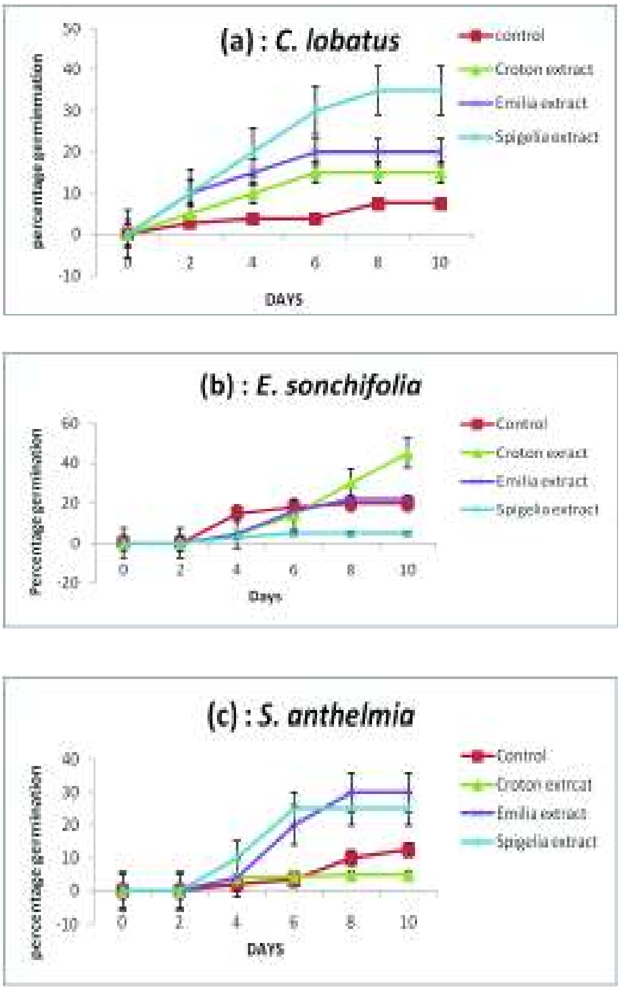


***Fig 2a-c** : Percentage germination of seeds of C. iobatus, E. sonchifolia and S. anthelmia in water soluble extracts from their leaves. Values shown are Mean ± SE*

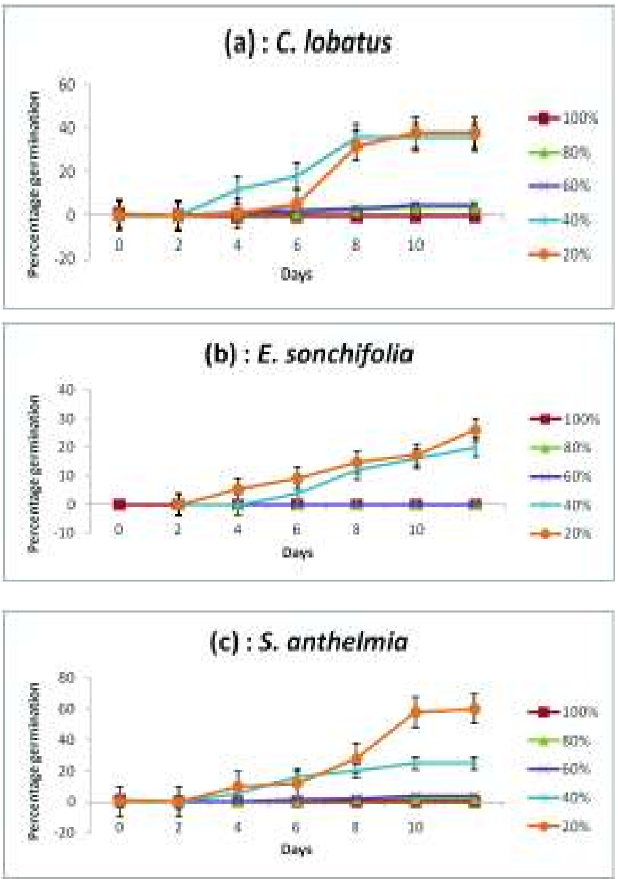
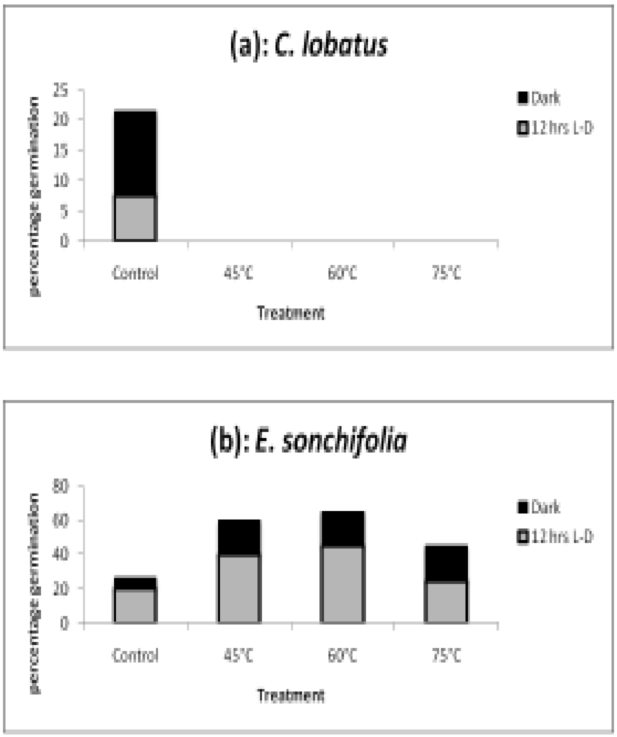


Fig 3a-c : Percentage germination of seeds of C. iobatus, E. sonchifolia and S. anthelmia in different soil moisture regimes. Values shown are Mean ± SE



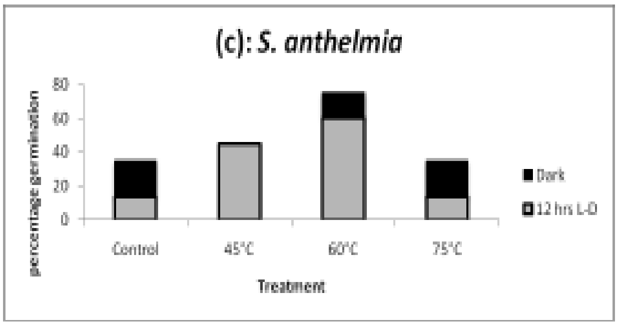


***Fig 4a-c** : Percentage germination of seeds of C. iobatus, E. sonchifolia and S. anthelmia subjected to different temperature treatments in 12 hr L-D and continuous darkness at four soaking periods.*

DISCUSSION

When the seeds were not treated, light promoted the germination of *E. sonchifolia* seeds, but reduced those of *C. lobatus* and *S. anthelmia* seeds which had higher percentage germination in continuous darkness. This shows the variability in the way by which light affect the germinability of seeds of different weed species. Soaking increased the percentage germination of *S. anthelmia* seeds under12 hr L – D photoperiod at all soaking periods while only 2 hr soaking did same for *E. sonchifolia* seeds.The difference in the rate of germination and percentage germination at increased soaking time may thus be an adaptive feature for the seeds to moisture conditions at different habitats. In water – logged condition, there was no germination at all in the three plant species. Percentage germination however increased with decreasing soil moisture regime, 20 % soil moisture regime recorded the highest percentage germination for all the three weed species. This indicated that the weed seeds could germinate at very low soil moisture regime and hence they could be found in both wet and dry seasons of the year. This confirms their importance as secondary successional weed species.

The most suitable temperature for germination of *E. sonchifolia* and *S. anthelmia* seeds in 12 hr L – D photoperiod was found to be 60°C. This explains the fact that they thrive well in tropical regions, hence they are common tropical secondary successional weed species.

Treatment of *C. lobatus* seeds with

temperature above the environmental condition (32 ± 3 ◌̊C) however inhibited their germination suggesting that high temperatures above the environmental temperature destroys the seeds of *C. lobatus*, thus distribution is temperature dependent. *S. anthelmia* extracts significantly reduced the percentage germination of *E. sonchifolia* seeds. Germination of *C. lobatus* was enhanced by *E. sonchifolia* and *S. anthelmia* extracts. Extracts of *C. lobatus* and *E. sonchifolia* enhanced germination of *E. sonchifolia* seeds while extracts of *E. sonchifolia* and *S. anthelmia* enhanced germination of *S. anthelmia* seeds. This confirms the fact that allelochemicals either enhance or inhibit the germination of seeds of same or other plants.

ACKNOWLEDGEMENT

I wish to express my gratitude to Mr Oye of Biological Garden, University of Lagos and Dr A. W. A. Edwards of University of Lagos for making their garden and laboratory available for the work.

REFERENCES

Baksin, J. M. and Baksin, C. C. (1989). Germination Responses of buried Seeds of *Capsella bursa-pastoris* exposed to seasonal temperature Changes . *Weed Research* **29 (3):** 205-212

Benvenuti, S., Machia, M. and Miele, S. (2001). Light, Temperature and Burial depth Effects on *Rumex obtusitolius* seed Germination and Emergence. *Weed Research* **41(2):** 177-186.

Bhagirath, S. C., and David, E. J. (2010). Growth and Reproduction of Junglerice (*Echinochloa colona*) in Response to water stress. *Weed Science* **58 (2):** 132-135

Clewis, S. B., Jordan, D. L., Spears, J. F. and Wilcut, J. W. (2004). Influence of Environmental Factors on cut leaf evening primrose (*Oenothera laciniata*). Germination, Emergence, Development, Vegetative Growth and control. *Weed Science* **55 (3):** 264-272

Crutwell, R. W. (1972). The insects of *Eupatorium odoratum L* in Trinidad and their potentials as agents for biological control. PhD thesis, Trinidad University of the West Indies, St. Augustine,

Guyme, D. C. and Murray, R. B. (1985). *Weed Biology and Control in Agriculture and Horticulture.* Batsford Academics and Educational, London.

Haran, S. S., Senarathine, E. O. and Sagakkara, R. (2008). Influence of Selected Environmental Factors on seed Germination and Emergence of major weed species in coconut plantation of Sri Lanka. Abstracts of 5th International Weed Science Congress held in Vancouver.

Joshi, B., Sarika, N. P. and Rao, B. P. (2009). Allelopathic Effects of Weed species Extracts on Germination, Growth and Biochemical aspects in varaities of Weeds (*Triticum aestivum* L.). *Indian Journal of Agricultural Research* **43 (2):** 79-81

Kamal, J., Bano, A., Riaz, M. and Azam, Q. I. (2008). Allelopathic Potential of Sunflower Plant (*Helianthus annus* L.) on soil metals and its leaves' extracts on physiology of wheat (*Triticum aestivum* L.). Abstracts of 5th International Weed Science Congress held in Vancouver.

Khan, M. A. and Gluzar, S. (2003). Light, Salinity and Temperature effects on the seed germination of perennial grasses. *American Journal of Botany* **90:** 131-134.

Oriega, E. Z. and Nasca, Z. P. (2005). Early Growth of Bindweed (*Ipomea* species) Radical system under water deficient condition. *Biocell* **29 (1):** 80

Saeed, S. (2011). Allelopathic effects of *Xanthium strumarium* L. *Research on Crops* **12 (3):** 783-788.

Rice, E. L. (1979). Allelopathy: An Update *The botanical Review* **45:** 15-109

Singh, M. and Sharma, S (2008). Effects of Environmental Factors on the Gernination of *Ipomea purpurea* . Abstracts of 5th International Weed Science Congress held in Vancouver.

Tang, D., Hamayun, M., Khan, S. J., Na-

waz, Y., Irshad, M., Na, Y. and Lee, I. (2012). Exposure to red light, temperature and exogenous gibberellins influenced germination of some serious winter weeds. *African Journal of Biotechnology* **11 (2):** 273-279.

Tang, D. and Pork, K. (2008). The role of temperature, Nitrogen containing compounds Gibberellins and red light in seed germination of winter annuals. Abstracts of 5th International Weed Science Congress held in Vancouver.

Xuan, T. D. and Tsuzuki, E. (2001). Effects of Application of Alfalfa pellet on Germination and Growth of Weeds. *Journal of Crop Production* **4:** 303-312.

Zhou, J. D., Deckard, E.I. and Arhens, W.H (2005). Factor affecting germination of hairy nightshade (*Solanum sarrachoides*) seeds. *Weed Science* **53 (1):** 41-45.