



Research Paper

ALLELOPATHIC POTENTIAL OF *Himatanthus obovatus* LEAF EXTRACT ON LETTUCE GERMINATION

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Abstract

The Cerrado native species present allelopathic potential still little investigated. *Himatanthus obovatus* (Müll. Arg.) Woodson is one of the commonest species in the Cerrado and lose all the leaves in the dry season leaving the ground covered. The objective of this study was to evaluate the allelopathic potential of *Himatanthus obovatus* leaf extracts on germination and growth of *Lactuca sativa* L. seedlings. The extract was obtained by 50 g leaves in 500 ml of distilled water in a blender. From this extract was obtained by diluting in water in concentrations of 0 (control), 25, 50, 75 and 100%. The bioassay was conducted in completely randomized design with five levels and four replicates of 50 seeds of *L. sativa*. The seeds were placed in transparent plastic boxes type gerbox sealed with plastic wrap and kept in BOD incubator at 20 °C and constant photoperiod of 12 hours for seven days. The characteristics were germination and abnormal seedlings, speed germination index, shoot length and root dry weight of seedling. Different concentrations of the *Himatanthus obovatus* extract did not affect the percentage of lettuce germination ranging 99-100%, the percentage of abnormal seedlings, dry weight of shoot and root dry mass. The variation in germination speed index, length of root and shoot length of lettuce seedlings can be explained by polynomial models of second-degree regression with R² above 97%. The IVG and root length decreased with increasing concentrations of the extract, but the length of the shoot was favored by higher concentrations of the extract. The *Himatanthus obovatus* leaf extract at different concentrations did not affect the lettuce seed germination and the allelopathic potential was seen in developmental characteristics of lettuce seedlings.

Key words: *Allelochemicals, aqueous extracts, germination, Himatanthus obovatus.*

INTRODUCTION

Himatanthus Willd. exSchult. isa gender pantropical belonging to Rauvolfioideae sub-family, Plumerieae tribe and has a total of nine species, with one species in Panama and eight species in South America. The species of *Himatanthus* occurring in Brazil are distributed in the Amazon

region, Central region Cerrado areas in the northeast in areas of Caatinga and Carrasco, and the coastal region occurs in the Atlantic Forest [1]. In more recent studies, *Himatanthus obovatus* (Müll. Arg.) Woodson was considered the most widely distributed species in Brazil and Bolivia, mainly occurring in cerrado, savanna and dirty field [1].

The importance of *Himatanthus* gender in folk medicine is supported by reports from several different local communities in Brazil where the preparations of the bark and latex are used to treat mainly tumors, inflammations and ulcers [2], while the leaves are used to treat hypertension [3]. The species is widely used by people of Planaltina, DF, in the form of garrafada as purifying blood, and intestinal worms against infection [4].

Himatanthus obovatus loses its leaves during the dry period and the dough sheets lying on the ground can be allelopathic action on other species, as is known in the literature, the isolation of plant alkaloids belonging to Apocinaceae family such as species of the genera *Rauvolfia* and *Tabernaemontana*.

The positive or negative interference of secondary metabolic compounds produced by a plant and released in the medium is known as "allelopathy" and the effect on the development of another plant can be indirect, through the processing of these substances in the soil and microorganisms activity [5].

The presence of secondary compounds or allelochemicals has been found in all plant organs, with a tendency to accumulate in the leaves, and the release of these compounds can occur by root exudation, leaching or volatilization [6]. The leaf is the most active plant body metabolically, reasonable being to present greater diversity of allelochemicals [7].

The possibility of controlling weed species at allelochemicals was shown by [8], [9] and [10]. The natural compounds have several advantages over synthetic compounds, such as increased water solubility, absence of halogenated molecules and less half life [11]. Therefore, allelochemicals are revealed as natural herbicides, which would be free from the harmful effects caused by synthetic herbicides. The aim of this study was to verify the allelopathic potential of leaf extracts of *Himatanthus obovatus* under the lettuce germination

MATERIALS AND METHODS

The experiment was conducted in the Faculty of Agronomy Seed Laboratory Animal Science and Veterinary Medicine (FAMEVZ) of the Federal University of Mato Grosso (UFMT) Campus Cuiabá. *Himatanthus obovatus* leaves were collected from adults in Chapada dos Guimarães (MT) between the geographic coordinates 15°10' - 15°30' South latitude and 55°40' - 56°00' West longitude. The climate is Aw (savanna climate), according to Köppen classification.

The leaves were ground in a blender at a ratio of 50g leaves/500ml of distilled water. The extract was filtered on filter paper and stored in glass vials (Amber).

For bioassay of germination was used completely randomized design with five treatments consist of the concentrations of the leaf extract obtained by diluting in distilled water (0 - control, 25, 50, 75 and 100%), with four replications of 50 lettuce seeds (*Lactuca sativa*). The pH determination was made pH meter and the electrical conductivity (EC) were measured by conductivity. From the EC values determined the osmotic potential (OP) according to the formula proposed by [12]: osmotic potential in the atmosphere (ATM) = - 0.36 * CE. The data were transformed to ATM (Mpa).

The seeds were placed in transparent plastic boxes gerbox (11x11x3 cm) on two sheets of blotting paper moistened with their treatment, in the amount of 2.5 times the mass of the substrate. The boxes were covered and sealed with plastic wrap and kept in BOD incubator at 30 °C during the day and 20 °C overnight in a photoperiod of 12 hours for seven days.

Every 24 hours was noted the number of germinated seeds. The criterion to assess the germination of the seeds was based on the physiological germination concept cited by [13], which describes the beginning of germination to seed soaking and its end with the protrusion of the radicle. Seven days after treatment application, lettuce seeds were evaluated as to the length of the shoot: root transition region to the insertion of the cotyledons and root length: transition region of the shoot to the apex of the root.

The seedlings were classified as normal or abnormal according to the specifications [14]. Were considered abnormal those who have shown potential to continue its development, and normal seedlings with minor defects as limited or minor damage, growth retardation in the root system. So were considered abnormal, the seedlings with root systems or rotten air, absent totally atrophied.

The germination rate index was determined according to [15] calculated by the expression: $IVG = G_1/N_1 + G_2/N_2 + \dots + G_n/N_n$, where G_1, G_2, G_n = number of germinated seeds counted in the first, second and last counts, and N_1, N_2, N_n = number of days from sowing to first, second and last counts. The allelopathic effect index (RI) was calculated according to the formula $RI = 1 - C/T$ ($T \geq C$) or $RI = T/C - 1$ ($T < C$) where: C = speed of germination of the control and T = speed of germination of the treatment.

The variables were subjected to analysis of variance and regression when significant models were selected with higher R^2 .

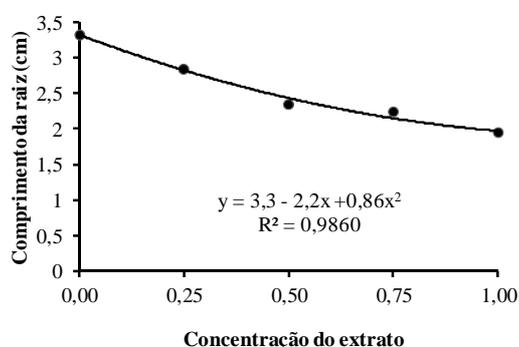
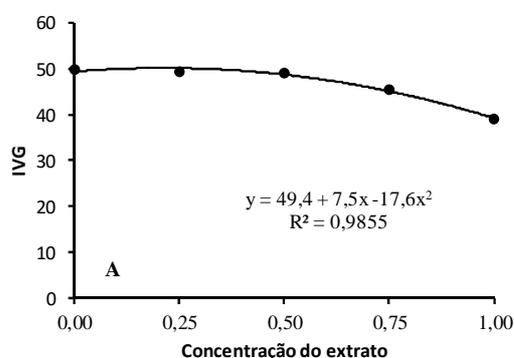
RESULTS AND DISCUSSION

The physicochemical characteristics presented by the extracts of *Himatanthus obovatus* leaves in different concentrations are shown in Table 1. It is observed pH range compared to the control, with acidity in the extracts, but remained within acceptable standards for germination and seedling growth allelopathic tests [16]. As for the osmotic potential, the values were lower than -0.2 MPa and therefore not responsible for possible changes in germination behavior of lettuce [17].

TABLE 1. Physical and chemical characteristics of aqueous extracts of leaves of *Himatanthus obovatus*. Cuiabá, MT. 2015.

Extracts Concentration	pH	PO (MPa)
0%	7,6	-0,000109422
25%	4,59	-0,013531915
50%	4,58	-0,025167173
75%	4,58	-0,036474164
100%	4,61	-0,047051672

Different concentrations of the *Himatanthus obovatus* extract not affect the percentage of lettuce germination ranging 99-100%, the percentage of abnormal seedlings, dry weight of shoot and root dry mass. The action of allelochemicals was evidenced on IVG, the length of shoots and roots (Figure 1). In general the allelopathic effects do not occur on germination in the physiological sense, but seedling development [18].



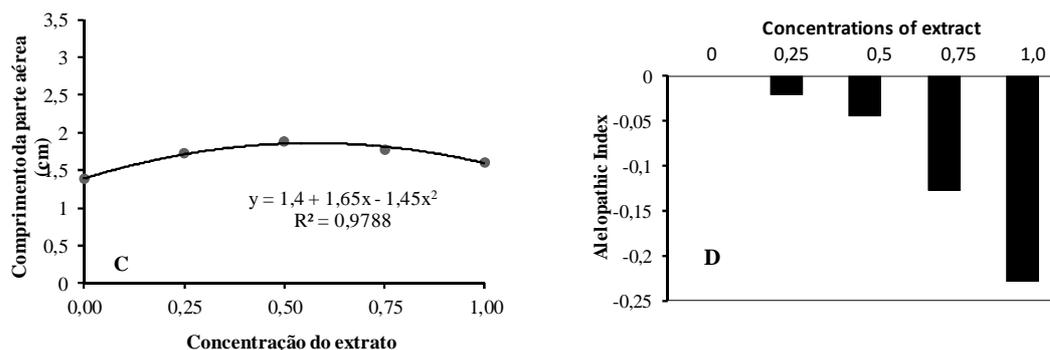


Figure 1. Speed of germination index - IVG (A), root length (B) and shoot length (C) and Allelopathic Index (D) of the lettuce seedlings on different concentrations of *Himatanthus obovatus* extract leaves.

The variation in the speed of germination index (Figure 1A), root length party (Figure 1B) and shoot length (Figure 1C) of the seedlings can be explained by polynomial models of second-degree regression with R^2 above 97%. The IVG and root length decreased with increasing concentrations of the extract, but the length of the shoot was favored by higher concentrations of the extract.

The allelopathic potential of *Senna occidentalis* (L.) was evaluated [19], who observed a significant reduction in germination speed index (GSI) in the seeds of lettuce and tomato when it increased the concentration of extract.

A significant reduction in IVG with increasing concentration of the extract of fresh and dried leaves of *Durantarepens* L. on *Lactuca sativa* L. was observed in [7]. Reducing the speed of germination index shows reduction of seed vigor of expression, due to the toxic effect of the extract.

Another indication of the allelopathic effect is also given by allelopathic activity index (Figure 1D). With increasing the concentration of the extract was the most allelopathic effects and similar results were observed in *Ziziphusjoazeiro* extracts on corn, melons and beans. [20].

Therefore, the leaf extract of *Himatanthus obovatus* at different concentrations did not affect the lettuce seed germination and the allelopathic potential was seen in developmental characteristics of lettuce seedlings.

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