ALELOPATIA /LCB 1402 - 2015

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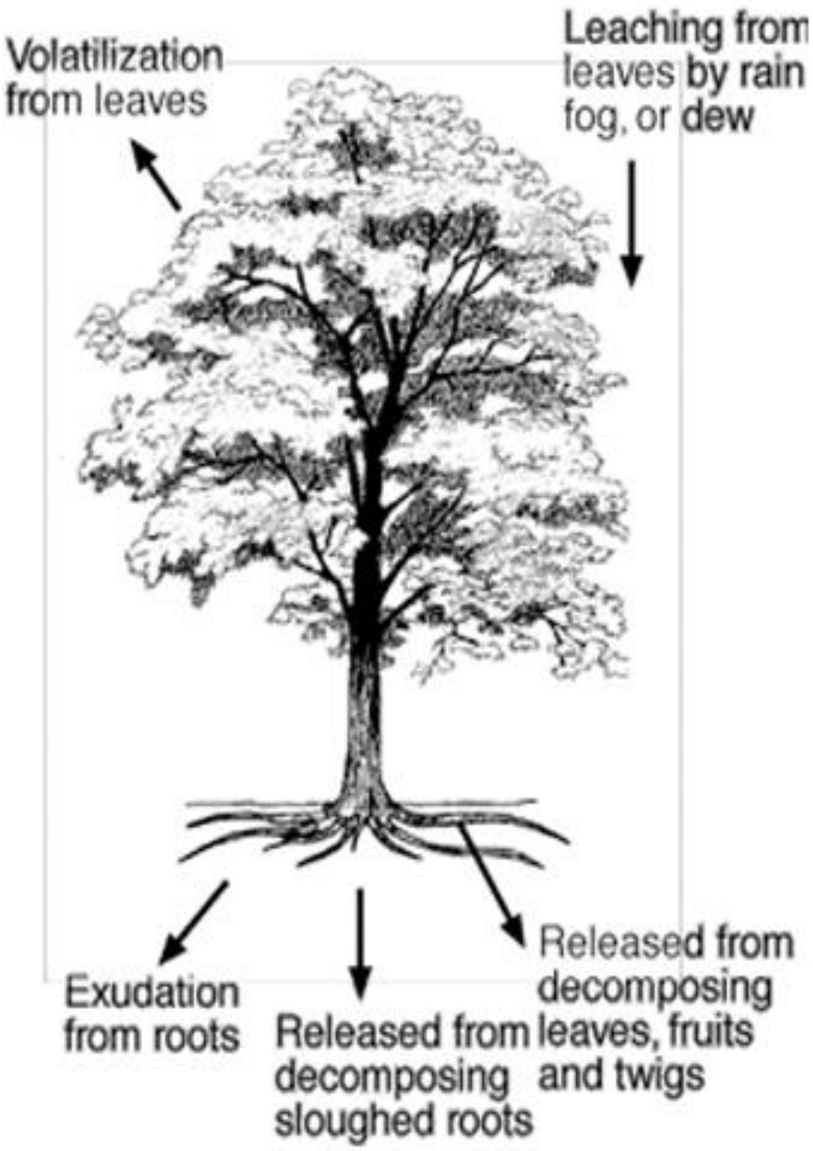
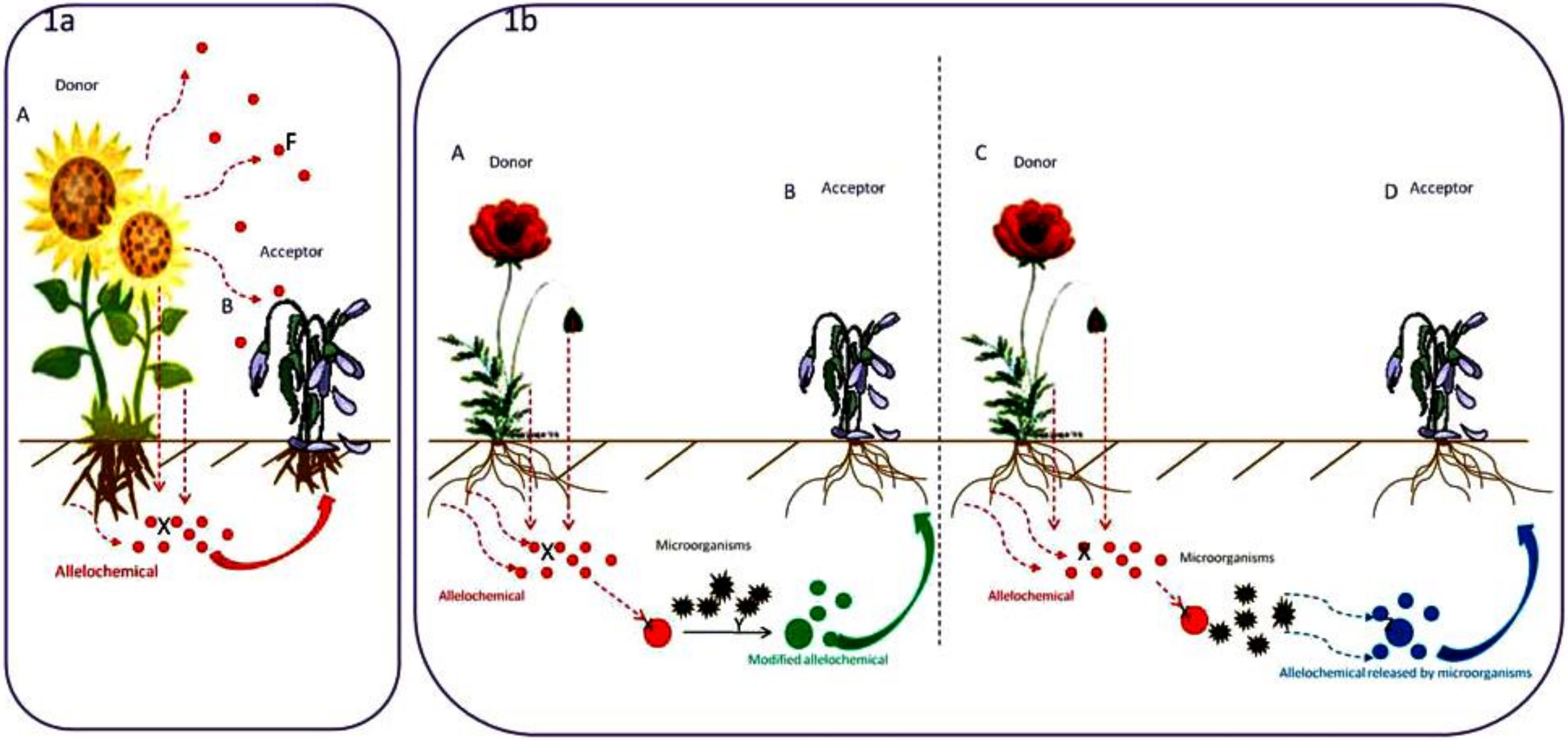
Modos de liberação de compostos alelopáticos



ACACIA PRUINOCARPA PRODUCES COMPOUNDS THAT ARE ALLELOPATHIC (ELIMINATE THE GROWTH OF COMPETING PLANTS IN THE DIRECT AREA) AND CYTOGENIC IN NATURE. NOTE THAT THERE ARE NO OTHER PLANT SPECIES GROWING BELOW THIS ONE.



1a
Donor
A
F
Acceptor
B
X
Allelochemical
1b
A
Donor
B
Acceptor
X
Microorganisms
Allelochemical
Y
Modified allelochemical
C
Donor
D
Acceptor
Microorganisms
Allelochemical
Allelochemical released by microorganisms


Forte efeito alelopático do Bambu

Interações

Sub-bosque de uma floresta mostrando indivíduos de várias espécies num local sem MARICÁ, uma árvore alelopática.

Sub-bosque da mesma floresta anterior num local com MARICÁ, mostrando um forte efeito alelopático que inibe as a presença de plantas no sub-bosque

Tabela 3. Detecção de aleloquímicos em extratos foliares aquosos de espécies nativas.[1]

Espécie	Saponinas	Flavonóides	Taninos
Cecropia pachystachya	+	+*	+
Peltophorum dubium	+	+*	+
Psychotria leiocarpa	+	-	-
Sapium glandulatum	+	-	+
Sorocea bonplandii	-	-	-

[1]Extratos aquosos de pó de folhas a 5%, preparados em banho-maria; (+)presença; (-)ausência; *flavonas.

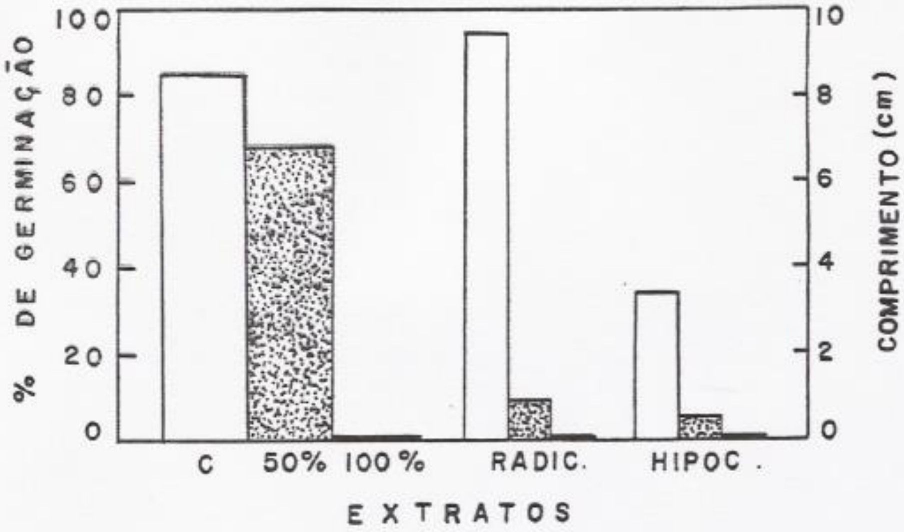


Figura 1 — Histograma representativo dos valores relativos a porcentagem de germinação e comprimento da radícula e hipocótilo do tomateiro, determinados 7 dias após a semeadura, em placas de Petri umidecidas com 0, 50% e 100% do extrato de tubérculos de *Cyperus rotundus*.

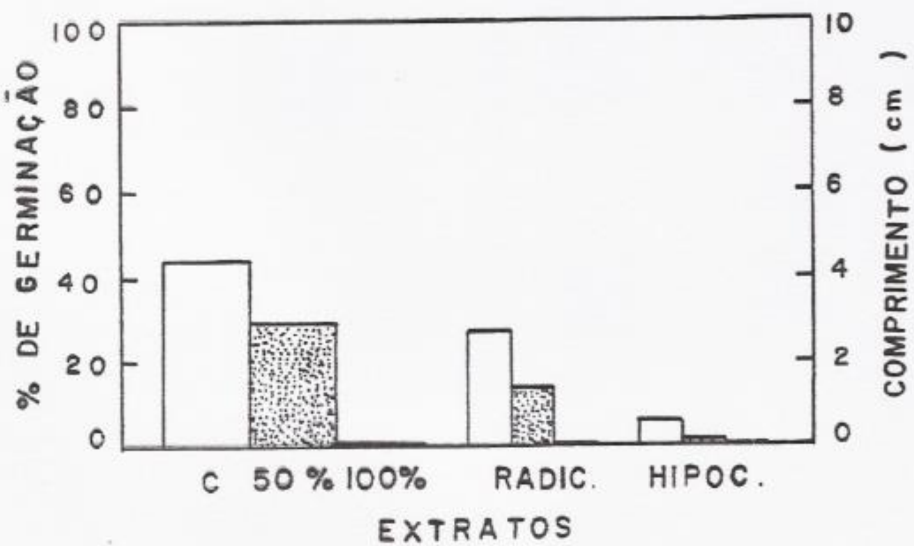


Figura 2 — Histograma representativo dos valores relativos a porcentagem de germinação e comprimento da radícula e hipocótilo do tomateiro, determinados 7 dias após a semeadura, em placas de Petri umidecidas com 0, 50% e 100% do extrato de rizomas de *Sorghum halepense*.

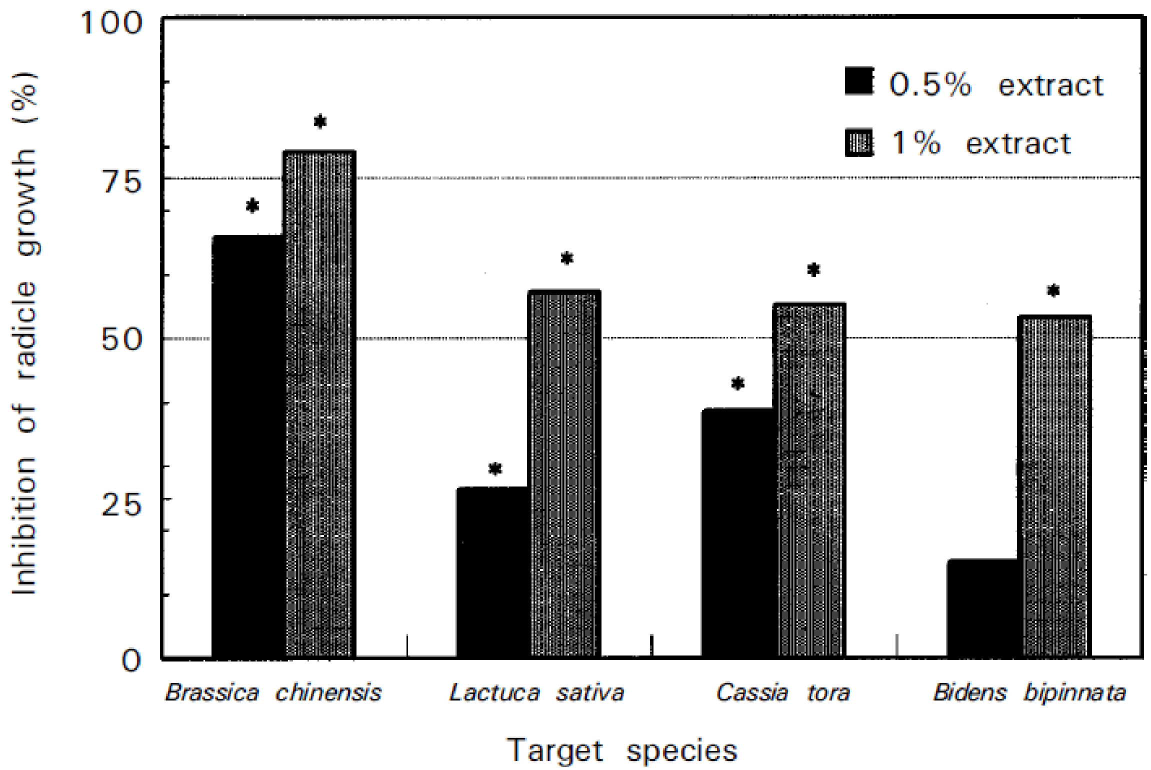


Fig. 5. Percent inhibition of radicle growth of four local herbaceous plants caused by 0.5% and 1.0% leaf extracts of *Stachytarpheta urticaefolia*. Asterisks denote significant difference from the controls ($p <= 0.05$)

CRAVO DA ÍNDIA – SUBSTÂNCAIS VOLÁTEIS

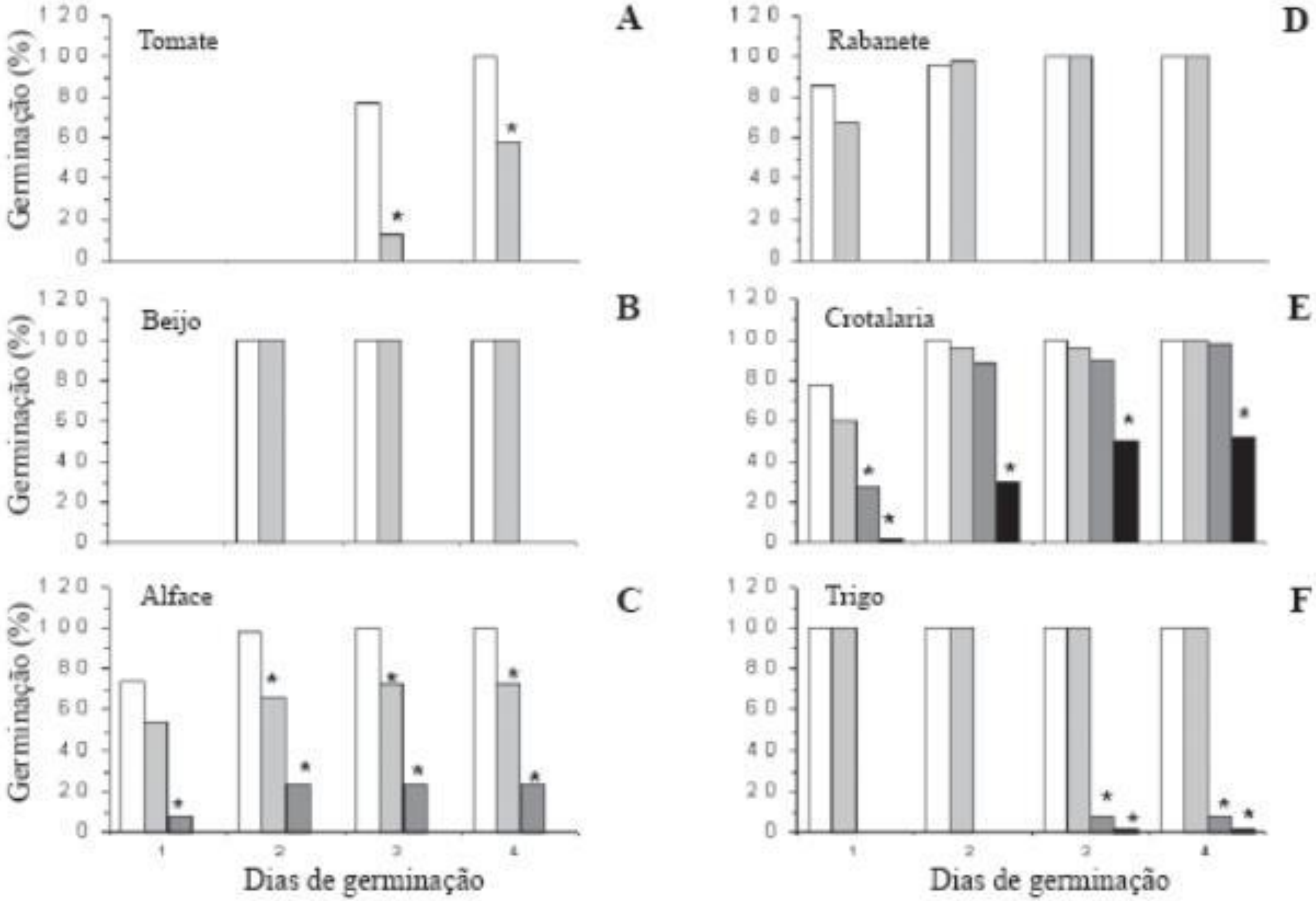


Figura 1. Germinação de sementes expostas a soluções de extrato de cravo-da-índia nas concentrações de 7,75; 31 e 62 mg.mL^{-1}. A germinação é apresentada como porcentagem do controle. Asterisco indica diferença do controle a $p \leq 0,05$. □ Água; ■ 7,75 mg.mL^{-1}; ■ 31 mg.mL^{-1}; ■ 62 mg.mL^{-1}.

TABELA 1 - Índices de fitotoxicidade, em diferentes plantas daninhas submetidas a doses crescentes do extrato de leucena.

Doses do Extrato (%)	Fitotoxicidade *		
	Desmódio	Picão-preto	Caruru
0	1 Nula	1 Nula	1 Nula
12,5	2 Muito leve	2 Muito leve	2 Muito leve
25,0	2 Muito leve	3 Leve	3 Leve
50,0	2 Muito leve	3 Leve	4 Média
100,0	2 Muito leve	4 Média	4 Média

*Escala EWRC modificada.

LEUCENA x MILHO

TABELA 2 – Freqüência das diferentes fases da mitose em células meristemáticas de raízes de plântulas de milho desenvolvidas sob diferentes concentrações do extrato de leucena.

Concentração do extrato de leucena (%)	Número de células em mitose	% de células nas fases			
		Prófase	Metáfase	Anáfase	Telófase
0	127 a	55,96 ab	1,80 ab	1,38 a	2,02 a
0,4	106 ab	62,46 a	2,41 a	1,47 a	2,17 a
0,8	62 bc	43,06 bc	0,75 ab	0,87 a	0,66 ab
1,6	54 c	50,51 ab	0,85 ab	0,19 a	0,00 b
3,2	50 c	32,26 cd	0,42 b	0,61 a	0,00 b
6,4	24 c	21,67 d	0,00 b	0,45 a	0,00 b

Médias seguidas de mesma letra não diferem entre si pelo teste Duncan a 5 % de probabilidade.

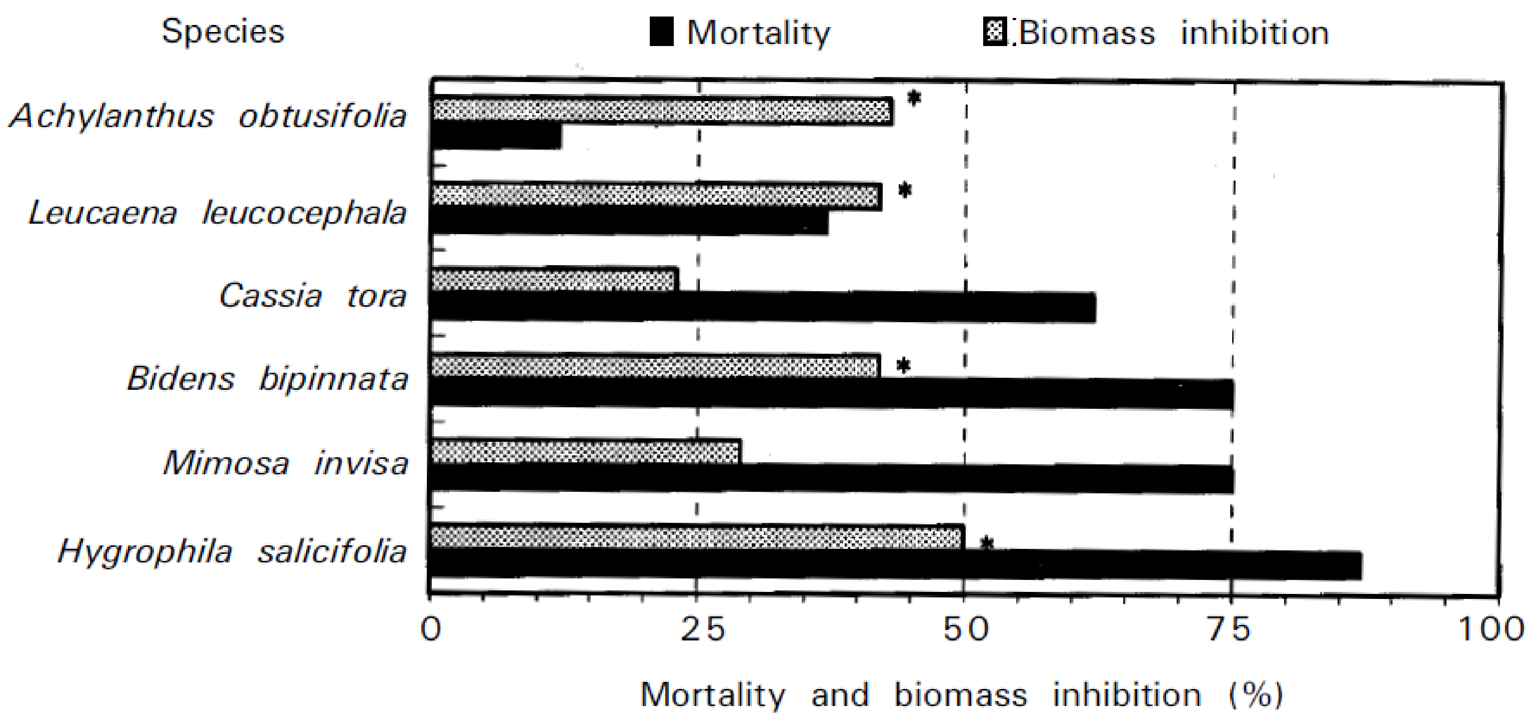


Fig. 6. Mortality and percent biomass inhibition of six test species affected by a mulch of powdered leaves of *Stachytarpheta urticaefolia*. An asterisk denotes a significant difference from the control ($p <= 0.05$)

Controle biológico de *Parthenium hysterophorus* L. por *Cassia uniflora* Mill. na India

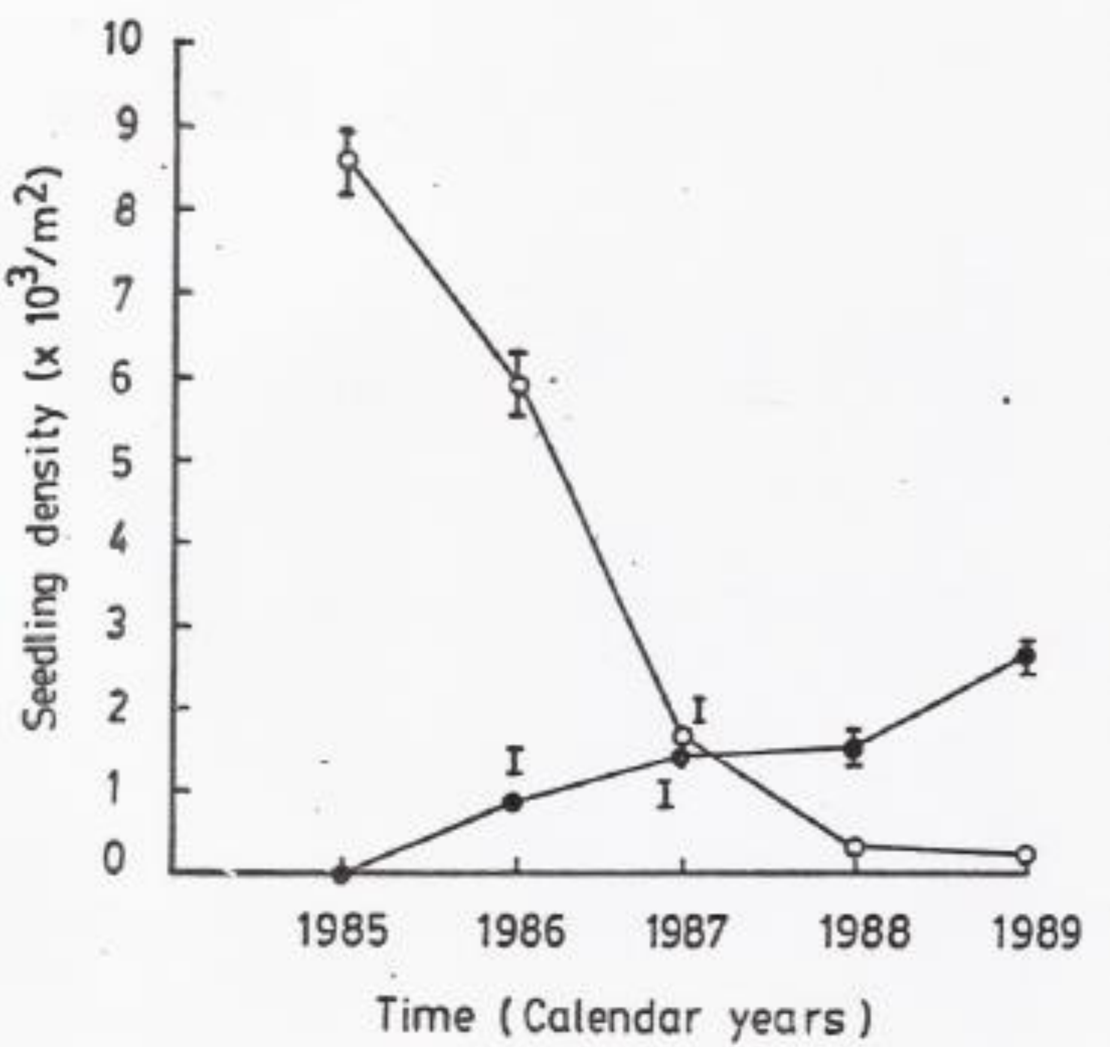


Figure 1. Seedling density of parthenium (○) and C. uniflora (●) over 5 years; vertical bars indicate ± S.D. (n = 10); bars smaller than symbols are not shown.

A SEGUIR ALGUNS EXEMPLOS DE ESTUDOS SOBRE ALELOPATIA

Critical Reviews in Plant Sciences, 22(3&4):239–311 (2003)

Allelopathic Interactions and Allelochemicals: New Possibilities for Sustainable Weed Management

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ABSTRACT: Weeds are known to cause enormous losses due to their interference in agroecosystems. Because of environmental and human health concerns, worldwide efforts are being made to reduce the heavy reliance on synthetic herbicides that are used to control weeds. In this regard the phenomenon of allelopathy, which is expressed through the release of chemicals by a plant, has been suggested to be one of the possible alternatives for achieving sustainable weed management. The use of allelopathy for controlling weeds could be either through directly utilizing natural allelopathic interactions, particularly of crop plants, or by using allelochemicals as natural herbicides. In the former case, a number of crop plants with allelopathic potential can be used as cover, smother, and green manure crops for managing weeds by making desired manipulations in the cultural practices and cropping patterns. These can be suitably rotated or intercropped with main crops to manage the target weeds (including parasitic ones) selectively. Even the crop mulch/residues can also give desirable benefits. Not only the terrestrial weeds, even allelopathy can be suitably manipulated for the management of aquatic weeds. The allelochemicals present in the higher plants as well as in the microbes can be directly used for weed management on the pattern of herbicides. Their bioefficacy can be enhanced by structural changes or the synthesis of chemical analogues based on them. Further, in order to enhance the potential of allelopathic crops, several improvements can be made with the use of biotechnology or genomics and proteomics. In this context either the production of allelochemicals can be enhanced or the transgenics with foreign genes encoding for a particular weed-suppressing allelochemical could be produced. In the former, both conventional breeding and molecular genetical techniques are useful. However, with conventional breeding being slow and difficult, more emphasis is laid on the use of modern techniques such as molecular markers and the selection aided by them. Although the progress in this regard is slow, nevertheless some promising results are coming and more are expected in future. This review attempts to discuss all these aspects of allelopathy for the sustainable management of weeds.

Chapter 20

Allelochemicals as Bioherbicides — Present and Perspectives

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Renata Bogatek and Agnieszka Gniazdowska

Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/56185

7. Conclusions - The phenomena of allelopathy and phytotoxic interactions between plants are strongly expanding branches of biological science. Allelochemicals, as a group of substances also called biocommunicators, seem to be a fruitful challenge for combining traditional agricultural practices and new approaches in pest management strategies. Allelochemicals have already been used to defend crops against pathogens, insects or nematodes, parallel to some attempts to use them for weed control. Crop rotation, cover crops, dead and living mulches are being employed in agriculture. Both in natural and agricultural ecosystems allelopathic interactions are involved in practically every aspect of plant growth, as they can play the role of stimulants and suppressants. Complex plant-plant and plant-microbe interactions in ecosystems and currently developing studies on molecular, cytological and physiological levels bring us to a better understanding of processes occurring around us. The ancient knowledge of well-known toxic properties of water extracts of a variety of allelopathic plants give us a basis that could be used in the creation of a novel approach in weed control. Some allelochemicals, mainly these that are mentioned in the text above, may act as a starting point for production of new bioherbicides with novel target sites, not previously exploited, as the understanding of their mode of action is still growing. Creation of bioherbicides based on allelochemicals generates the opportunity to exploit natural compounds in plant protection and shows the possibility to cope with evolved weed resistance to herbicides. Despite the fact that we have extensive knowledge about thechemical nature of natural compounds, we can synthesize its analogues, and we have basically explored its phytotoxic potential, we still have insufficient data. Until recently, most studies on phytotoxicity have been conducted under laboratory conditions due tothe ability to eliminate other environmental factors such us temperature, soil texture and its chemical and physical properties. Such approach allows the recognition of only direct effects of allelochemical action. There is still a great need to transfer laboratory data into field conditions. Such experiments are not willing to be taken on due to troublesome field experiments dependent on environmental conditions and a few year repetitions. New tools of molecular genetics, proteomics and metabolomics profiling as well as modern and sophisticated methods of chemistry and biochemistry will lead to the creation of substances, maybe based on the structure of particular compounds occurring in nature, which could be used without any risks as selective and eco-friendly herbicides.

Agron. Sustain. Dev. 30 (2010) 349–358

DOI: 10.1051/agro/2009027

Available online at:
www.agronomy-journal.org

Agronomy for Sustainable Development

Review article

Allelopathy in Compositae plants. A review

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Abstract – Allelopathy plays an major role in agricultural management such as weed control, crop protection, and crop re-establishment. Compositae plants have potent allelopathic activity, and the activity is confirmed through (a) bioassays with aqueous or various solvent extracts and residues, (b) fractionation, identification, and quantification of causative allelochemicals, and (c) mechanism studies on the allelochemicals. Most assessments of allelopathy involve bioassays of plant or soil extracts, leachates, fractions, and residues based on seed germination and seedling growth in laboratory and greenhouse experiments. Plant growth may be stimulated below the allelopathic threshold, but severe growth reductions may be observed above the threshold concentration depending upon the sensitivity of the receiving species. Generally germination is less sensitive than is seedling growth, especially root growth. Some approaches showed that field soil collected under donor plants significantly reduced or somewhat promoted growth of the test plants. Petri-dish bioassays with methanol extracts or fractions and causative phenolic allelochemicals showed significant phytotoxic activities in concentration-dependent manner. Delayed seed germination and slow root growth due to the extracts could be confounded with osmotic effects on rate of imbibition, delayed initiation of germination, and especially cell elongation; the main factor that affects root growth before and after the tip penetrates the seed coat. Light and electron microscopic approaches extract evaluation at the ultrastructural level have been precisely investigated. Many Compositae plants have allelopathic potentials, and the activities and types and amount of causative compounds differ depending on the plant species. The incorporation of allelopathic substances into agricultural management may reduce the use of pesticides and lessen environmental deterioration.

Journal of Chemical Ecology, Vol. 31, No. 5, May 2005 (©2005)
DOI: 10.1007/s10886-005-4256-y

ALLELOPATHIC EFFECTS OF VOLATILE MONOTERPENOIDS PRODUCED BY *Salvia leucophylla*: INHIBITION OF CELL PROLIFERATION AND DNA SYNTHESIS IN THE ROOT APICAL MERISTEM OF *Brassica campestris* SEEDLINGS

Abstract:
Salvia leucophylla, a shrub observed in coastal south California, produces several volatile monoterpenoids (camphor, 1,8-cineole, b-pinene, a-pinene, and camphene) that potentially act as allelochemicals. The effects of these were examined using *Brassica campestris* as the test plant. Camphor, 1,8-cineole, and b-pinene inhibited germination of *B. campestris* seeds at high concentrations, whereas a-pinene and camphene did not. Root growth was inhibited by all five monoterpenoids in a dose-dependent manner, but hypocotyl growth was largely unaffected. The monoterpenoids did not alter the sizes of matured cells in either hypocotyls or roots, indicating that cell expansion is relatively insensitive to these compounds. They did not decrease the mitotic index in the shoot apical region, but specifically lowered mitotic index in the root apical meristem. Moreover, morphological and biochemical analyses on the incorporation of 5-bromo-20-deoxyuridine into DNA demonstrated that the monoterpenoids inhibit both cell-nuclear and organelle DNA synthesis in the root apical meristem. These results suggest that the monoterpenoids produced by *S. leucophylla* could interfere with the growth of other plants in its vicinity through inhibition of cell proliferation in the root apical meristem.