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Seed Germination and Dormancy Breaking in Seeds of *Cucurbita Maxima* Duch. and *Cucumis Sativus* L. in Response to Different Treatments

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Abstract:
Seed germination studies and effect of different treatments on dormancy breaking and early seedling growth of *Cucurbita maxima* and *Cucumis sativus* seeds was investigated in the laboratory. Growth parameters such as percentage germination, Shoot length, Root length, Leaf area and Numbers of nodes were evaluated. Standard procedures were used in the evaluation of the growth parameters. The results indicated that in all the two plant species tested, growth parameters were significantly (P=0.05) by treatment with concentrated H_2S0_4, soaking with 0.1% KNO_3, chilling treatment and removal of seed coat were stimulated above the fresh seeds treatment. Treatment with concentrated H_2S0_4, soaking with 0.1% KNO_3 and chilling treatment showed highest promotion of percentage germination and early seedling growth parameters. *Cucurbita maxima* showed better responses to treatments with concentrated H_2S0_4, soaking with 0.1% KNO_3 and chilling treatment than *Cucumis sativus*. Results from this research indicates that dormant seeds of *Cucurbita maxima* and *Cucumis sativus* should can be overcome by treatment with concentrated H_2S0_4, soaking with 0.1% KNO_3 and chilling or removal of seed coats as this can promote the germination and early seedling growth process of *Cucurbita maxima* and *Cucumis sativus* seeds improving its yield and productivity thus proving to be a very useful pretreatment operational practice for farmers.

Keywords:
Chilling, *Cucurbita maxima*, *Cucumis sativus*, Dormancy, Germination, H_2S0_4, KNO_3, Seed

1. Introduction

Provided there are favourable conditions, all viable seeds have the potential to geminate. In certain plants such seeds will germinate immediately after harvest, in other they may fail to germinate for a period of time even when placed under favourable conditions that are ordinarily favourable for germination either due to

some internal factors or due to specific requirement for some environmental factors [1]. This dormant state of rest where the seeds germination and growth is suspended is referred to as dormancy of seeds.

The seed phase is the most important stage in the life cycle of higher plants as regards survival; dormancy and germination are natural mechanism to ensure this [2]. The seed is often well equipped to survive extended periods of unfavourable conditions and the embryo is protected by one or several tissues including endosperm, peristerm, seedcoats and fruit tissues that protect the embryo from physical damage [2], [3]. Seed is a small meristematic axis made of storage tissue and enclosed with membranes and sometimes with stony shells that forms the seedcoat which prevents entry of water, oxygen and may limit the enlargement of the embryo or may change the growth substance relationship of enclosed tissues [4]. Seed dormancy is a physical or physiological condition of viable seed which prevents germination even in the presence of favorable conditions for germination [2]. Seed often reveal complex and effective mechanisms which ensure survival under many environments and temporal situations while most vegetable species and commercially important cultivars are relatively free of dormancy mechanisms; members of Apiaceae, Asteraceae, Chenopodiceae, Malvaceae, Cucurbitaceae and Solanaceae are among the families with erratic germination due to seed dormancy [2], [5].

Cucurbits seeds are variable in size, shape and structure, traits which are used in family classification [6], [7]. The high economic value of some species including cucumber, melons and squash increases the importance of studying their optimal seed production [7], [8]. Most seed production in the Cucurbitaceae is directed for propagation. However, in some parts of the world cucurbits seeds (mainly watermelons and squash) are produced and consumed as snack food, because their nutritive values are high [9] [7]. Example, melon seeds may be served as nutritive addictives to pasta dishes [10]. In Nigeria, melon seeds are used to prepare the popular melon soup (egusi soup/efere ikon), and those of a wild watermelon ancestor can be used as a source of protein for human food and animal feed [11], [7]. Thus, this study is aimed at determining the effect of different treatment on seed germination and breaking of seed dormancy in *Cucurbita maxima* and *Cucumis sativus*.

Figure 1. *Seeds of Cucumis sativus L.*

Figure 2. *Seeds of Cucurbita maxima Duch.*

2. Materials and Methods

2.1. Source of Seeds for the Experiment

The mature seeds (fresh and dry) of *C. maxima* and *C. sativus* were obtained from Akwa Ibom state Agricultural Development Project (AKADEP), local farmer and markets. The viable seeds were used for this study.

2.2. Soaking of seeds in conc. Hydrogen Tetraoxosulphate (VI) acid (H_2SO_4)

Seeds of *C. maxima* and *C. sativus* were soaked in H_2SO_4 for 10 minutes and there after rinsed with sterile water and then transferred to the germination test process according to the methods described by [3].

2.3. Soaking of seeds in 0.1% Potassium Nitrate (KNO_3)

Seeds of *C. maxima* and *C. sativus* were soaked in KNO_3 for 10 minutes and there after rinsed with sterile water and then transferred to the germination test process according to the methods described by [12].

2.4. Cold Treatment (Chilling)

The dry seeds of *C. maxima* and *C. sativus* were chilled in refrigerator at 6.0^oC for 10 days and there after rinsed with sterile water and then transferred to the germination test process according to the methods described by [3].

2.5. Removal of Seedcoat

Seedcoats of *C. maxima* and *C. sativus* were mechanically removed by peeling off the seedcoats. Care was taken not to damage the endosperm.

2.6. Fresh Seeds

Fresh seeds of *C. maxima* and *C. sativus* were also used for this experiment, after harvest fresh seeds were removed from the fruits, rinsed with sterile water and then transferred to the germination test process according to the methods described by [3].

2.7. Germination Studies Setup

Germination experiments were tested using three replications of 10 seeds per treatment. After every treatment, seeds were placed on 15 cm sterilized petri dishes containing double layered Wathman No. 1 filter papers moistened with 10 ml of double sterilized water and incubated at 23 ± 2^0C under 16 hours photoperiod supplied by two Philips TL 40W florescent tubes. Germinated seeds and rotten seeds were counted and observed. A seed was considered germinated when the tip of the radicle had grown up to 2 cm long, in the petri dishes [2].

2.8. Determination of Growth Parameters

Early seedling growth parameters such as percentage germination shoot length, root length and number of nodes was determined by direct measurement using a measuring ruler. While the leaf area was determined by multiplying the leaf length by the leaf width (widest portion) with the correction co-efficient (0.82).

2.9. Used Statistical Analysis

Two-way analysis of variance (ANOVA) was employed to test for significant differences between treatments. However, p=0.05 was considered statistically significant [13].

3. Results and Discussion

Percentage germination responses to the different treatments was significantly different (p=0.05) between treatments and the two plants (*C. maxima* and *C. sativus*) tested. *C. maxima* showed better response in percentage germination to the different treatment with treatment with conc. H_2SO_4 and chilling treatments recording the highest percentage germination 63.33 ± 0.33 % and 61.11 ± 0.11 % respectively, while treatments with KNO_3 and seedcoat clipped recorded 59.22 ± 0.22 % and 53.33 ± 0.33 %. Fresh seeds recorded d lowest values 26.66 ± 0.66 % and 3.12 ± 0.08 % respectively (Figure 3). For *C. sativus* treatment with conc. KNO_3 recorded the highest percentage germination (61.11 ± 0.11 %), followed by treatments with and seedcoat clipped and H_2SO_4 (57.00 ± 0.07 and 56.66 ± 0.66 %), Chilling treatment recorded 47.77 ± 0.77 % germination, fresh seeds recorded the lowest values (18.88 ± 0.88 %). (Figure 3)

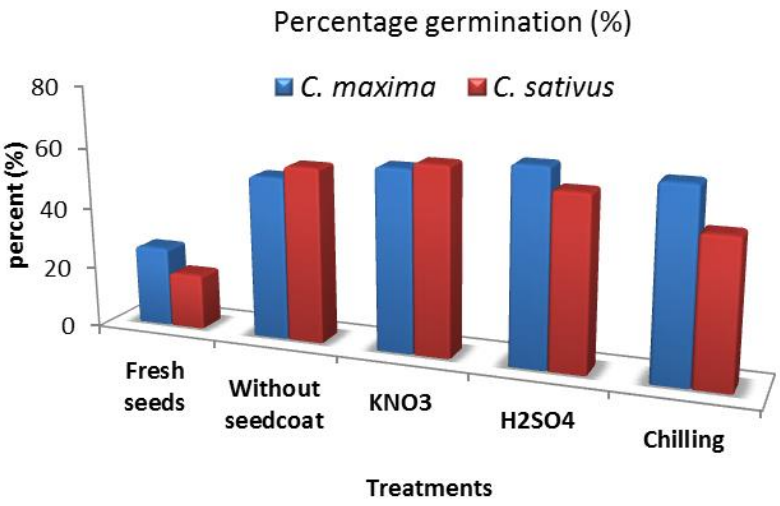

Figure 3. *Effect of Different Treatment on Percentage Germination of C. maxima and C. sativus.*

Growth parameters responses to the different treatments was significantly different (p=0.05) between treatments and the two plants (*C. maxima* and *C. sativus*) tested. *C. maxima* showed better response in shoot length to the different treatment with treatment with conc. H_2SO_4 and chilling treatments recording the highest values 5.21 ± 0.25 cm and 5.02 ± 0.15 cm respectively. While treatments with seedcoat clipped and fresh seeds recorded d lowest values 3.22 ± 0.11 cm and 3.12 ± 0.08 respectively (Figure 4). For *C. sativus* treatment with conc. KNO_3 recorded the highest values of shoot length (35.21 ± 0.21), followed by treatments with and seedcoat clipped and H_2SO_4 (3.22 ± 0.41 and 3.10 ± 0.45), Chilling treatment recorded 2.86 ± 0.31, fresh seeds recorded the lowest values (1.32 ± 0.02) (Figure 4).

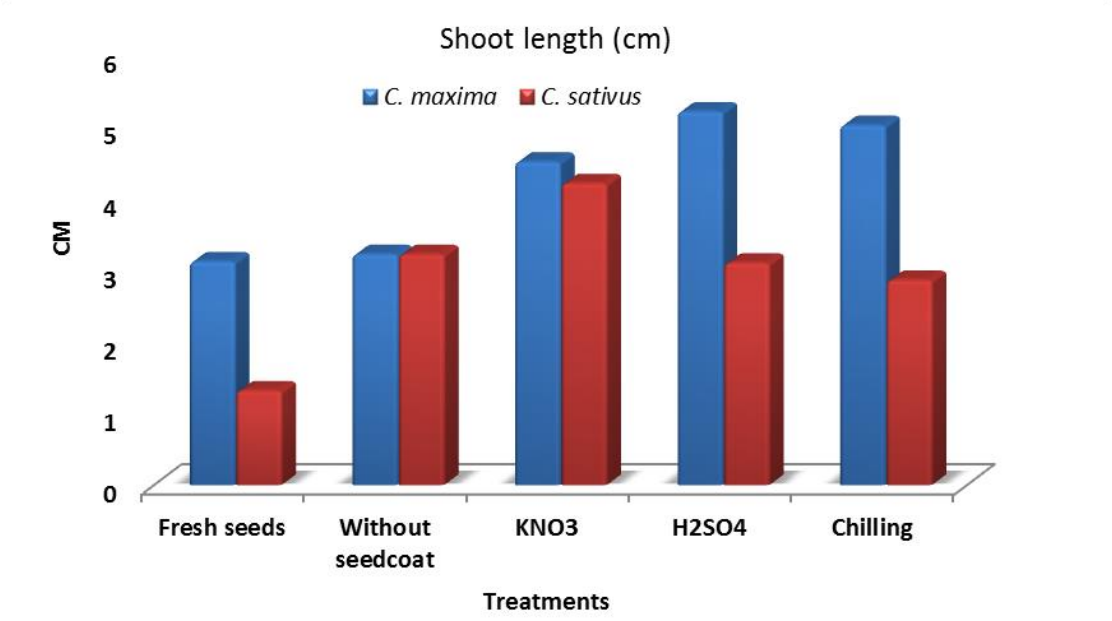

Figure 4. *Effect of Different Treatment on Shoot Length of C. maxima and C. sativus.*

C. maxima showed better response in root length to the different treatment with treatment with conc. H_2SO_4 and chilling treatments recording the highest values 5.04 ± 0.15 cm and 4.11 ± 0.22 cm respectively. While treatments with seedcoat clipped and fresh seeds recorded d lowest values 3.05 ± 0.16 cm and 2.11 ± 0.18 respectively (Figure 5). Treatment with KNO3 recorded 3.41 ± 0.41 (Figure 5). For *C. sativus* treatment with KNO_3 recorded the highest values of root length (3.91 ± 0.71), followed by treatments with conc. H_2SO_4andseedcoat clipped (3.31 ± 0.42 and 2.46 ± 0.35), while chilling treatment and fresh seeds recorded the lowest values (1.87 ± 0.07 and 1.24 ± 0.12) (Figure 5).

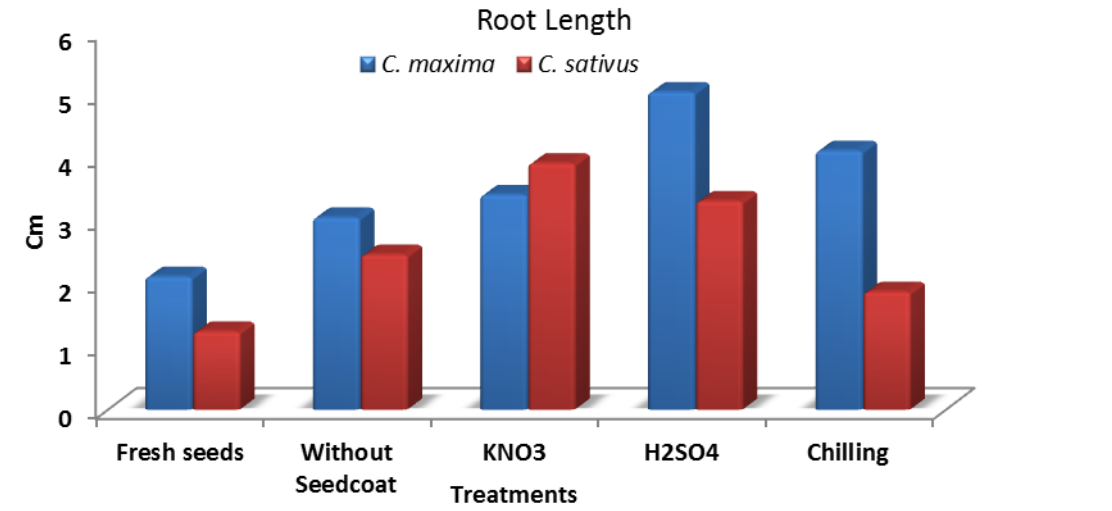

Figure 5. *Effect of Different Treatment on Root Length of C. maxima and C. sativus.*

C. maxima recorded better response in number of nodes to the different treatment with treatment with conc. H_2SO_4 and chilling treatments recording the highest values 7.00 ± 0.00 cm and 6.00 ± 0.00 cm respectively, While treatments with seedcoat clipped and treatment with KNO_3 recorded 5.00 ± 0.00 and 5.00 ± 0.00 respectively.

Fresh seeds of *C. maxima* recorded the lowest values 4.0 ± 0.00 (Figure 6). For *C. sativus* treatment with KNO_3 recorded the highest number of nodes (6.00 ± 0.00), followed by treatments with seedcoat clipped and conc. H_2SO_4 (4.00 ± 0.00 and 4.00 ± 0.00), while chilling treatment and fresh seeds recorded the lowest values (3.00 ± 0.00 and 2.00 ± 0.00) (Figure 6).

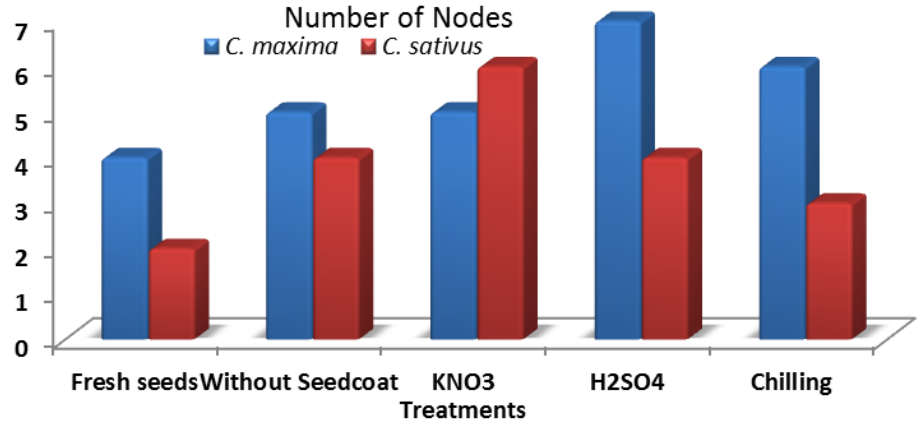

Figure 6. *Effect of Different Treatment on Number of Nodes of C. maxima and C. sativus.*

C. maxima recorded better response in leaf area to the different treatment with treatment with conc. H_2SO_4 and chilling treatments recording the highest values 1.22 ± 0.15 cm and 1.01 ± 0.05 cm^2 respectively. Treatments with KNO_3 and seedcoat clipped recorded 0.59 ± 0.22 and 0.53 ± 0.10 respectively. Fresh seeds of *C. maxima* recorded the lowest values 0.41 ± 0.07 (Figure 7). For *C. sativus* treatment with KNO_3 recorded the highest number of nodes (1.21 ± 0.20), followed by treatments with seedcoat clipped and conc. H_2SO_4 (0.70 ± 0.07 and 0.57 ± 0.11), while chilling treatment and fresh seeds recorded the lowest values (0.49 ± 0.13 and 0.28 ± 0.07) (Figure 7).

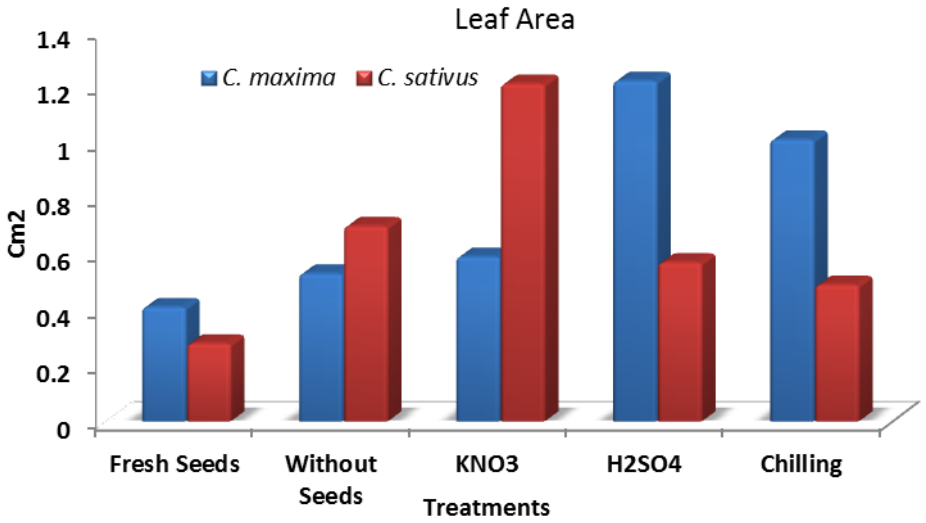

Figure 7. *Effect of Different Treatment on Leaf Area of C. maxima and C. sativus.*

The results of this research is further corroborated by the work [2] who reported that seeds sown and treated with conc. H_2SO_4 and chilling for two weeks showed significant stimulation in percentage germination and germination rate above the

control (fresh seeds). [14]Also reported that these treatments have improved germination and broken dormancy in about 650 plant species.Improvements in germination and breaking of dormancy of two varieties of *Cucumis sativus* and other Cucurbits has been reported by [15], [12]. To further support the high percentage germination obtained in this research in the chilling treatment, it is possibly due to days of chilling and hours of soaking in H_2S0_4 [16]. Low percentage germination in fresh seeds of *C. maxima* and *C. sativus* is probably as a result of changes and fluctuations in endogenous GA and ABA contents in fresh seeds of *C. maxima* and *C. sativus*.

4. Conclusions

From results obtained from this research work, it can be concluded that treatment with 0.1% KNO_3, soaking in concentrated H_2S0_4 solution and removal of seed coat can promote the germination process of *Cucurbita maxima* and *Cucumis sativus* seeds improving its growth parameters of the subsequent seedlings thus proving to be a very useful pretreatment operational practice.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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