FACTORS AFFECTING PHYSICAL DORMANCY BREAK OF *IPOMEOA HEDERACEA* SEEDS

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Introduction

Dormancy breaking treatment may differ from species to species. However, application of dry or wet heat and dry or wet storage are among the highly effective treatments for breaking dormancy in most species with physical dormancy. After seed become non-dormant it can germinate under wide range of environmental conditions.

Jayasuriya *et al.*, (2007) have studied a proposed mechanism for physical dormancy break in seeds of Ipomoea lacunose and observed that there was a significant relationship between incubation temperature and relative humidity with the percentage of seed dormancy break. Bell *et al.*, (1995) have studied the effects of Temperature, Light and Gibberellic Acid on the Germination of seeds of 43 species native to Western Australia.

The present study was dealt with the seed of *Ipomoea hederacea*, which is one of a morningglories that are very difficult to control broadleaf weeds in row crop and other agricultural and non-agricultural areas in the southeastern U.S. Seed of *Ipomoea hederacea* is physically dormant. To control this weed it is necessary to clearly identify the germination strategy, and then a suitable method can be used to destroy the weeds. The main objective of this study was to identify the effects of storage time and storage temperature on the dormancy break of *Ipomeoa hederacea* seeds.

Methodology

The analysis was done by using a dataset collected by Dr.K.M.G.G. Jayasooriya. In 2007 two collections have been made as early in the fruiting season and late in the fruiting season. Four replicates of 15 seeds have been stored at five different temperature regimes. Seed mass has been measured prior to storage. Seeds have been retrieved after 1, 4, 6, 8 and 12 weeks after storage. They have been reweighed and incubated at 25 ^{0}C for 30 days. Germinated seeds have been calculated in 7 days intervals. Radical emergence was the germination criterion.

The germination percentage was considered as the dependent variable. The storage temperature (SP), storage time (ST), collection time (CT) and the mass difference (D) were taken as the independent variables. To identify the effects of storage temperature, storage time and collection time, GLM procedure was used by considering the germination stage (germinated or not) as the binary response. Logistic regression procedures were used to explain the relationship between the response and the predictors. Statistical software R was used for most of the analysis and in few cases MINITAB was used.

Results and Discussion

By using the GLM procedures, a model was fitted by taking storage time, storage temperature and collection time as factors and with all possible interaction terms. Analysis of Variance was used to identify the non-significant terms. The effects due to storage temperature (SP), storage time (ST), collection time (CT) were significant at 5 % significant level. The interaction between the collection time and storage temperature and also between storage time and temperature were significant at 5 % significant level. The two-way interaction between collection time and storage time and the three-way interaction among these three factors were not significant.

With the logistic regression, all the predictor variables were used and a full model with all possible interaction terms was fitted (1st model in Table 1 in Appendix). A best model was selected by removing the non-significant terms one by one (Back-ward elimination method). Chi-squared test was used to check the appropriateness of reduced model (P (>|Chi|) in Table 1). To compare models the hypotheses H_0: Reduced model is appropriate vs H_1: Full model is appropriate were used. When the 7th model was compared with 6th model (Table 1), null hypothesis was not rejected (P(>|Chi|)=0.124), and hence the 7th model was appropriate. Since the residual deviance of the 7th model was less than the corresponding critical value, it is the simplest and best one among those fitted models. When the cross validation is done, the selected model explained 91.6 % of total variation.

The selected model is given below:

$$\log it(\pi) = -7.602 + 1.262 * coll + 0.376 * time + 0.213 * temp + 4.043 * diff - 0.05 * (coll : temp) - 0.009 * (time : temp) - 0.409 * (time : diff) - 0.095 * (temp : diff) + 0.012 * (time : temp : diff)$$

According to the above model each unit increment in storage time increases the odds of germination stage by a factor of exp(0.3763) = 1.4569. In another way, each unit increase in storage time changes the odds of germination stage by $100(e^{0.3763}-1)$ = 45.69 %. Each unit increment in storage temperature increases the odds of germination stage by a factor of exp (0.2128) = 1.2371. In another way, each unit increase in storage time effects a $100(e^{0.2128}-1)$ = 23.71 % increment in these odds. The odds of germination stage increases by a factor of exp(4.0426) =56.9718 and by 5597.43 % with each unit increment in the mass difference.

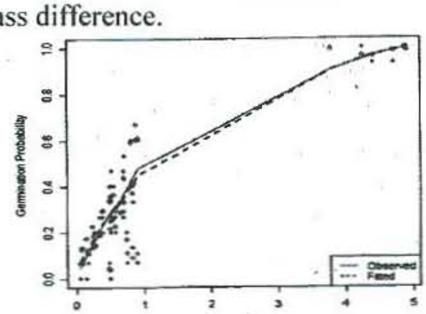

Figure 1. Observed and predicted

Figure 1 shows the observed and fitted plots of germination probability vs.

mass difference for the logistic regression model. The plots indicate that the fitted values are very closer to the observed values.

Conclusion

There is an effect of storage temperature and storage time on the germination of *Ipomeoa hederacea* seeds. In addition, an effect due to the collection time also exists. The germination percentage increases with increase in both storage temperature and storage time. And also there is a strong relationship between the germination and the mass difference.

By using the selected model in logistic regression, one can predict whether the germination stage change with the change in storage temperature, storage time, collection time and mass difference.

References

Jayasuriya, K. M. G. G., Baskin, J.M., Geneve, R. L. and Baskin, C. C., (2009). Annuals of Botany. 103, 433-445.

Bell, D.T., Rokich, D.P., McChesney, C.J. and Plummer, J.A. (1995), Journal of Vegetation Science, 6:797-806.

Appendix

Table 1. Coefficients and other statistics of the fitted logistic models

	Models with the Interaction terms						
	1	2	3	4	5	6	7
(Intercept)	-12.43***	-8.76***	-8.65***	-8.69***	-8.35***	-8.38***	-7.60***
CT	4.09*	1.92*	1.86*	1.89**	1.66***	1.70***	1.26***
ST	1.01*	0.48**	0.48**	0.49**	0.45***	0.46***	0.38***
SP	0.35***	0.24***	0.23***	0.23***	0.22***	0.22***	0.21***
D	11.32*	4.49	4.25**	4.42**	4.47**	4.07**	4.04**
CT:ST	-0.39	-0.06	-0.07	-0.07	-0.04	**-0.05**	
CT:SP	-0.13*	-0.06	-0.06*	-0.06*	-0.05***	-0.05***	-0.05***
ST:SP	-0.03*	-0.01	-0.01	-0.01	-0.01**	-0.01**	-0.01**
CT: D	-4.23	-0.22	-0.09	-0.20	**-0.20**		
ST: D	-1.31*	-0.37	-0.37	-0.40*	-0.41*	-0.40*	-0.41*
SP: D	-0.31	-0.10	-0.10*	-0.10*	-0.10*	-0.10*	-0.09*
CT:ST:SP	0.01	0.00	0.00	**0.00**			
CT: ST: D	0.54	-0.02	**-0.02**				
CT: SP: D	0.13	**0.00**					
ST: SP: D	0.04*	0.01*	0.01*	0.01*	0.01*	0.01*	0.01*
CT: ST: SP: D	**-0.02**						
Residual deviance	82.371	84.708	84.718	84.814	84.961	86.386	88.746
Critical Value	158.712	159.814	160.915	162.016	163.116	164.216	165.316
R-Squared	0.925	0.923	0.922	0.921	0.921	0.919	0.916
$P(>\vert Chi \vert)$		0.126	0.923	0.757	0.701	0.233	0.124