Australian Journal of Basic and Applied Sciences

2018 April; 12(4): pages 1-4
DOI: 10.22587/ajbas.2018.12.4.1

Research Article AENSI Publications

Medicinal Extract and Its Effects In The Development of Vegetables: An Alternative To Small Farmers

[1]Tauane Santos Brito, [1]Renan Pan, [1]Lenir Aparecida Buss, [1]João Paulo Fonesi de Carvalho, [1]Tatiane Eberling, [2]Márcia de Holanda Nozaki

[1]State University of Western Parana, Center for Agrarian Sciences, Postgraduate Program in Agronomy, 1777 Pernanbuco Street, PO Box 91, Marechal Cândido Rondon, Parana, Zip: 85960000, Brazil.
[2]School of Life Sciences, Pontifical Catholic University of Paraná, 500 União Avenue, Toledo, Parana, Zip: 85902532, Brazil.

Correspondence Author: Tauane Santos Brito, State University of Western Parana, Center for Agrarian Sciences, Postgraduate Program in Agronomy, 1777 Pernanbuco Street, PO Box 91, Marechal Cândido Rondon, Parana, Zip: 85960000, Brazil.
E-mail:tauane-brito@hotmail.com.

Received date: 23 February 2018, **Accepted date:** 1 April 2018, **Online date:** 15 April 2018

Abstract

Background: During the metabolic process, plants produce compounds that may interfere in the physiological development of near plants, stimulating or inhibiting characteristics of interest or even inhibiting the germination and causing the plant death, this capacity is called allelopathy. The cultivation of vegetables is rigorous for the use of agrochemicals, so the search for ecological alternatives is an important focus of study to the field**. Objective:** *the objective of this research was to evaluate the interference of aqueous extract of medical plants on the development of cress, Chinese cabbage, arugula and Brassica sylvestris (L.) Mill on lab.* **Results:** Under the influence of rosemary extracts the germination of all vegetables was reduced, even in concentration of 25%**. Conclusion:** The use of medicinal plants extract reduced the germination of the tested vegetables. Chamomile and mind extracts up to 50% contributed to the aerial part and root development of the tested vegetables. The use of medicinal extracts is shown as an alternative for controlling the germination of invasive plants.

Key words: Brassicaceae, *Matricaria recutita, Mentha x piperita*, Rosmarinus officinalis, secondary metabolism.

INTRODUCTION

During the metabolic process, plants produce compounds that may interfere in the physiological development of near plants, stimulating or inhibiting characteristics of interest or even inhibiting the germination and causing the plant death (Aslam, *et al.*, 2017), this capacity is called allelopathy.

Some plants have this characteristic accentuated, such as rye, which straw is used to control weeds in organic crops, because it releases metabolites on its decomposition which contain many compounds that inhibit germination of the soil weed seed bank, others have more subtle characteristics, such as wheat which does not inhibit germination but reduce the development of crops such as corn and soybean (Jabran, 2017), ginger that works as a repellent for cockroaches (Nour, Yap and Nour, 2017), as well as inhibiting the germination of *Sclerotinia sclerotiorum* (Siega *et al.*, 2018) and improving the production of eucalyptus (El Mauroni *et al.*, 2016).

The cultivation of vegetables is rigorous for the use of agrochemicals, so the search for ecological alternatives is an important focus of study to the field. The secondary metabolites of the crop are a defense characteristic of the plant(Al-Tawaha et al, 2013), where the plant produces secondary enzymatic byproducts that protect competition from other plants, acting in many stages and forms of development (Taiz*et al*., 2017).

The organic agriculture aims to preserve the environmental characteristics, based on techniques that avoid the use of compounds harmful to the environment and the human organism, guaranteeing quality products, without contaminants (Bevenuti and Pardossi, 2017). However, vegetables are often attacked by pathogens and insects or suffer an influence of weeds growing along their cycle, reflecting directly in the final yield on weight or quality (Aslam *et al*., 2017). The use of control alternatives, in addition reductions related to the productive cost, aims at better environmental conditions for both the consumer and the farmer.

Watercress (*Nasturium officinale*) is a semi perennial vegetable, better adapted to cool weather but with productive potential to all regions of Brazil. With an elevated number of leaves and tillering capacity, the plant has a peculiar flavor, very appreciated in Brazilian food. Limited for light and temperature, inadequate conditions may reduce its crop cycle and, consequently, its productivity and quality (Hirata and Hirata, 2015). Environmental managements are essential to ensure a satisfactory development of this crop, so intercropping should be based in previous research, ensuring that this crop does not have its yield impaired.

The plants of *Brassica rapa* var. *chinensis* and *Brassica oleraceae* L. are leafy vegetables widely used in world cuisine. They are rustic crops, with good adaptability to different environments, not requiring high technological level on its cultivation. However, despite being a crop known by Brazilian producers, these need studies that aim to increase their productivity, especially guaranteeing the quality standard of the commercialized leaves (Azevedo *et al.*, 2014).

Leafy vegetable with low height the arugula (*Eruca sativa*) is a crop widely used in salads, originally from Europe, introduced in Brazil by Italian immigrants. The cultivation has expanded in Brazil due to the attractive price, presenting itself as an option for expansion of arable area. However, the expansion of the crop in Brazilian agriculture makes it necessary to produce technical information that will assist the farmers in implementation and conduction of the crop (Oliveira, 2014).

Watercress, *Brassica oleraceae L*., *Brassica rapa var. chinensis* and arugula are widely consumed in Brazil, the belong to the Brassicaceae family, has the main characteristic its high number of leaves which are their commercialized by-products (Filgueira, 2008). The objective of this research was to evaluate the interference of the aqueous raw crude extract of medicinal plants in the development of Cress, *Brassica oleraceae L*., *Brassica rapa var. chinensis* and arugula in the laboratory.

MATERIAL AND METHODS

1.1. Place of experiment and obtainment of materials:

The seeds of watercress (*Nasturtium officinale*), *Brassica oleraceae* L., *Brassica rapa* var. *chinensis* and arugula (*Eruca sativa*) were obtained from the local commerce of the city of Toledo, Parana, Brazil. The medical plants Rosemary (*Rosmarinus officinalis*), chamomile (*Matricaria recutita*) and mint (*Mentha piperita*) where obtained *in natura* with farmers licensed by Itaipu Binacional in Vera Cruz do Oeste city, Parana, Brazil.

Medicinal plants were harvested between 9:00 and 10:00 am, roots were removed with the help of pruning shears and the aerial part, packed in brown paper bags and then transported to the laboratory. In the sequence the plants were checked and removed senescent or diseased areas, besides possible weeds that may were with the plants when harvested. They were washed in running water in triplicate and rinsed in distilled water. Subsequently, the material was weighted for further processing.

1.2. Preparation of extracts:

To obtain extracts, the weighted material, according to the desired treatment, was chopped manually in a coarsely way and posteriorly ground in a blender with distilled water for five minutes. Subsequently, the resulting liquid was squeezed into clean cotton cloth and the solid part was discarded, characterizing by then the following treatments: only distilled water, extract at 25%, extract at 50%, extract at 75%, extract at 100%, being the solution made of 1 ml of distilled water to 1 g of green material (1:1) and the dilutions made to correspond to each treatment.

1.3. Mounting the experiment:

In Gerbox® boxes, filled with two sheets of Germitest® paper previously moistened with distilled water, 25 seeds of each specie were conditioned, being four replications for each treatment, totalizing 2000 plants per treatment. Five 5 ml of the crude aqueous extract were applied over the seeds, using a graduated pipet of 5 ml. The experimental design was totally randomized in a 3x4x5 scheme. The boxes were conditioned at a temperature of 25 ±2°C and luminosity of 12 hours light / 12 hours dark for 14 days.

1.4. Statistical analysis:

At seven days, the number of germinated seeds was accounted, considering the germinated seeds with radicle emitted. At 14 days, the morphological parameters of aerial part height and root length were evaluated. The results were submitted to analysis of variance and posteriorly to regression analysis, when significant, with the statistical program SISVAR (Ferreira, 2014).

RESULTS AND DISCUSSION

Germination:

The use of medicinal extracts in crops aims at methods, among factors such as pathogen control and weeds, which increase the characteristics related to development of plants of crops of interest. The high concentrations of extracts of the three medical plants tested (Figure 1) reduced the germination percentage of the watercress, *Brassica oleraceae* L., *Brassica rapa* var. *chinensis* and arugula.

Under the influence of rosemary extracts (Figure 1A) the germination of all vegetables was reduced, even at 25% concentration. As a plant rich in phenolic compounds, responsible for the antimicrobial activity, antioxidant and plant defense activities (Prins, Lemos and Freitas, 2006), the use of rosemary as an allelopathic alternative will inhibit the development of submitted crops.

This characteristic is evidenced in the work of Gusman, Bittencourt and Vestena (2007), where cauliflower, cabbage and broccoli, besides the inhibition in the germination percentage, reduced their morphological characteristics when submitted to different doses of the aqueous extract of *Baccharis dracunculifolia* (Field rosemary).

The use of chamomile extract (Figure 1B) reduced the percentage of germination according to the increase of the extract concentration in all evaluated vegetables, completely inhibiting the germination of watercress at 75 and 100%. The mint extract (Figure 1C) did not cause drastic reductions as the extracts previously tested, even at 100% concentration.

The potential of these plants to inhibit the germination of the seeds is evidenced in tests which objective was to test the influence of plant extracts on the germination of weeds that are common in the areas of vegetable cultivation. In the experiment of Gaziri and Carvalho (2009), the development of *Cyperus rotundus* was inhibited by plant extracts of *Baccharis trimera*, *Symphytum officinale* and *Achillea millefolium* and, in, Bonfim *et al*., (2011), the use of aqueous extracts of mint and *Melissa officinales* inhibited the germination percentage of *Plantago major* L, and also reduced the vigor of its seeds.

In order to evaluate the residual effect on the soil, Pereira, Vidal and Resende (2015) reported that lettuce seedlings cultivated in soil previously cultivated with *Cymbopogon citratus* were negatively affected by seedling speed and emergence index, and, in soil previously cultivated with *Mentha arvensis*, negatively affected the seedling development. In contrast, when cultivated in soil previously cultivated with *Thymus vulgaris*, there was an accumulation of root and aerial fresh weight, in addition to a better initial development of seedlings.

Therefore, in crops where the use of seedlings is common, inhibition of seed germination is an advantage in relation to weeds germination, being the allelochemical metabolites able to influence in the soil weed seed bank.

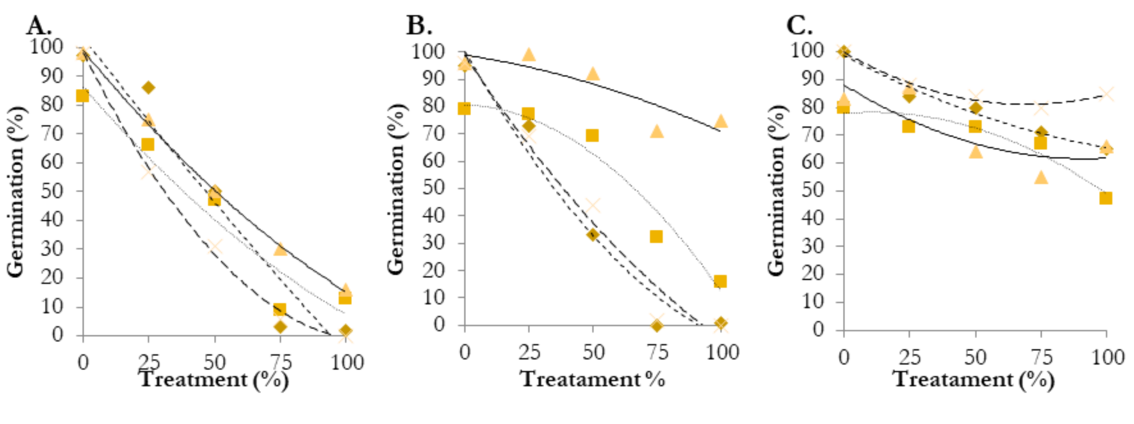

Fig. 1: Seeds germination of watercress (♦ ------), *Brassica rapa* var. *chinensis* (■ □□□□□□□□□), *Brassica oleraceae* (▲□□) and arugula (× - - - - - - -) submitted to different concentrations of extracts of rosemary (A.), chamomile (B.) and mint(C.).

Aerial Part Development:

The action of the mint extract (Figure 2C), in low concentrations, positively altered the aerial part development, *Brassica oleraceae* presented a positive reflection of the applications. Extracts of rosemary (Figure 2A) and chamomile (Figure 2B), positively increased the development of arugula and *Brassica* *oleraceae* in concentrations up to 25%. The medicinal plants improved in different forms the plants submitted to the extracts. All doses of rosemary caused a decreased in the development of the tested vegetables.

Doses of up to 50% of chamomile (Figure 2B) increase the development of *Brassica rapa* var. *chinensis* and decreased the development of watercress and arugula. In contrast, doses up to 50% of mint extract (Figure 2C) increase the development of watercress, *Brassica oleraceae, Brassica rapa* var. *chinensis* and arugula, with low reductions in the development of plants submitted to high concentrations. Allelochemicals act in different ways according to the crop, and the presence of some may affect negatively the development, while others may bring beneficial characteristics to the plants of interest. In addition, allelochemicals have the potential to act in the biological control, as natural repellents of pathogens and pests or even to induce resistance, sending signals to the nucleus that activate defense genes (Jabran, 2017).

Activities, as the inhibition of germination of crops, but promotion in seedling development, as occurs in concentrations up to 50% of chamomile and mint (Figure 2B and 2C) reinforces the option of use of the extracts in crops with seedling propagation, and not direct seeding, as the vegetables in this study, reducing the germination of the soil seed bank and increasing the development of cultivated plants.

In order to study the effect of *Mentha x piperita* and *Plectranthus barbatus* on the germination and development of four commercial species of pumpkin, Dias, Costa and Pasin (2014) reports that treated plants presented better initial development when compared to the control, especially for length of radicle. Hendges (2016), studying the intercrop effect of *Petroselinum crispum* Nym and *Brassica oleraceae*, from which the practice was agronomically viable, contributing to the development of crops and reducing the population of aphids in the area when compared to the single crop.

The use of extract is not the only option, in organic agriculture, farmers opt for some determined crop plants, being them of commercial interest or not, in order to remove pathogens or common pests to the development of vegetables, as is the case of *Tagetes erecta* which is used to prevent pests in vegetables, being cultivated in a random and spaced matter between the beds (Restello, Menegatt and Mossi, 2008; Ritzinger and Fancelli, 2006).

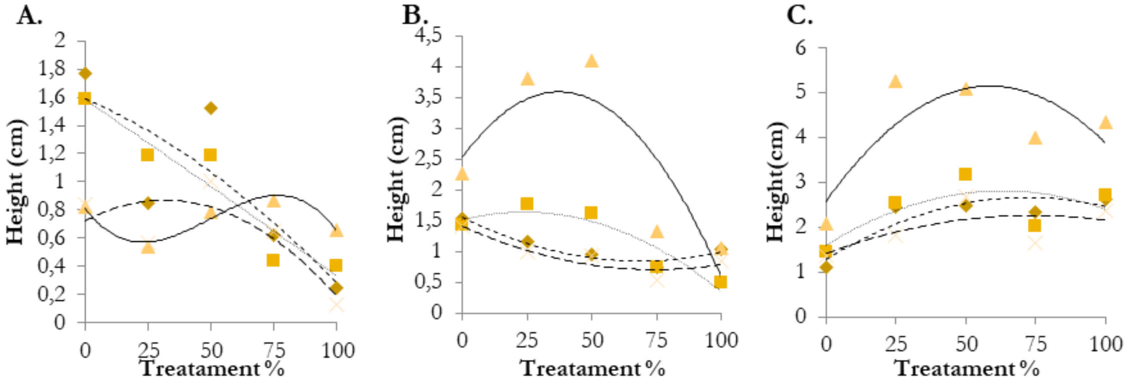

Fig. 2: Aerial part development of watercress seedlings (♦ ------), Brassica rappa var. *chinensis* (■ □□□□□□□□□), Brassica oleraceae (▲□□) and mint (× - - - - - - -) submitted to different concentrations of extracts of rosemary (A), chamomile (B) and mint (C).

Root length:

Soil is a complex medium that, besides acting as a means of sustaining plant development, provides necessary nutrients for a satisfactory development, however, there are organisms that negatively influence the vegetal development, being they pathogens or pests. Thus, plants with a well-developed root system have a higher survival rate.

The use of chamomile and mint extracts (Figure 3B and 3C) in concentrations up to 25% helped the development of the vegetables even with little expression. Studies that aim at the use of plants with allelopathic potential as natural herbicides to some crops, being the development reduction of the root system, as occurs in vegetables submitted to all concentrations of rosemary extract (Figure 3A) and at a concentration higher than 25% of the other extracts stand out as an excellent method of weed control (Belinel *et al*., 2008; Borella and Pastorini, 2010; Magiero *et al*., 2009).

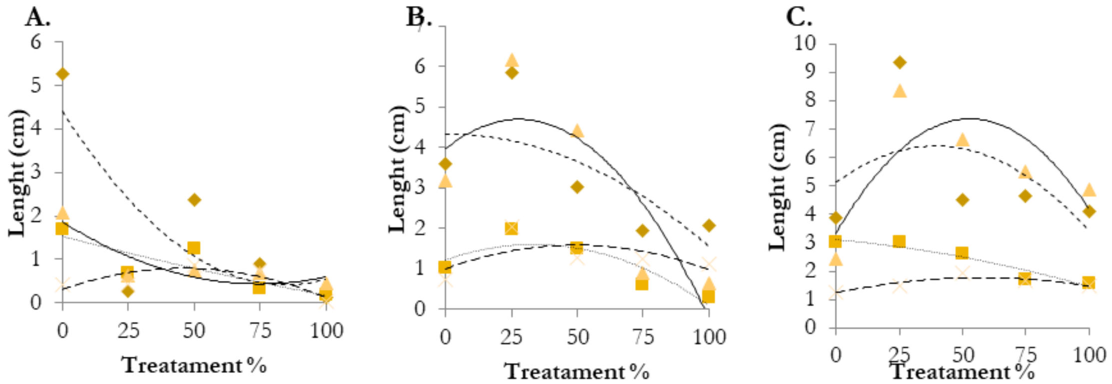

Fig. 3: Root development at 14 days of plants of watercress seedlings (♦ ------), *Brassica rapa* var. *chinensis* (■ □□□□□□□□□), *Brassica oleraceae*(▲□□) and arugula (× - - - - - - -) submitted to different concentrations of extracts of rosemary (A.), chamomile (B.) and mint (C).

The development of the root is directly related to the development of the aerial part, so that the use of compounds reduces the development of the root where the commercial focus is the aerial part, as the studied case, is not economically viable.

However, the use of medicinal plants that may influence the establishment of weeds can be used when some of these plants are grown along vegetable beds, where they can produce secondary metabolites that may negatively influence in the development of weeds, but with a little influence in the already established plants, due to low concentrations, besides acting to remove pathogens and pests (Ferreira and Aquila, 2000).

When tested in consortium of lettuce with watercress and mint, the authors point out that single crops result in greater fresh and dry weight for all the crops, however, intercropping is viable due to the production gain resulting from the higher efficiency of the land use (Orrico *et al*., 2011). In this way, the use of plants with allelopathic potential in crops of interest, can result in gains of productivity and sanity of the used crops.

Citation: Tauane Santos Brito, Renan Pan, Lenir Aparecida Buss, João Paulo Fonesi de Carvalho, Tatiane Eberling, Márcia de Holanda Nozaki, 2018. Medicinal Extract and Its Effects In The Development of Vegetables: An Alternative To Small Farmers. Australian Journal of Basic and Applied Sciences., 12(4): 1-4.

Conclusion:

The use of medicinal plants extract reduced the germination of the tested vegetables. Making it not viable in some cases.

Chamomile and mind extracts of up to 50% contributed to the aerial part and root development of the tested vegetables.

The use of medicinal extracts is shown as an alternative for controlling the germination of invasive plants.

REFERENCES

Al-Tawaha, A., Al-Karaki, G., & Massadeh, A. (2013). Comparative response of essential oil composition, antioxidant activity and phenolic contents spearmint (Mentha spicata L.) under protected soilless vs. open field conditions. Advances in Environmental Biology, 902-911.

Aslam, F., A. Khaliq, A. Matloob and A. Tanveer, 2017. Allelopathy in agro-ecosystems : a critical review of wheat allelopathy-concepts and implications. Chemoecology, 27(1): 1-24. https://doi.org/10.1007/s00049-016-0225-x

Azevedo, A.M., V.C. Andrade Júnior, J.S. Fernandes, C.E. Pedrosa, N.R. Valadares, M.A. Ferreira and R.A. Martins, 2014. Divergência genética e importância de caracteres morfológicos em genótipos de couve. Horticultura Brasileira, 32(1): 48-54. https://doi.org/10.1590/S0102-05362014000100008

Belinelo, V.J., M.P. Czepak, S.A. Vieira, L.F.T. Menezes and C.M. Jamal, 2008. Allellopathy of *Arctium minus* bernh (asteraceae) on the germination and root growth of sorghum and cucumber. Revista Caatinga, 21(4): 12-16.

Benvenuti, S. and A. Pardossi, 2017. Weed seedbank dynamics in Mediterranean organic horticulture. Scientia Horticulturae, 221: 53-61. https://doi.org/10.1016/j.scienta.2017.04.011

Bonfim, F.P.G., I.C.G. Honório, V.W.D. Casali, M.C.M. Fonseca, E. Mantovani-Alvarenga, F.M.C. Andrade, … M.G. Gonçalves, 2011. Potencial alelopático de extratos aquosos de Melissa officinalis L. e Mentha x villosa L. na germinação e vigor de sementes de Plantago major L. Revista Brasileira de Plantas Medicinais, 13(SPECIAL ISSUE), 564–568. https://doi.org/10.1590/S1516-05722011000500010

Borella, J. and L.H. Pastorini, 2010. Allelopathic effects of fruits of Phytolacca dioica L . on the germination and early growth of lettuce and beggartick. Ciência E Agrotecnologia, 34(5): 1129-1135. https://doi.org/10.1590/S1413-70542010000500008

Dias, L.A., S.M.L. Costa and L.A.A.P. Pasin, 2014. Efeito alelopático in vitro de hortelã-pimenta e boldo sobre a germinação e desenvolvimento inicial de sementes comerciais de abóbora. Revista Científica Da FEPI, 6(1): 1-4.

El Marouni, L.F., Magalhães, J.L., Rodrigues, A.A., Rodrigues, D.A., Magalhães, P.A.N.R., Di Campos, M.S., *et al., Growth of eucalyptus seedlings irrigated with different vinasse concentrations.* Australian Journal of Basic and Applied Sciences.*, 10(18): 115-121, 2016*

Ferreira, A.G. and M.E.A. Aquila, 2000. Alelopatia: uma área emergente da ecofisiologia. *Revista Brasileira de Fisiologia Vegetal*, *12*(Edição especial), 175-204.

Ferreira, D.F., 2014. Sisvar: a guide for its bootstrap procedures in multiple comparisons. Ciencia E Agrotecnologia, 38(2): 109-112. https://doi.org/10.1590/S1413-70542014000200001

Filgueira, F.A.R., 2008. *Novo manual de olericultura:agrotecnologia moderna na produção e comercialização de hortaliças* (2nd ed.). Viçosa: UFV.

Gaziri, L.R.B. and R.I.N. De. Carvalho, 2009. Efeito alelopático de carqueja, confrei e mil-folhas sobre o desenvolvimento da tiririca. Revista Academica: Ciências Agrárias E Ambientais, 7(1): 33-40.

Gusman, G.S., H.A.C. Bittencourt and S. Vestena, 2007. Efeito alelopático de extratos aquosos de Baccharis dracunculifolia DC . Revista Científica de Faminas, 3(1): 12-21.

Hendges, A.R.A., A. de, 2016. *Desempenho do cultivo de couve de folha com espécies aromáticas e condimentares*. Universidade Federal do Ceará.

Hirata, A.C.S. and E.K. Hirata, 2015. Desempenho produtivo do agri??o d'??gua cultivado em solo sob telas de sombreamento. Pesquisa Agropecuaria Brasileira, 50(10): 895-901. https://doi.org/10.1590/S0100-204X2015001000005

Jabran, K., 2017. *Manipulation of Allelopathic Crops for Weed Control*. (S. in P. Science, Ed.) (1 st.). Duzce: SpringerBriefs in Plant Science. https://doi.org/10.1007/978-3-319-53186-1

Magiero, E.C., J.M. Assmann, J.A. Marchese, D. Capelin, M.V. Paladini and M.M. Trezzi, 2009. Efeito alelopático de Artemisia annua L. na germinação e desenvolvimento inicial de plântulas de alface (Lactuca sativa L.) e leiteiro (Euphorbia heterophylla L.). Revista Brasileira de Plantas Medicinais, 11(3): 317-324. https://doi.org/10.1590/S1516-05722009000300014

Nour, A.H., Yap, S.S., Nour, A.H. Extraction And Chemical Compositions of Ginger (Zingiber Officinale Roscoe) Essential Oils As Cockroaches Repellent. Australian Journal of Basic and Applied Sciences., 11(3): 1-8, 2017

Oliveira, S.G.de., 2014. *Alelopatia e potencialidade do consórcio entre rúcula e campim-cidreira*. Universidade Estadual Paulista "Julio de Mesquita Filho."

Orrico, A.C.A., M.A.P. Orrico Junior, J. De Lucas Junior, R.A.M. Fernandes, S. Sunada and J.P. Rodrigues, 2011. Revista Agrarian. Revista Agrarian, 4: 222-227.

Pereira, T.S., M.C. Vidal and F.V. Resende, 2015. Efeito de solo previamente cultivado com plantas aromáticas na germinação e no desenvolvimento inicial de alface. Revista Brasileira de Plantas Medicinais, 17(4): 543-549. https://doi.org/10.1590/1983-084X/14_051

Prins, C.L., C.S.L. Lemos and S.P. Freitas, 2006. Efeito do tempo de extração sobre a composição e o rendimento do óleo essencial de alecrim (Rosmarinus officinalis). Revista Brasileira de Plantas Medicinais, 8(4): 92-95.

Restello, R.M., C. Menegatt and A.J. Mossi, 2008. Efeito do óleo essencial de Tagetes patula L . (Asteraceae) sobre Sitophilus zeamais Motschulsky (Coleoptera , Curculionidae). Revista Brasileira de Entomologia, 53(2): 304-307.

Ritzinger, C.H.S.P. and M. Fancelli, 2006. Manejo Integrado de nematoides na cultura da bananeira. Resvista Brasileira de Fruticultura, 28(2): 331-338.

Siega, T.C., Bernardi, C., Rey, M.S., Busso, C., Mazaro, S.M. Effect of essential oils on miceliogenic and carpogenic germination of Sclerotiniasclerotiorum (Lib.) de Bary. Australian Journal of Basic and Applied Sciences., 12(1): 32-36.2018

Taiz, L., E. Zeiger, I. Max and M. Angus, 2017. Fisiologia e Desenvolvimento Vegetal (6 th). Porto Alegre: Artmed.