

Original Research Article

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Morpho-physiological Qualities and Evaluation of Germinative Behavior of *Hyptis suaveolens* Poit (Big balm) Seeds

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ABSTRACT

Hyptis suaveolens (L.) Poit. (Lamiaceae) is a threat of biodiversity, environment and especially crops and pastures. This species has high propagation capacity in the environment. This study was initiated to contribute to the biological control of *Hyptis suaveolens*. To achieve this objective, morphological and physiological characteristics of seeds were realized. Mean length of 3.55 ± 0.18 mm, mean width of 2.20 ± 0.13 mm and mean thickness of 0.84 ± 0.08 mm were obtained. A purity rate of $94.4\% \pm 2.96$ and mean number of 4850 seeds per gram were also obtained at morphological study. At physiological level, germination rate of 64.25% and percent water content of $10.2 \pm 1.79\%$ were obtained. Physical scarification reduced germination to 16% at micropylar level (CMI) and 31% at opposite side of micropyl (COM). Chemical scarification had virtually no germination rate. After three (3) months of storage, germination rate of 63.25% in refrigerated and 23.00% in ambient condition were observed. Change light and darkness was more favorable for better seed germination with 80% germination rate compared to 74.25% in light and 53.75% in darkness. These results could help effectively to combat this invasive plant.

Keywords

Hyptis suaveolens,
weed, germination,
biological control,
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Introduction

Hyptis suaveolens (L.) Poit. Lamiaceae is native in American tropic. It has spread rapidly on all continents with acuity in Mediterranean basin of Central Asia and in Sub-Saharan Africa (Thiombiano *et al.*, 2009). It is widely used in traditional medicine for its pharmacological and bacteriological properties. *Hyptis suaveolens* is sudorific, antispasmodic, galactogenic,

insect repellent and insecticide plant (Ngom *et al.*, 2012).

The leaves are used as tea, infused, decocted and poultice forms. The decocted of these leaves has used to treat asthma, jaundice and hyperthermia. The leaves are consumed against head pain, euphoric, bechic, stimulating and thinning of bronchial secretions as tea form (Bissangou and Ouamba, 1997). Despite all these used, *Hyptis*

suaveolensis an invasive plant. It infests cities, villages, fields, wasteland and roads (Madjidou *et al.*, 2010; Aboh, 2008). Furthermore, its presence also compromises agro-pastoral activities because it is not appetized by animals (Thiombiano *et al.*, 2009; Thiombiano, 2008).

Hyptis suaveolens has a great capacity of propagation and also has strong capacity of regeneration in new biotopes. Therophyte plant, many feet species are able to get through bad season and seems to progressively evolve to Chamephyte stage (Thiombiano *et al.*, 2009).

Many studies of this plant have concerned therapeutic aspect. Few of them have focused on biological control. This study aims to focus on morphological and physiological characteristics of seeds of *Hyptis suaveolens*.

Materials and Methods

Study site

This work was carried out in Poro region in Korhogo department in Northern Côte d'Ivoire (Figure 1). It is limited in Mali Republic in North, at Bounkani in South, at Tchologo and Hambol in East and in West by Bagoué area (CGK, 2007).

Seeds harvest

Seeds harvest was done by mowing and bearing mature fruits. Protective envelopes and stems was separated with seeds by threshing of harvested.

Morphological and physiology description of seeds

The morphological study consisted to realize physical parameters including length, width, thickness, specific purity of seeds of *H.*

suaveolens and number of seeds per gram. The physiological parameters study has consisted to evaluate water content, germination time, germination rate, means germination time and germination speed.

Seeds specific purity

Seeds gram (1g) was taken with four repetitions. They were selected at random from entire seed using precision balance (Kameswara *et al.*, 2006). Plant debris and sand were removed using fine forceps, than seeds were weighed. Purity percent was calculated according to following formula.

$$\text{Percent purity (\%)} = \frac{\text{Pure seed weight (g)}}{\text{Total sample weight (g)}}$$

Means seed size and number

Length, width and thickness means of seeds measurements, were carried out using caliper. Seeds mean number per gram has been calculated using the formula below.

$$\text{Seeds mean number} = \frac{\sum \text{pure seeds number of lot}}{\text{Total number of lots}}$$

Germination capacity of *Hyptis suaveolens* seeds

Germination capacity percent (CG) was calculated from number of seeds germinated daily according to the formula below.

$$\% \text{ CG} = (\sum n_i/N) \times 100$$

n_i is germinated seeds number a day,
 N is total seeds number.

The germination time corresponds to necessary time (in days) to observe first germinated seed, and germination speed is time necessary to obtain 50% of germination capacity (Côme, 1982).

Seed germination conditions

Different parameters influencing germination of *H. suaveolens* seeds have been studied. These are physical and chemical scarification and light impact on germination capacity of seeds, the medium and shelf life of the seeds have been studied.

Physical scarification impact on germination

The lysis of seed coat by piercing with needle has allowed better penetration of water and oxygen. Mechanical materials were used. Three treatments were applied to 100 seeds with four replicates. In first group seeds were scarified at micropyl (CMI), second group has consisted of scarification on micropyl opposite side (COMI). The third treatment has concerned non-scarified seeds which has control group (TM). The seeds has sown in distilled water and then placed under germination conditions.

Chemical scarification impact on germination

Soaking time (TP5; TP15; TP30) and rate of acid dilution (DL0; DL50; DL100) have been combined. Each treatment is a combination of two factors. Untreated seeds have constituted control treatment (TM).

Four hundred (400) pure seeds were taken to form 4 samples of 100 seeds. These seeds were exposed to ambient temperature for five hours to remove moisture.

Seeds was placed in tray containing sulfuric acid dose. Seeds were washed in tap water for 5 to 10 mn and spread in thin layer on sieve to wring them out. They were sown in germination tank. Distilled water was used for humidification.

Light, environment and storage time impact on germination

Seeds were placed in light, in dark, in light/dark alternating conditions. Treatments were applied to each group with four repetitions of 100 seeds. Batch was maintained in darkness; in light and dark alternate and in light, in distilled water for each treatment. The follow-up was carried out every day and germinated seeds were recorded and removed from test.

For environment and storage time impact, seeds were kept in refrigerated temperature (MR) at 7 ° C and in ambient medium (MA).After 1, 2 and 3 months of storage, seeds were extracted for viability tests.

Data analysis and processing

Excel spreadsheet was used for descriptive statistics and curves. XLSTAT 2014 and SATISTCA version 7.1 software were performed for statistical analyzes.

Results and Discussion

Morphological parameters description

Seeds of *Hyptis suaveolens* measurements have showed means length of 3.55 ± 0.18 mm, means width of 2.20 ± 0.13 mm and means thickness of 0.84 ± 0.08 .For specific purity, seeds of *Hyptis suaveolens* are pure at $94.4\% \pm 2.96\%$.Means number of seeds per gramis 4850 ± 352 seeds (Table 1).

Physiological parameters descriptions

Physical scarification effect on germination capacity

In terms of physical scarification, Control seeds group (TM) recorded a strong growth in germination rate (62%) on 6th day after

sowing with germination speed of two days. Seeds scarified at micropylar level (COM) and on micropyl opposite side (CMI), have shown respectively germination rates of 16% and 31% as highest rates in the test. Statistical analyzes showed a significant difference between the three groups (Fig. 2).

Chemical scarification effect

Chemical scarification of seeds of *Hyptis suaveolens* showed considerable drop of germination rate with different doses of acid sulfuric used or time required for soaking. No-scarified seeds have shown highest germination rate (34.75%), the other treatments did not have effect or had a very weak effect on seeds germination. The statistical tests showed that there is a significant difference between acid treatments group and the control group. In general, longer of duration of soaking has provoked less of seeds germinated. Tests with same letters in the columns are not statistically different at 5% level (Fig. 3).

Influence of light on seeds germination

Seeds are germinated in all light conditions in this study. The highest germination rates were recorded at 8th day after sowing for the three tests group. It was 53.75% in darkness condition, 74.25% at light and 80% light / dark alternation. Statistical analyzes performed have shown that seed germination varies with light condition at $P (0.01) < 0.05$ (Fig. 4).

Environmental and storage duration impact on seeds germination

Germination rate of *Hyptis suaveolens* seeds was studied according to environment and duration of storage. After 1 month of storage, means germination rate of 62.75% in the cold (7°C) and 65.66% in an ambient environment were obtained. Statistical analysis showed that after one month of storage, germination was same in both groups.

At two (2) months of storage, germination of seeds stored in cold (7 °C) and in the ambient environment was different. The germination rate was 61% in a refrigerated temperature against 43.25% in an ambient condition.

Three (3) months of storage after, 63.25% and 23.00% germination rates were obtained respectively in refrigerated environment and in ambient environment. Analyzes of variance revealed that conservation in refrigerated environment is more effective than conservation in an ambient condition (Table2).

Hyptis suaveolens seeds measurements has showed means thickness of 0.84 ± 0.08 mm, means width of 2.20 ± 0.13 mm and means length of 3.55 ± 0.18 mm. This result is different from those of Aboh (2008) in terms of length in a similar study in Benin. For this author, means length was 2 mm, that could be due to the difference in local or geographic conditions.

Table.1 Morphological parameters measured

Morphological parameters	Means values
Length (mm)	3.56±0.19
Width (mm)	2.20±0.13
Thickness (mm)	0.84±0.08
Specific purity (%)	94.40±2.96
Number of seeds	4850±352

Table.2 Means germination rate of *Hyptis suaveolens* seeds with storage time

Storage time	Temperature Conditions	Means rate	F	Pr > F
1 month	Refrigerated condition	62.75a	0.41	0.50
	Ambient condition	65.66a		
2 month	Refrigerated condition	61.05a	16.37	0.01*
	Ambient condition	45.00b		
3 month	Refrigerated condition	63.25a	17.30	0.01*
	Ambient condition	23.00b		

Fig.1 Map of the Poro region (Côte d'Ivoire)

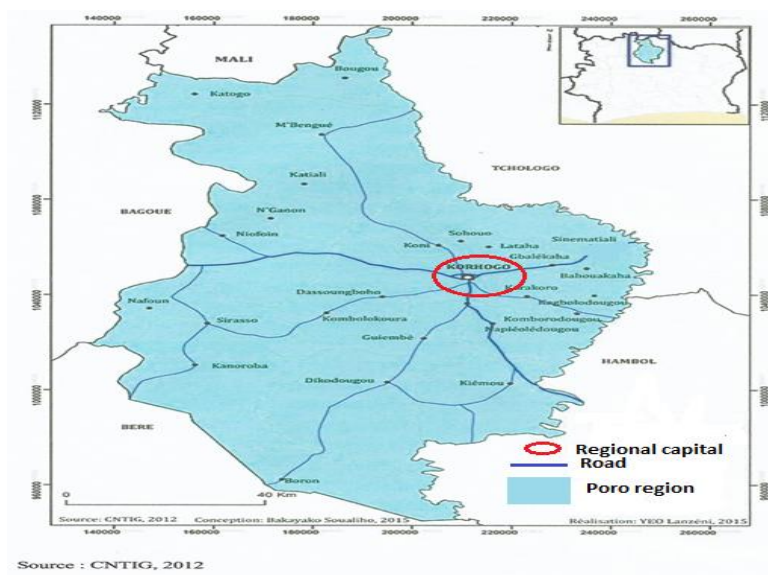


Fig.2 Effect of physical scarification on *Hyptis suaveolens* seeds germination capacity

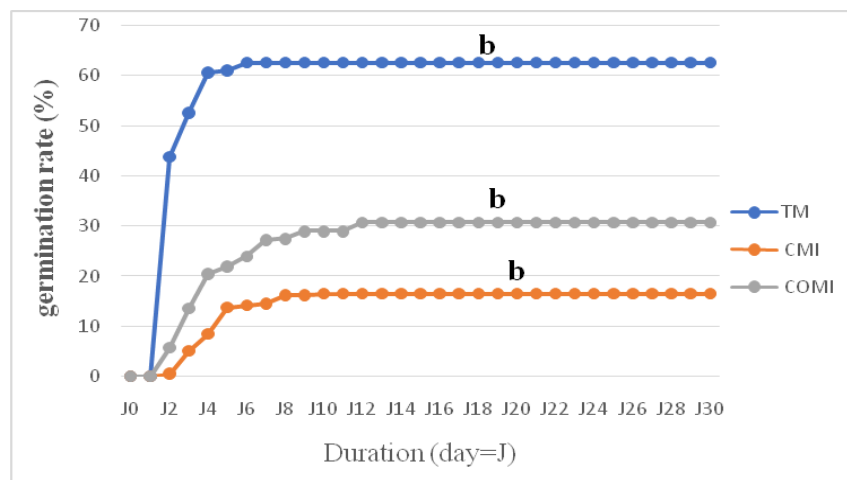


Fig.3 Evolution of germination rate of *Hyptis suaveolens* seeds with soaking time and acid dilution

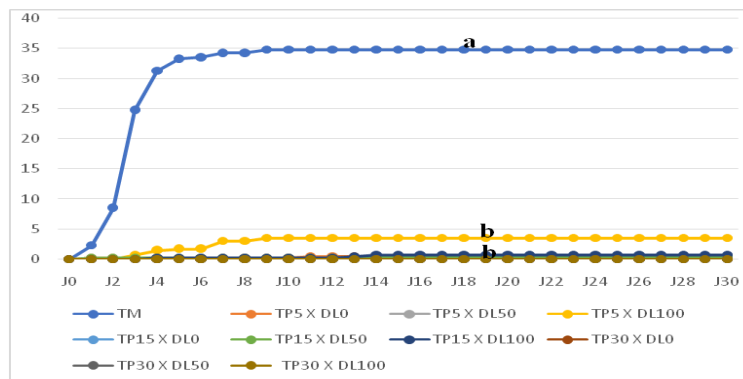
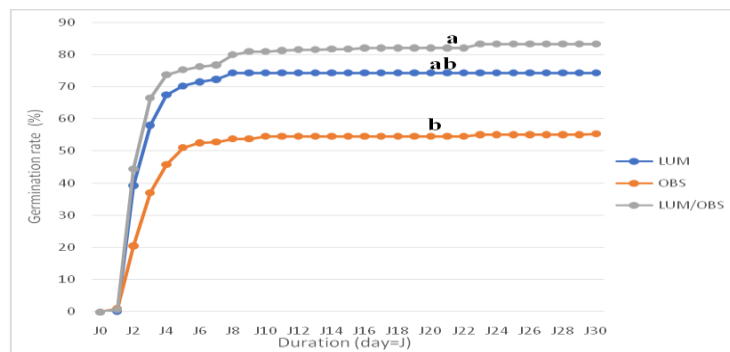


Fig.4 Evolution of germinative capacity of *Hyptis suaveolens* seeds with light conditions



The purity rate of $94.4\% \pm 2.96\%$ and means number of seeds of 4850 ± 352 seeds per gram were obtained. Thiombiano (2008) obtained similar result with 6.5 grams of seeds per foot of *Hyptis suaveolens*. For Aboh (2008) square meter (m^2) of soil occupied by this plant could produce more than 5000 seeds. All those studies revealed that *Hyptis suaveolens* has a high capacity to produce seed.

The scarified seeds recorded a low germination rate. This result could be justified because physical scarification reduces the germination capacity of seeds. Micropylar region should be avoided because it is the most sensitive part. Embryo is located on it (Kameswara *et al.*, 2006).

Sulfuric acid treatment revealed low germination rate of *Hyptis suaveolens* seeds. That could be explained because sulfuric acid treatment has inhibited germination of seeds. These observations would lead that there is no dormancy in *Hyptis suaveolens* seeds Caesar (2008).

Studies of *Hyptis suaveolens* seeds viability have shown that refrigerated temperature is better at seeds conservation than ambient temperature. This result is similar to those of Cole (1979) who obtained same result with *Hyptis suaveolens* and contrary result with *Panicum laxum* (Poaceae). This could be explained because *Hyptis suaveolens* (Lamiaceae) and *Panicum laxum* (Poaceae) are from different botanical families.

Conclusion and perspectives

This study aim to determine morphological and physiological characteristics of *Hyptis suaveolens* seeds. At morphological level, means length of 3.55 ± 0.18 mm, means width of 2.20 ± 0.13 mm and means thickness of 0.84 ± 0.08 mm have been obtained. A purity rate of $94.4\% \pm 2.96\%$ and means number of 4850 ± 352 seeds per gram have been obtained. Physiologically, means germination rate of 64.25% and means water content of $10.2 \pm 1.79\%$ have been obtained. The two types of scarification carried out, inhibited germination of seeds. Physical scarification germination to 16% at micropylar level (MIC) and to 31% at opposite side of micropyl (COM). Chemical scarification recorded almost zero germination rate. At three (3) months of storage, germination rate of 63.25% in refrigerated condition and 23.00% in ambient condition have been observed. An alternation of light and dark is more favorable for better germination of seeds with 80% germination rate against 74.25% in light and 53.75% in dark. Morphological and physiological seeds parameters studied of *Hyptis suaveolens* could be used to develop or improve effective and sustainable method of control of this plant.

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