Brief Communication

Allelopathic potential of aqueous extracts of leaves and branches of mint under the initial development of cowpea beans

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Abstract

This study aims to evaluate the allelopathic potential of aqueous extract of leaves and branches of mint under the initial development of seedlings of cowpea (cv. BRS Guariba). This study was developed at the Federal Rural University of Pernambuco, Campus Serra Talhada-PE. Six concentrations were evaluated: 0, 20, 40, 60, 80 and 100% of aqueous extract of leaves and branches of mint. The variables analyzed were seedling emergence, shoot and root length, shoot and root dry matter and stem diameter. The aqueous extracts of leaves and branches of mint in the different studied concentrations had no significant effects on the studied variables, except for root length of seedlings submitted to mint leaf extract. However, when compared with the extracts from branches and leaves, it is observed that the leaf extract caused a decrease in all variables in relation to those of branches. Possibly, this result indicates that the extract from leaves of mint contains a secondary metabolic at a higher concentration, delaying the initial development of seedlings of cowpea.

Keywords: Vigna unguiculata L., Mentha, Allelopathy, Seedlings

The cultivation of cowpea (Vigna unguiculata L.) in the Brazilian Northeast has been fundamental for improving food quality. Source of vitamins and minerals, cowpea has as other characteristics an easy adaptation to the edaphoclimatic conditions of the semiarid region. Its cultivation is often mixed with other crops in a same area, which is called intercropping.

Among the plants cultivated intercropped with cowpea, a species has become characterized as medicinal. Mint (Mentha x villosa Huds.) stands out among them due to several medical and industrial functions. Its medicinal functions comprise an expectorant, antispasmodic, stomach, antiseptic, carminative, choleretic and vermifuge action (Bonfim et al., 2017). Furthermore, mint is also used as a condiment and as food essence in the cosmetics and drinks industries (Martins et al., 2002).

Because it is easy to cultivate and has a low production cost, mint is usually grown intercropped with other species. However, studies report allelopathic effects of some medicinal species on other crops. Species of the genus Mentha stand out due to their allelopathic potential by having monoterpenes as major components of essential oils. Allelochemicals are compounds present in the tissues of different structures of plants and are released into the environment as a form of protection against other plants which compete for water, light and nutrients (Cruz-Silva et al., 2015). The release of such compounds by plants occurs through exudation in the roots and through volatilization by leaves (Reigosa et al., 2013).
These compounds are able to cause harmful effects to plants close to the issuer legume; for this reason, it is important to know the plants that can be grown in intercropping (Rossi et al., 2015).

Thus, the objective of this work is to evaluate the allelopathic effect of the aqueous extract of leaves and branches of mint during the initial development of seedlings of cowpea.

This experiment was carried out at the premises of the Federal Rural University of Pernambuco, in the Academic Unit of Serra Talhada, Serra Talhada, PE, Brazil.

Green leaves and branches of mint were collected at the campus Academic Unit of Serra Talhada. The collected material was crushed using blender, adding distilled water to facilitate the crushing of the material at a proportion of 100 g L⁻¹, resulting in the crude extract corresponding to a concentration of 100%. After the extract was obtained, it was sieved.

From the crude extract, dilutions were made to obtain the concentrations of 20, 40, 60, 80 and 100% of aqueous extract; the distilled water concentration (0%) was the control, totaling six treatments. The seeds of cowpea (cv. BRS Guariba) were moistened at different concentrations. After being treated, seeds were sown in polystyrene trays containing 128 cells. One seed was sown per cell. The trays were filled with soil collected at a depth of 20 cm, and then this material was autoclaved at 120 °C for 1 hour.

After sowing in trays, seeds were taken to the experimental nursery of that university and watered until the final cycle of the initial development of seedlings (8 days after sowing).

To evaluate the allelopathic potential of the aqueous extract of leaves and branches of mint on germination, the following variables were analyzed:

The evaluations were made by counting the emerged seedlings with expanded cotyledonary leaves at the 8th day after sowing (Brasil, 2009).

The evaluation of shoot and root length was performed at the 8th day after sowing using 10 normal seedlings. For these determinations, we used a graduated ruler.

The shoot and root system used in previous evaluation was submitted to drying in an oven at 60°C for 48 hours, and then weighed in a precision scale of 0.0001 g for determination of mass.

An evaluation was performed at the 8th day after sowing using 10 normal seedlings per replication. Measurements were made using a pachymeter.

The averages were compared by Scott-Knott test at a 5% level of probability.

The results showed no significant differences between the concentrations of aqueous extract of branches of mint on the variables analyzed at a 5% probability (Table 1). It was observed that the aqueous extract from branches of mint, according to different concentrations, stimulated the emergence of seedlings and shoot dry matter in relation to the control treatment (0%), evidencing a positive effect.

Table 1. Means of seedlings emergence (SE), shoot length (SL), root length (RL), shoot dry matter (SDM), root dry matter (RDM) and stem diameter (SD) of seeds of cowpea beans, cv. BRA Guariba, subjected to different concentrations of aqueous extract of branches of mint.

| Concentrations | SE (%) | SL (cm) | RL (cm) | SDM (g) | RDM (g) | SD (mm) |
|---------------|-------|--------|--------|---------|---------|---------|
| 0             | 62 a  | 3.26 a | 3.01 a | 0.50 a  | 0.14 a  | 2.74 a  |
| 20            | 64 a  | 3.07 a | 3.08 a | 0.55 a  | 0.16 a  | 2.36 a  |
| 40            | 65 a  | 3.40 a | 2.74 a | 0.61 a  | 0.22 a  | 2.37 a  |
| 60            | 66 a  | 2.96 a | 2.40 a | 0.45 a  | 0.14 a  | 2.48 a  |
| 80            | 70 a  | 3.48 a | 2.56 a | 0.45 a  | 0.14 a  | 2.59 a  |
| 100           | 75 a  | 3.56 a | 2.70 a | 0.64 a  | 0.16 a  | 2.61 a  |

CV % 24.8 11.0 17.3 22.4 37.9 8.5

Different letters within each column differ by Scott-Knott test at 5% probability.

The results corroborate those of Brito and Santos (2012), who studied the allelopathic effects of tree species from the Caatinga on germination and seed vigor of cowpea and verified that the extracts of quince and Jurema did not interfere with emergence of seedlings; on the other hand, Santos et al. (2010) observed a negative allelopathic effect on germination of cowpea seeds in function of the application of aqueous extract of pigeon pea. Ribeiro et al. (2009), evaluating the allelopathic effects of aqueous extracts of Crinum americanum L on vegetable species, verified that the action of different extracts of Crinum americanum interfered significantly with the development of shoots and roots of lettuce, radish and sesame seedlings.

Wandscheer and Pastorini (2008) studying the allelopathic interference of Raphanus raphanistrum L. on the germination of Lactuca sativa L. and
*Solanum lycopersicum* L., verified that when lettuce seeds were subjected to treatments with extracts from leaves of turnip, there was a visible browning of rootlets and, consequently, degradation of its tissues. For Ferreira and Borguetti (2004), some allelopathic substances may influence the emergence of abnormal seedlings, with a common characteristic necrosis of the primary root. Manoel et al. (2009), evaluating the allelopathic activity of fresh and dry extracts from leaves of Barbatimão (*Stryphnodendron adstringens* (Mart.) Coville) and “pata de vaca” (*Bauhinia forficata* Link) on the germination and initial development of tomato seedlings, also verified that there was a decrease in the average length of roots of seedlings.

Effect of aqueous extract of mint leaves on cowpea bean seedlings. It was observed that there was a significant difference in root length (RL). The concentration of 40% of aqueous extract of mint was beneficial for root growth; as for the other variables, there was no significant difference between the treatments, as shown in Table 2. Santos et al. (2010), evaluating the allelopathic effect of leguminous trees on the germination of seeds of cowpea, observed that there was a reduction in germination of cowpea seeds in function of the application of aqueous extract of leaves of pigeon pea.

### Table 2. Mean of seedling emergence (SE), shoot length (SL), root length (RL), shoot dry matter (SDM), root dry matter (RDM) and stem diameter (SD) of seeds of cowpea beans, cv. BRA Guariba, subjected to different concentrations of aqueous extract of leaves of mint.

| Concentrations | SE (%) | SL (cm) | RL (cm) | SDM (g) | RDM (g) | SD (mm) |
|----------------|--------|---------|---------|---------|---------|---------|
| 0              | 56 a   | 2.14 a  | 2.92 b  | 0.25 a  | 0.05 a  | 2.07 a  |
| 20             | 50 a   | 2.11 a  | 3.44 b  | 0.23 a  | 0.04 a  | 1.96 a  |
| 40             | 57 a   | 2.31 a  | 4.59 a  | 0.27 a  | 0.05 a  | 1.97 a  |
| 60             | 61 a   | 2.11 a  | 3.70 b  | 0.28 a  | 0.05 a  | 2.00 a  |
| 80             | 55 a   | 2.15 a  | 3.43 b  | 0.25 a  | 0.04 a  | 2.32 a  |
| 100            | 58 a   | 2.28 a  | 3.52 b  | 0.27 a  | 0.04 a  | 2.28 a  |
| CV %           | 30.1   | 11.0    | 20.2    | 24.2    | 30.1    | 12.2    |

Different letters within each column differ by Scott-Knott test at 5% probability.

Bach et al. (2010), evaluating the allelopathic effect of the aqueous extract of boldus and picão preto on the germination and development of seedlings of lettuce, concluded that the concentrations of 20, 30 and 40% exerted more severe effects on shorter shoot length of seedlings of lettuce (*Lactuca sativa*). In studies conducted by Mauli et al. (2009), evaluating the allelopathy of leucaena on soya beans, lettuce and weed, it was observed that there was a significant difference in the percentage of germination and root length of lettuce seeds when treated with aqueous solutions, using hot and cold water, from the leaves of leucaena.

These results corroborate those of Manoel et al. (2009), who found that there was a decrease in the average length of roots of tomato seedlings when treated with fresh and dry extracts from leaves of barbatimão and “pata de vaca”.

The aqueous extracts of leaves and branches of mint at the different concentrations studied had no significant effects on the studied variables, except for root length of seedlings submitted to mint leaf extract. This evidences a positive general allelopathic effect on the initial development of seedlings of cowpea.

However, when compared with extracts from branches and leaves, it was observed that the leaf aqueous extract caused a decrease in all variables in relation to branches. Possibly, this result indicates that the extract from leaves of mint contains a secondary metabolic content at a higher concentration, delaying the initial development of seedlings of cowpea.

Thus, we recommended to perform experiments in the field for evaluation of viability of cultivation of cowpea intercropped with mint.

### Conflict of interest: All authors declare no conflict of interest.

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