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Assessment of the Effect of Some Medicinal Plants Extracts on Germination and Growth of Lentil (*Lens culinaris*).

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ABSTRACT

Assessments of plants liquid extracts showed that some crops enhance or reduce growth, development and yield of other crops growing simultaneously or subsequently in the fields. Another aspect of interest regarding crop extracts is that allelochemicals may exhibit inhibitory effect on the same crop which is commonly called as *crop auto toxicity*. In the present study, the effects of three famous medicinal plants *Viz.*, *Eruca sativa*, *Mentha peperina*, and *Coriandrum sativum* water extracts, prepared by grinding fresh leaves of the medicinal plants in distilled water and three concentrations were taken from the crude extracts (100%, 50% and 25% in addition to 0% as control), were tested for their effects on seed germination and some growth parameters of ***Lens culinaris***. the experiment was conducted in sterilizes Petri dishes under the natural laboratory conditions at temperature of 25° C, with a 24 h, 48 h, 72 h, 96 h and 120 h time interval for seed germination and 24 h, 48 h and 72 h for plumule, radicle lengths, fresh and dry weights of plumule, in addition to the essential elements.. The effects of different concentrations of aqueous extract were compared to distilled water (Control 0 % concentration). In lentils, germination percentage, reached 100% when treated with 50% and 25% *E. sativa* and 25% *M. peperina* extracts and reduced at 100% crude extracts of all plants. Radical and plumule length were increased at concentrations of 50% and 25% *C. sativum*, and 25% *M. peperina* compared to the control. Plumule fresh and dry weights increased at all *M. peperina* aqueous extracts compared to control. Medicinal plants extracts aided lentil in increasing sulfur and magnesium in plumule and reducing sodium and chlorine in radical and plumule. We can conclude that these medicinal plants leaf aqueous extract contain water-soluble allelochemicals which could enhance the seed germination and other growth parameters of *Lens culinaris* and reducing sodium chloride content.

Keywords: *Lens culinaris*, *Eruca sativa*, *Mentha peperina*, *Coriandrum sativum*, medicinal plants, allelochemicals**,** aqueous extract

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INTRODUCTION

Allelopathy is a biological phenomenon by which a plant produces one or more biochemicals that influence the growth, survival, and reproduction of other plants (Willis, 2007). These biochemicals are known as allelochemicals and can have beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms (Stamp, 2003). Allelochemicals are a subset of secondary metabolites, which are not required for metabolism (i.e. growth, development and reproduction) of the allelopathic organism. Allelochemicals with negative allelopathic effects are an important part of plant defense against herbivores.

Allelopathy can be defined as an important mechanism of plant interference mediated by the addition of plant-produced secondary products to the soil rhizosphere. Allelochemicals are present in all types of plants and tissues and are released into the soil rhizosphere by a variety of mechanisms, including decomposition of residues, volatilization, and root exudation.

A number of crops exhibit allelopathic interactions that play a significant role in the complex environment of agro ecosystems. Several studies have shown that allelopathic crops reduce growth, development and yield of other crops growing simultaneously or subsequently in the fields. Another aspect of interest regarding crop allelopathy is that allelochemicals may exhibit inhibitory effect on the same crop which is commonly called as *crop autotoxicity*. It is predominantly common in fields where sole cropping under reduced or no-tillage system is practiced. Though any crop part can be allelopathic, including even the pollens, but decomposing crop residues exhibit more influence on other plants (Daizy *et al*, 2008, Khawar, *et al*., 2010). Furthermore, the extent of allelopathy by a crop plant varies with age, part and type of cultivar being used. Nowadays allelo-pathic crops are being used as an important tool in managing weeds (Bhadoria, 2010, Awan *et al*., 2012 and Bertholdsson, *et al*., 2012) and harmful pests under sustainable pest management programs (Bangarwa *et al*., 2012). In this context several cover/smother and green manure crops with allelopathic nature hold a good promise as well as challenge for the future as they have a potential to suppress noxious.

Lens Culinaris

Belongs to the family Fabaceae. Lentils have been part of the human diet since the ceramic (before pottery) Neolithic times, being one of the first crops domesticated in the Near East. Lentil colors range from yellow to red-orange to green, brown and black. Lentils also vary in size and are sold in many forms, with or without the skins, whole or split. With about 30% of their calories from protein, lentils have the third-highest level of protein, by weight, of any legume or nut, after soybeans and hemp. Proteins include the essential amino acids isoleucine and lysine, and lentils are an essential source of inexpensive protein in many parts of the world, especially in West Asia and the Indian subcontinent, which have large vegetarian populations (Estrella et al., 1994).

Lentiles seedlings **Lentiles seeds**

MATERIAL AND METHODS

Preparation of aqueous extracts

Fresh leaves of Salad Rocket (*Eruca sativa*), *Mentha peperina* and *Coriandrum sativum* were extracted with distilled water using ground blender. The resulting solution was filtered through four layers of cheesecloth to remove debris, and centrifuged for 30 minutes. The supernatant was then filtered through one layer filter paper (Whattman NO .1). Three concentrations were prepared from the crude extract *Viz*, 100%, 50% , 25%, and 0% (pure distilled water, control).

Treatments and Measurements

Ten uniform and surface sterilized seeds (2% sodium hypochlorite for 15 min) of ***Lens culinaris*** were kept for germination in sterilized Petri-dishes lined double with blotting paper. The seeds of ***Lens culinaris*** were treated with 3 concentrations of the extracts of the three plants (100%, (crude extract) 50%, 25% and 0% (distilled water). Each treatment had three replicates. The Petri-dishes were maintained under laboratory conditions (room temperature 25°C at mid day, and diffused light during day). Some growth parameters were taken. These include, germination rate, radicle and plumule length, fresh and dry weight and elements content of radicle and plumule of ***Lens culinaris*** at the end of the experimental period.

Statistical analysis

The data obtained was subjected to three way analysis of variance, Completely Randomized Block Design (CRBD) and the mean values were analyzed at $P < 0.05$ by using one way analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Germination Rates

The tested extracts of all medicinal plants increased percentage of germination of Lentils except 100% crude extract of *C. sativum* (Fig. 1). The concentration of 100 % *C. sativum* caused 36 % reduction in Lentils germination rate compared to control. On the other hand Lentils treated with 25% and 50 % *E. sativa* achieved 100% germination rate. Noteworthy is that, all tested extracts at concentrations 25 and 50% increased germination rate of Lentils more than distilled water (control).

Radicle and Plumule Length

Lentil radicle length showed different responses to the medicinal plants extracts used. 25% of *C. sativum* , 25% of *M. peperina* and 50% of E. sativa extracts enhanced the radical growth of lentil plants (1.50, 2.8 and 2.2 cm) respectively compared to the control (1.17 cm) (Table 1, Fig.2). These findings are in consistence with those of Ebrahimi *et al*., (2011), Cerdeira, *et al*., (2012) and De Bertoldi, *et* al., (2012). In contracted, 100% of *C. sativum,* 100% 0f *M. peperina* significantly suppressed the growth of lentil radicle (0.20 and 0.9 cm) respectively. Worth mentioning is that, *E. sativa* has pronounce positive effect on radicle growth at 100% concentrations (Fig.2).

Concerning plumule length, 50% and 25% concentration *E. sativa* extract enhanced the growth of lentil plumule (4.7 and 3.7 cm) respectively compared to 0.9 cm in the control. Moreover, C. sativum extract reported a reasonable plumule length at all concentrations (2.5, 3.9 and 3.6 cm at 100%, 50% and 25%) respectively.) Kimberly *et al*., (2002) reported that *E. sativa* contains Glucosinolates originate from a group of amino acids, including alanine, leucine, methionine, phenylalanine and tryptophan which may be responsible for this increase.

Plumule and Radicle Fresh and Dry Weights

Results of plumule fresh and dry weights (Fig. 3) revealed that, all concentrations of water extracts of *M. peperina* reported a significant increase in plumule fresh weight compared to the control ($P \leq 0.01$). In addition, plumule fresh and dry weight treated with 100% and 50% of *E. sativa*, achieved almost similar results of the control. On the other hand, 100% *C. sativum* suppressed the fresh and dry of lentil plumule. These findings are in consistent with those of Hesammi and Farshidi (2012) and Khan *et al*., (2012). In contrast, Aasifa and Siddiqui (2014), have reported that Aqueous extract of *Eclipta alba* (L.) leaves shows the maximum inhibition seedling growth and dry biomass.

TDS and essential Elements

Results in Table 2 elucidate the effect of aqueous extract of the three plants on TDS(%) and the essential elements (mg/g dry wt.) on Lentil (*Lens culinaris*) plumule . the crude extract (100%) of plants was used to evaluate these parameters. *C.sativum* let lentile plumule to accumulate a small amount of sulphur SO_4^{-2} (1.26 mg/g/dry weight). However, a big amount of chlorione was reported with the same plant extract (41.54 mg/g/dry weight) compared to other plant extracts. On the other hand, the crude extract of *M.perinta* reduced the amount of sodium compared to other extracts (2.34 mg/g/dry weight). In addition, the crude extract of *E.sativa* aided lentiles plants to have amount of potassium and magnesium (7.96 and 23.79 mg/g/dry weight) respectively. Worth noting is that plants treated with the extracts reported almost twice the values of magnesium and sulfur compared to control ($p<0.05$). Magnesium is one of the most beneficial elements to plant for photosynthesis because it forms the central atom of chlorophyll (Xiuming and Papadopoulos, (2004). On the other hand, the beneficial effects of sulfur on increasing plants production is reported by many authors (Isuwan, 2007; Al-Solimani , 2010; Ahmad *et al.*, 2013).

Concerning TDS, the percents were in the matter E.sativa>M. perinta>C.sativa>Control (Table 2). Total Dissolved Solids (TDS) are solids in water that can pass through a filter (usually with a pore size of 0.45 micrometers). TDS is a measure of the amount of material dissolved in water. This material can include carbonate, bicarbonate, chloride, sulfate, phosphate, nitrate, calcium, magnesium, sodium, organic ions, and other ions. A certain level of these ions in water is necessary for plant life (Phyllis, *et al*., 2007).

Results represented in Table 3, revealed that , radicles of lentil accumulated elements in their roots (radicle) following similar pattern of shoots (plumule). Nonetheless, the amounts of elements in radicle were much more than those in plumule including TDS. Accumulation of elements in roots more than shoot is reported by many authors (Nafiseh, *et al*., 2012). However, some authors reported high amount of elements in shoots more than roots (Sêkara, *et al*.,2005) who found that, Red beet accumulated high amounts of cadmium and lead in leaves (2.65 and 8.71 mg kg-1 d. wt, respectively). The roots contained 2.8 times less cadmium and 3.6 less lead than the leaves.

The interesting observation from Table 4, that control plants accumulated 3 to 4 times sodium (Na^{+}) and chloride (Cl^{-1}) than the treated plants. This considered as a good factor in beneficial effect of aqueous extracts as was reported by many authors who concluded that The effects of salt-salinity stress on physiological responses have been observed in several species including not only herbaceous plants and woody plants (Nuran and Hüsnü, 2002; and Huang et al., ,2013).

Moreover, unlike in shoot, control plants has high amount of sulfur, calcium and magnesium in roots than other treatment ($P<0.05$). which may be related to photosynthesis in other treatments which appear in their lengths and weights.

CONCLUSION

The present investigation revealed that aqueous extract of *C.sativa, M*. *peperina* and *E. sativa*, at different concentration levels enhanced the germination percentage, radical length, Plumule length and fresh and dry weights of *Lens culinaris* seedlings. In addition, magnesium was high in plumule while sodium and chlorine were low, which considered as good factors in saline soils like those of Saudi Arabia. Their effectiveness on germination and growth suggests that leaves of these medicinal plants may act as a source of beneficial allelochemicals. There is a need to provide information to farmers about these plants and their allelopathic effects. Further studies are suggested to clarify the possible physiological mechanism related to allelopathic effect on plants.

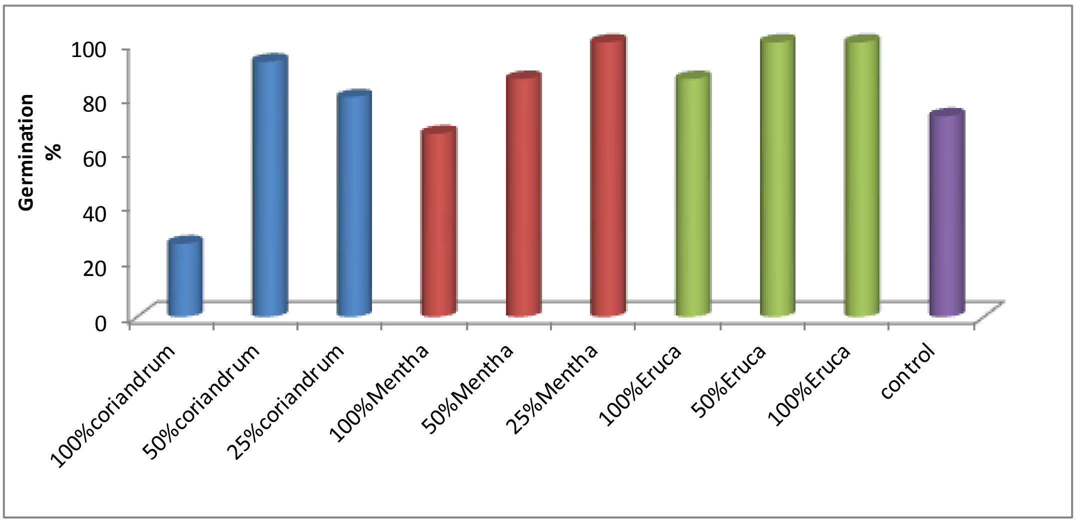

Figure 1: % Germination of Lentil (*Lens culinaris*) grown with different plant extracts.

Table 1: Radicle and Plumule Length (cm) of Lentil (*Lens culinaris*) grown with different plant extracts

Length (Cm)								
	Radicle	Plumule		Radicle	Plumule		Radicle	Plumule
C. sativum 100%	0.20±.01 a	0.60±.01 a	*M. peperina 100%*	0.90±.01 A	2.50±.05 a	*E. Sativa 100%*	1.80±.05 a	1.02±.05 a
C. sativum. 50%	0.83±.01 b	1.90±.01 b	*M. peperina. 50%*	2.60±.01 B	3.90±.05 b	*E. sativa. 50%*	2.2±.05 b	4.7±.02 b
C.sativum. 25%	1.50±.05 c	3.10±.01 c	*M. peperina 25%*	2.80±.01 B	3.60±.05 b	*E. Sativa. 25%*	1.7±.05 d	3.7±.05 b
Control	1.17±.05 d	0.9±.01 a						

The data are expressed in mean ± SE. n=3 in each group.
Means marked with different letters in the same column significantly differ at $P < 0.05$ of probability compared to control

Table 2: Effect of aqueous extract of the three plants on Total suspended solids (TDS%) and the essential elements (mg/g dry wt.) on Lentil (*Lens culinaris*) plumule (shoot).

Plants	TSS	Na^{+}	K^{+}	Cl^{-1}	SO_4^{-2}	Ca^{+2}	Mg^{+2}
Distilled water 0% (control)	2.78a	1.89a	5.27a	19.17a	0.77a	0.02a	11.53a
*C. sativum*100%	3.16b	2.73b	7.41b	41.54b	1.26b	0.03a	23.79b
M. peperina. 100%	3.93b	2.34b	7.33b	27.96c	1.32b	0.04a	21.41b
E. Sativa. 100%	4.66c	2.73b	7.96b	25.35c	1.90b	0.02a	23.79b

The data are expressed in mean ± SE. n=3 in each group.
Means marked with different letters in the same column significantly differ at $P < 0.05$ of probability

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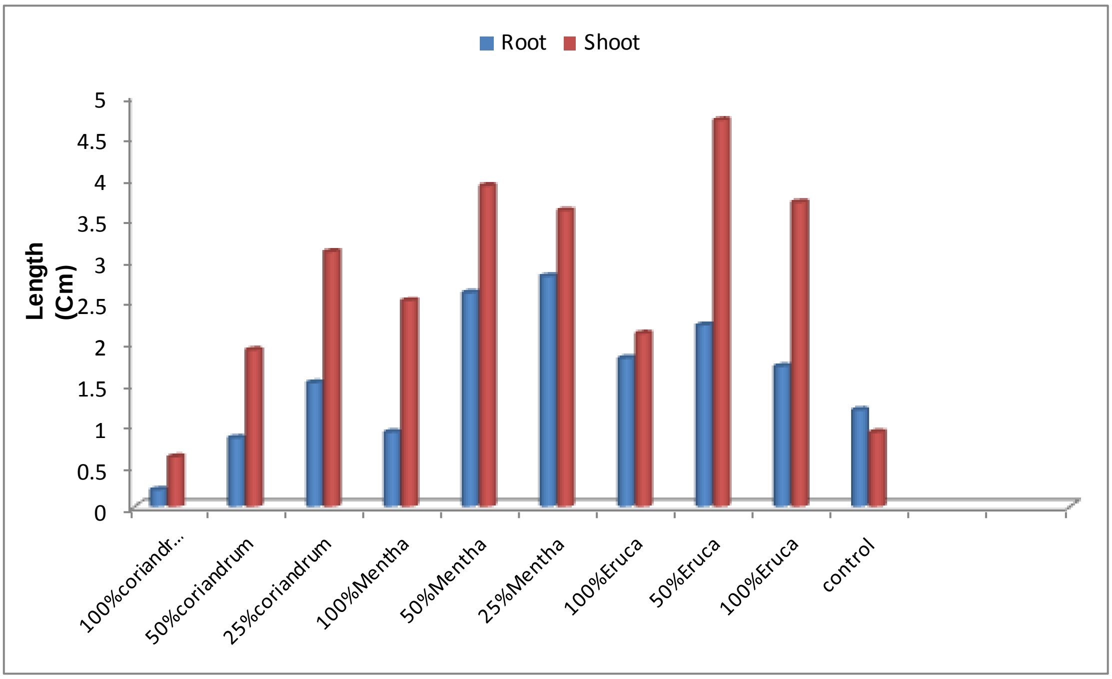

Figure 2: Radicle (Root) and Plumule (shoot) Length of Lentil (*Lens culinaris*)grown with different plant extracts.

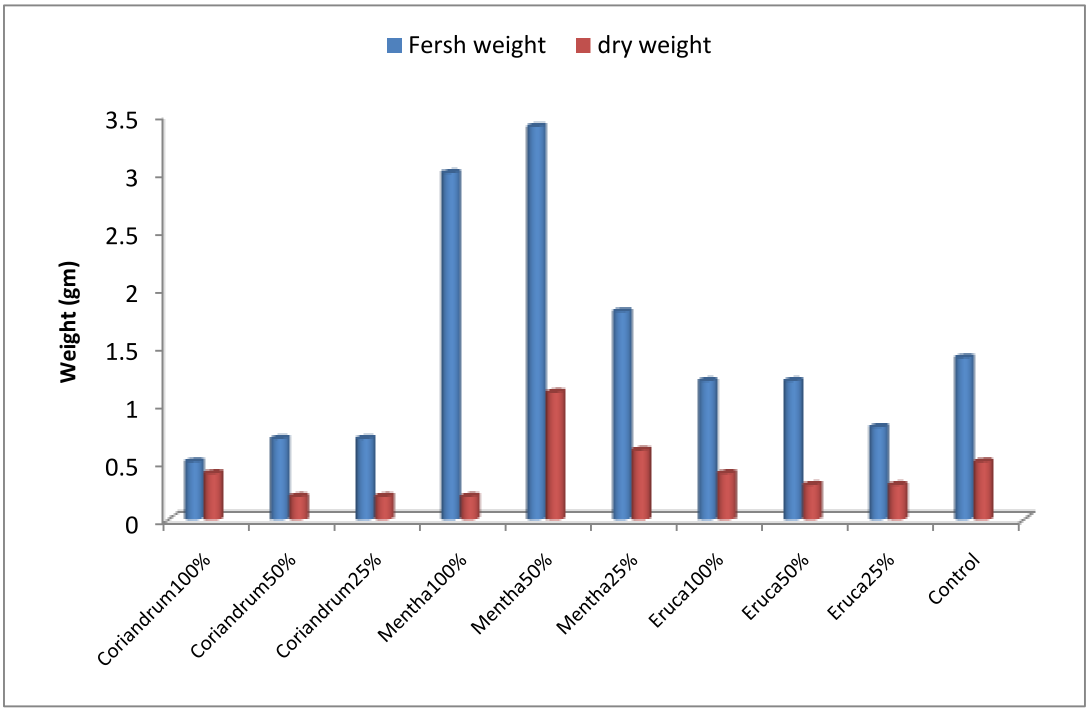

Figure 3: Plumule Fresh and Dry weights (gm) of Lentil (*Lens culinaris*) grown with different plant extracts.

Table 3: Effect of aqueous extract of the three plants on Total suspended solids (TDS%) and the essential elements (mg/g dry wt.) on Lentil (*Lens culinaris*) Radicle (Root).

Plants	TSS	Na^{+}	K^{+}	Cl^{-1}	SO_4^{-2}	Ca^{+2}	Mg^{+2}
Distilled water 0% (control)	12.84a	27.00a	8.28a	319.50a	5.47a	0.32a	192.15a
*C. sativum*100%	12.28a	6.75b	16.54b	159.75b	3.04b	0.10b	20.59b
M. peperina. 100%	16.08b	9.10c	24.57c	138.45b	3.69b	0.07b	71.37c
E. Sativa. 100%	17.06b	9.75c	21.88c	76.92c	2.49c	0.09b	19.83b

The data are expressed in mean ± SE. n=3 in each group.
Means marked with different letters in the same column significantly differ at $P < 0.05$ of probability

REFERENCES

[1] Ahmad, KM, Mohammad A, Matin JM. Int J Agron Plant Prodn 2013;4(7):1474-1478.
[2] Aasifa G, Siddiqui MB. J Agric Ext Rural Develop 2014;6(1):55-60.
[3] Al-Solimani SG, El-Nakhlawy FS, Al-Morshdy MH. Arab Universities J Agric Sci 2010;18(2): 263-270.
[4] Awan FK, M Rasheed, M Ashraf, MY Khurshid. J Animal Plant Sci 2012; 22: 715–721.
[5] Bangarwa SK, JK Norsworthy, EE Gbur. Weed Technol 2012;26: 364–370.
[6] Bertholdsson NO, SC Andersson, A Merker. Plant Breeding 2012;131: 75–80.
[7] Bhadoria PB. American J Exp Agric 2011; 50(1):41–44
[8] Cerdeira AL, CL Cantrell, FE Dayan, JD Byrd, and SO Duke. Weed Sci 2012; 60: 212–218.
[9] Daizy RB, Singh HP, Shalinder K. J Crop Prod 2008;4(2): 121-161.
[10] De Bertoldi C, M De Leo, and A Ercoli. Chemoecology 2012;22: 13–21.
[11] Ebrahimi F, NM Hosseini and MB Hosseini. Iranian J Field Crop Sci 2011;42: 757–766.
[12] Estrella I, Maria J, Raquel R, Jim B. J Agric Food Chem 1994;42(10):2291–2295.
[13] Hesammi E, and A Farshidi. Adv Environ Biol 2012;6: 1520–1522.
[14] Huang G, Wang L, Zhou Q. Biol Trace Element Res 2013; 151: 105–112, 2013
[15] Isuwan A, Saelim J, Poathong S. Silpakorn University Sci Technol J 2007;1(2):13-19.
[16] Khan MB, M Ahmad, M Hussain, K Jabran, S Farooq, M Waqas-Ul-Haq. J Animal Plant Sci 2012;22: 339–346.
[17] Khawar J, Muhammad F, Mubshir H, Hafeez R, Muhammad A. J Plant Prot Res 2010;1(1): 7-20.
[18] Kimberly L Falk, et al. Phytochem 2002;65 (8): 1073-1084.
[19] Nafiseh N, Mehrdad L, and Ali G. European J Exp Biol 2012; 2 (4):969-974.
[20] Nuran C and Hüsnü Ç. Bulg J Plant Physiol 2002;28(1–2):66–74.
[21] Phyllis K, Weber S. and Lawrence KD. American J Environ Sci 2007;3(1): 1-6.
[22] Sêkara A, Poniedzia M. Ciura J, Jêdrszczyk E. Polish J Environ Studies 2005;14(4): 509-516.
[23] Stamp N. The Quart Rev Biol 2003;78(1): 23–55.
[24] Willis RJ. 2007, The History of Allelopathy", Springer: 3, ISBN 1-4020-4092-X, retrieved 2009-08-12.
[25] Xiuming H and Papadopoulos PA. Hort Sci 2004;39(3):512-515.