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Effect of Wet Heat Treatment and Gibberellic Acid Scarification on Germination of Dodder (*Cuscuta campestris* Yunck) Seed

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Abstract
Experiments were carried out to evaluate the effect of seed treatment on germination of *Cuscuta campestris*. This may provide the possible ways to overcome the problem of dormancy in *Cuscuta campestris.* The experiment were conducted in the Laboratory of Crop Production and Horticulture, Modibbo Adama University of Technology, Yola, Adamawa State, using wet heat treatment and gibberellic acid (GA3). For wet heat the treatments were control, 1 second, 2, 3, 4, and 5 seconds. For gibberellic acid (GA3) the treatment were control, 50, 100, 150, 200 and 250 ppm laid out in a Split plot design replicated three times. The results showed that wet heat treatment for 5 seconds significantly produced the highest germinated *C. campestris* seeds (36.53 %) than the control treatments. The effect of interaction between the giberrellic acid (GA3) and the soaking time shows 250 ppm GA3 and soaking time of 36 hours had significantly the highest germination percentage (4.50 %) of *C. campestris* seeds compared with the control (0.79 %), 50 ppm (0.99 %) and 200 ppm (1.98 %) treatments. It can be concluded that wet heat for 5 seconds and of 250 ppm GA3 and soaking time of 36 hours treatments has the potentiality to break dormancy of *C. campestris* seeds.

1. Introduction

Dodders (*Cuscuta* spp. Family: Cuscutaceae) are distributed worldwide (Holm *et al*., 1979). They have very low host specificity and attack many plants simultaneously. Although dicotyledons are preferred as hosts, attacks on monocotyledons have been reported by Gworgwor *et al*. (2001). Once a seed bank is established, they can remain dormant, yet viable, in the soil for 10 to 30 or more years, depending on the species and environmental conditions, and can also spread by stem fragments, which make it to be common contaminant of seeds (Lanini and Kogan, 2005).

Cuscuta campestris is a parasitic annual plant that infests many food crops, ornamental native plants and weeds. The impact of *Cuscuta campestris* ranges from moderate to severe reductions in growth of the host plant and in some instances may result in complete loss of vigor and death as reported by Marambe *et al*. (2002). Tomato crop vigor was lowered due to *Cuscuta* infestation and tomato production yield was reduced by 25 to 75% (Lanini *et al*., 2004). It was shown that field dodder infestation reduced carrot (*Daucus carota* L.) yield by 70-90% and also dodder weakens alfalfa,

reduces its stand and can reduce yield of forage seed production by more than 50% (Lanini and Kogan, 2005).

Germination is generally low and poor in annual holoparasites such as *Cuscuta*. Germination increases by scarification of seeds of many *Cuscuta* species (Marambe *et al*., 2002; Menlebrouck *et al*., 2008). *Cuscuta campestris* germination characteristics are not adequately reported in Nigeria and particularly in Adamawa State. With the incidence of the wide spread of *C. campestris* in the Northeast region and in Adamawa State in particular (Gworgwor *et al*., 2001), it has become imperative to undertake a study on its biology. Therefore, this study was aimed at investigating the effect of wet heat treatment and gibberellic acid as means of breaking seed dormancy of *C. campestris*.

2. Materials and Methods

Two different experiments were conducted in the Laboratory of the Department of Crop Production and Horticulture, Modibbo Adama University of Technology, Yola, Adamawa State, Nigeria. These experiments were on wet heat and gibberellic acid (GA3). Effect of wet heat was tested by placing one hundred and sixty eight seeds of *Cuscuta campestris* on wire gauze with handle; the seeds were then dipped in boiling water and removed at time intervals of 1, 2, 3, 4 and 5 seconds, respectively. The seeds were allowed to cool by soaking in tap water. Seeds for the control were not dipped in hot water. The treatments were arranged in a completely randomized design (CRD) replicated four times. The experiment was carried out two times.

Gibberellic acid (GA3) treatments at five concentrations (50, 100, 150,200 and 250 ppm) were used with distilled water as control. Ethanol was used to dissolve the GA3. Seeds of *Cuscuta campestris* were dipped for 12, 24 and 36 hours, after which the seeds were removed and laden on 9 cm diameter Petri-dish.

Data were collected on germination percentage (%) of *Cuscuta*. *Cuscuta campestris* that germinated days after placing on Petri-dish were observed at an interval of 3 days for 2 weeks. Data collected were analyzed using analysis of variance (ANOVA) as described by Gomez and Gomez (1984). Where ANOVA shows significance, mean separation was done using Duncan's multiple range test (DMRT) at 5% level of probability (Duncan, 1955).

3. Results

3.1. Effect of Wet Heat on Germination of *Cuscuta campestris*

Table 1 showed that there was significant effect of wet heat on germination of *C. campestris* seeds at day 3, 9 and the combined mean in Trial I and at day 3, 6 and combined mean in Trial II. While no significant difference was observed at day 6 and 9 in both Trials I and II respectively. Wet heat treatment of *C. campestris* seeds in the Trial I shows that, 3 seconds significantly produced the highest germinated number of seeds compared with the 1, 2 seconds and the control treatment. However, were at par with 4 and 5 seconds treatment on day 3 (Table 1). In Trial II the control treatment produced the highest number of germinated seeds compared with rest of the treatments. Similarly, the combined mean for the two trials showed that the control treatment produced higher percentage of 1.49 germinated *C. campestris* seeds which were at par with 3, 4 and 5 seconds treatments (Table 1). At day 6, significant difference was observed in Trial II where, the control, 1 second and 2 seconds treatments produced the highest percentage of germinated seeds compared with rest of the treatments, however in the combined mean for the two trials control, 1 second, 2, and 3 seconds treatments produced the highest percentage of 2.97, 5.17, 2.82 and 2.01 germinated *C. campestris* seeds respectively compared with 4 and 5 seconds treatments. On day 9 of Trial I, the 3, 4 and 5 seconds treatments produced the highest germinated *C. campestris* seeds compared with the rest of the treatments, though at par with 2 seconds treatment. However, when the two trials were combined the 5 seconds treatment had the highest percentage of 36.53 germinated *C. campestris* seeds which were at par with 1, 2, 3 and 4 seconds treatments (Table 1).

3.2. Effects of Gibberellic Acid (GA3) and Soaking Time on Germination of *Cuscuta campestris* at Day 1, 3, 6, 9 and 12

The effect of GA3 on germination of *C. campestris* was significant on day 1, 6 and combined mean in Trial I and on day 3, 9 and 12 in Trial II (Table 2). On day 1 in Trial I, 50, 150 and 250 ppm of GA3 gave the lowest germination of 0.33% each compared with the rest of the treatments (Table 2).The combined mean of Trial I and II on day 1 and 6, 100 ppm GA3 recorded the highest germination of 0.93% and 1.95%, but were comparable to the rest of the treatments (Table2).

On day 3 of Trial II, the control treatment had the lowest germination of 0.53% compared with rest of the GA3 treatments, but comparable with 50, 200 and 250 ppm (Table 2). On day 6 of Trial I the control, 100 and 200 ppm treatments produced the highest germination of 2.05% each of *Cuscuta* seed compared with the rest of the treatments (Table 2). On day 9 and 12 of Trial II, the control treatment had the lowest germination of *C. campestris* seeds of 0.46% and 0.33% respectively, though there were no significant difference with 50, 200 and 250 ppm and the 50 ppm on day 12 (Table 2).

The time of soaking the seeds in GA3 shows that soaking on day 1 in Trial II and the combined mean recorded a significant difference, where soaking for 36 hours had the highest germination of 1.03% and 0.81% respectively (Table 2).

Table 1. *Effect of wet heat on percentage germination of Cuscuta campestris.*

	Germination percentage (%)								
	Day 3			Day 6			Day 9		
Treatment	Trial I	Trial II	Mean	Trial I	Trial II	Mean	Trial I	Trial II	Mean
Control	0.00b1	2.97a	1.49a	2.68a	3.27a	2.97a	16.97c	12.58a	14.78b
1 second	0.00b	0.15b	0.07b	7.08a	3.27a	5.17a	25.00bc	10.50a	17.75ab
2 seconds	0.15b	0.30b	0.22b	2.68a	2.97a	2.82a	45.54ab	10.80a	28.17ab
3 seconds	1.19a	0.60b	0.89ab	2.08a	1.93bc	2.01a	60.57a	4.61a	32.59ab
4 seconds	0.74ab	0.89b	0.82ab	1.93a	0.89c	1.41b	50.30a	6.34a	28.32ab
5 seconds	0.74ab	0.74b	0.74ab	2.38a	1.49c	1.93b	69.00a	3.42a	36.53a
SE(+)	0.25	0.92	0.76	2.66	0.50	1.86	11.33	9.40	11.99

[1]Means in the same column followed by the same letter(s) are not significantly different from each other according to Duncan's Multiple Range Test (DMRT) at 5%level of probability.

Table 2. *Effects of gibberellic acid and soaking time on percentage germination of Cuscuta campestris.*

	Germination percentage														
	Day 1			Day 3			Day 6			Day 9			Day 12		
Treatment	Trial I	Trial II	Mean	Trial I	Trial II	Mean	Trial I	Trial II	Mean	Trial I	Trial II	Mean	Trial I	Trial II	Mean
Gibberellic Acid (GA3)															
Control	1.06a	0.40a	0.73ab	1.19a	0.53b	0.86a	2.05a	0.53a	1.29ab	2.51a	0.46b	1.49a	3.18a	0.33b	1.76a
50ppm	0.33b	0.86a	0.60ab	0.93a	1.93ab	0.93a	1.13b	1.93a	1.03a	1.52a	1.13ab	1.33a	1.65a	1.32ab	1.49a
100ppm	1.06a	0.79a	0.93a	1.19a	1.72a	1.46a	2.05a	1.85a	1.95a	2.51a	1.99a	2.25a	3.18a	2.12a	2.65a
150ppm	0.33b	0.79a	0.56ab	0.93a	1.66a	1.29a	1.13b	1.72a	1.42ab	1.52a	1.59a	1.56a	1.65a	1.72a	1.69a
200ppm	1.06a	0.73a	0.90a	1.19a	1.26ab	1.22a	2.05a	1.59a	1.82ab	2.51a	1.52ab	2.02a	3.18a	1.99a	2.59a
250ppm	0.33b	0.66a	0.50a	0.93a	1.39ab	1.16a	1.13b	2.17a	1.65ab	1.52a	1.66ab	1.59a	1.65a	1.79a	1.72a
SE (+)	0.37	0.3	0.17	0.44	0.52	0.29	0.59	0.67	0.40	0.95	0.65	0.42	0.99	0.70	0.54
Soaking time (T)															
12hrs	0.80a	0.70ab	0.75ab	0.60b	1.09b	0.84b	1.29b	1.13b	1.21a	2.19ab	1.19b	1.69a	2.28a	1.26b	1.77a
24hrs	0.70a	0.40b	0.55 a	1.79a	0.83b	1.31a	2.28a	0.93b	1.61a	2.48a	0.90b	1.69a	3.19a	1.06b	2.12a
36 hrs	0.60a	1.03a	0.81 a	0.79b	1.83a	1.31a	1.19b	2.34a	1.77a	1.39b	2.09a	1.74a	1.79a	2.32a	2.05a
SE (+)	1.21	0.19	0.25	1.78	0.55	0.41	3.09	0.27	0.56	8.04	0.84	0.60	8.86	0.97	0.77
Interaction (GXT)	NS2	NS	NS	NS	NS	NS	*3	NS	NS	NS	NS	NS	NS	NS	NS

[1]Means in the same column followed by the same letter(s) are not significantly different from each other according to Duncun's Multiple Range Test (DMRT) at 5 % level of probability.

* Significant different at 5 % level of probability, NS = not significant at 5 % level of probability

At day 3 Trial I, II and the combined mean showed a significant difference, in which the soaking time at 24 hours in Trial I recorded highest germination of 1.79% and Trial II and the combined mean 36 hours soaking time recorded the highest germination of 1.83% and 1.31% respectively (Table 2). At day 6 significant different were observed at Trial I and II, with 24 and 36 hours soaking time recorded the highest germination of 2.28% and 2.34% (Table 2). Similarly, at day 9 Trial I and II showed a significant different with soaking time for 24 hours at Trial I and 36 hours at Trial II gave the highest germination of 2.48% and 2.09% respectively (Table 2). However, on day 12 only Trial II recorded significant difference, with soaking time for 36 hours had the highest germination of 2.32% compared with the 12 and 24 hours soaking time (Table 2).

The interaction between GA3 and soaking time was significant on *Cuscuta* germination only on day 6 of Trial I (Table 2). The interaction result showed that, 250 ppm and 36 hours soaking time had significantly the highest germination of *C. campestris* seeds compared to the rest of the interaction effects, although it was comparable with 100 and 150 ppm with 36 hours. soaking time treatments (Table 3).

4. Discussions

Effect of Wet Heat on Germination of Cuscuta campestris

Dormancy in seeds is usually associated with the factors of protective covering such as the hard seed coat or enclosed embryo. In this study dipping *C. campestris* seeds for 5 seconds in wet heat were effective in breaking the seed dormancy compared with the control which recorded less germination for the period of the experiment. Wet heat might have weakening effect on the cuticle or lignin of the seed coat of *C. campestris* thereby permitting the absorbsion of more water that might probably leach out germination inhibitors present either in the seed coat or in the embryo. Ekhator *et al*. (2008) have also used hot water treatment to enhance the germination of *Mimosa invisa* Mart where 71% germination was observed when seeds were immersed in boiling water for 2 minutes. Similarly, Aliero (2004) reported that, treatment of *Parkia biglobosa* seed for 4 seconds in hot water gave the highest germination of 42.4% when compared with the control, 1, 2, 3 and 5 seconds hot water treatments. The interactions

between GA3 and soaking time might be due to longer effect of soaking time as it has shown the higher the concentration of GA3 and the soaking time the higher the germination rate. This agreed with the findings of Keshtkar *et al.* (2008) who reported that, highest germination percentage (81%) of *Astragalus cyclophyllon* was obtained when the seeds were treated with 500 ppm GA3.

5. Conclusion

It can be concluded that wet heat for 5 seconds and 250 ppm GA3 and soaking times of 36 hrs. treatments have the potentiality to break dormancy of *C. campestris* seeds to germinate.

Table 3. *Interaction effects between Gibberellic acid (GA3) and soaking time on percentage germination of Cuscuta campestris at day 6 in Trial I.*

Gibberellic Acid (GA3) Treatment	Soaking time (hours)		
	12	24	36
Control	0.60b	0.20b	0.79b
50ppm	1.39b	0.40 b	0.99 b
100ppm	1.39b	1.39b	2.87ab
150ppm	0.79b	1.39b	2.97ab
200ppm	1.19b	1.59b	1.98b
250ppm	1.39b	0.59b	4.50a
SE (+) 0.83			

References

[1] Aliero, B. L. (2004). Effects of sulphuric acid, mechanical scarification and wet heat treatments on germination of seeds of African locust bean tree, *Parkia biglobosa*. *African Journal of Biotechnology*. 3: 179-181.

[2] Duncan, N. G. and Hasketh, J. D. (1968): Net photosynthesis rates, relative Growth rate leaf Number of 22 cases of maize and eight Temperatures. Crop Sci. 8 (11) 670-674.

[3] Ekhator, F., O. A. Akinyemijo and S. N Utulu (2008). Factors affecting giant sensitive plant (*Mimosa invisa* Mart) Seed germination and emergence. *Nigerian Journal of Weed Science* Volume 21. Pp. 38-49.

[4] Gomez, K. A and A.A. Gomez (1984).*Statistical procedure for Agricultural Research*. Wiley. New York.

[5] Gworgwor N. A., W.B. Ndahi and H. Chr. Weber. (2001) Parasitic Weed of North-eastern region of Nigeria: a new potential threat to crop production. The BCPC conference-weeds.

[6] Holm, L., J Doll, E. Holm, J. Panch, and J. Herberger, (1979).*World Weeds: Natural Histories and Distribution*. John Wiley & Sons, New York. 1129 pp.

[7] Keshtkar, A. R., H. R. Keshtkar, S. M. Razavi and S. Ddlfardi (2098). Methods to break seed dormancy of *Astragalus cyclophyllon*. African Journal of Biochemistry Vol. 7 (2) pp 3874-3877

[8] Lanini, W.T. and M. Kogan (2005).Biology and Management of *Cuscuta* in Crops. *Cienciae Investigacion Agraria*. 32:3: 165-179.

[9] Lanini, W.T., M. Miranda-Sazo and Y. Goldwasser (2004). Management of *Cuscuta* in tomato with resistant varieties and herbicide. Proceeding of the 8th International Parasitic Weed Symposium. Durban (South Africa). P.34.

[10] Marambe, B., S. Wijesundara, K. Tennakoon, D. Peneniya and C. Jayasinghe. (2002).

[11] Growth and development of *Cuscuta chinensis* Lam. and its impact on selected crops. *Weed Biology and Management* 2: 79-83.

[12] Menlebrouck, K., E. Ameloot, J. A. V. Assche, K. Verheneyen, M. Hermy and C. C. Baskin (2008). Germination ecology of the holoparasite *Cuscutaepithymum*. *Seed Science Research*. 18, 25-34.