IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
ISSN: 2278-3008. Volume 5, Issue 1 (Jan. – Feb. 2013), PP 52-55
www.iosrjournals.org

Allelopathic effect of different concentration of water extract of *Argemone mexicana* L. on seed germination and seedling growth of *Sorghum bicolor* (L.) Moench

C. Alagesaboopathi
Department of Botany, Government Arts College (Autonomous),Salem - 636 007. Tamilnadu, India.

Abstract: *Laboratory experiments were conducted to evaluate the allelopathic effects of the water extract of Argemone mexicana L. on the seed germination, plumule length, radicle length, fresh and dry weight in Sorghum (Sorghum bicolor Moench). The allelopathic potentialities of leaf extracts of A.mexicana decreased the seed germination of Sorghum bicolor with raise of extracts concentration. The extracts also inhibited in plumule and radicle length of Sorghum bicolor seedlings with heighten of A.mexicana extracts concentration. The conclusion revealed that the inhibitory and stimulatory determine might be due to the presence of these allelochemicals such as alkaloids, glycosides, saponins, tannins and flavonoids etc., in the aqueous leaf extracts of A.mexicana from the present study. Hence, it could be concluded that the leaf aqueous extract contain water-soluble allelochemicals. Which could inhibit seed germination; reduce plumule and radicle length of Sorghum. It is recommended that Sorghum should not be planted near to Argemone mexicana due antagonistic effects on its development.*

Key words: *Allelopathic effect, Argemone mexicana, seed germination, seedling growth, Sorghum bicolor.*

I. Introduction

Certain plants may inhibit germination and subsequent development of other plants by exuding toxic essences. These essences are called allelochemicals or allelopathic chemicals and the process is called allelopathy (Rice, 1984). Angiosperms plants are a luxuriant principle of valuable allelopathic compounds used for weed manage technologies based on genuine produces. Allelopathic activity present in the extraction of numerous higher plants and in various plant organs can be achieved with bioassays under laboratory conditions. The initial laboratory assays of allelochemicals have focused on seed germination and seedling development (Vyryan, 2002). Rice in 1984 defined Allelopathy as the produces one plant on another plant via the release of chemicals into the environment. Allelopathy is the capability of plant to inhibit the germination of other plants through the production of allelochemicals which may be present in any organs of the plants such as roots, stems, rhizomes, leaves, fruits and seeds or sometimes found in just one or two of such parts (Zeng *et al.*, 2008), from where they are released to the soil through root exudation, volatilization, decomposition and leaching of plant residues (Rice, 1984; Chou, 1999).

The significance of allelopathy in biological regulate of weeds and crop productivity has been extremely recognized and several techniques have been suggested to know the allelopathic activities (Fujii *et al.*, 2004; Taiwo and Makinde, 2005; Terzi, 2008). Allelopathic determine of medicinal species is of peculiar attention in modern years (Han *et al.*, 2008; Li *et al.*, 2009). Allelopathic activities of *Sorghum* is used to control weeds in irrigated wheat (Cheema and Khaliq, 2000). Allelopathy proposes a challenge for workable weed management preferences (Travlos *et al.*, 2007). Various plants are reported to control allelopathic activity and efforts have been made to utilize them for weed control.

Argemone mexicana L. (Papaveraceae), commonly known as Prickly Poppy in English and Premathandu in Tamil found in Mexico and now has widely naturalised in the United States, India, Bangladesh and Ethiopia. It occurs as wasteland weed in almost every part of India (Mukherjee and Namhata, 1990; Das and Misra, 1987). In Mexico, the seeds have been used as an antidote to snake poisoning (Bhattacharjee *et al.*, 2006). In India, the smoke of the seeds is used to relieve toothache. The fresh yellow milky seed extract contains protein-dissolving substances effective in the treatment of diuretic, anti-inflammatory, malarial fever, leprosy, scorpion sting, warts, cold sores, wound healing, skin diseases, itches, jaundice and an antidote to various poisons (Chopra *et al.*, 1986; Prusti and Mishra, 2004; Alagesaboopathi, 2009; Dash and Murthy, 2011). The seeds are purgative and sedative (Ayurveda) (Das and Mishra, 1987), useful in skin diseases and leucoderma (Yunani) (Chaudhuri Rai *et al.*, 1985) and in Homeopathy, the tincture of the entire plant is reported to be used orally for bronchitis and whooping cough (Kala, 2005; Eldridge, 1995). The fresh juice of the leaves and the latex both are reported to be used externally as a disinfectant for open wounds and cuts (Alagesaboopathi, 2009; Panghal *et al.*, 2010). Various isoquinoline alkaloids viz. berberine, cryptopine, coptisine, muramine, scoulerine, stylopine, cheilkanthifoline, sanguinarine, sarguinarine, chelerytherine, sanguinarine, thalifoline and protopine

have been reported from the plant (Gupta *et al.,* 1990). The present investigation was conducted to assess the allelopathic potential of aqueous extract of *A.mexicana* on seed germination and seedling growth of *Sorghum bicolor*.

II. Materials and methods

Young and mature fresh leaves of *Argemone mexicana* were collected in January 2012 from Omalur, Salem District of Tamilnadu, India. The freshly collected leaves were washed several times by tap water, shade dried at room temperature (25°C - 30°C) for 10 days. Leaves samples were grounded and the powdered materials were stored in plastic bottles at room temperature. For leaf extract, twenty gram leaf powder was soaked in 100 ml. distilled water for 24 hours at the room temperature to get 25 percentage extract. By dilutions with distilled water 5, 10, 15, 20 and 25 percentage concentrations of extracts were prepared.

The seeds of *Sorghum bicolor* (L.) Moench (Sorghum) (Cholam in Tamil) were procured from Agricultural Office, Veerapandi, Salem. The seeds of *S. bicolor* were surface sterilized with 0.1% mercuric chloride for 1 min to eliminate the fungal spores on the seeds. Then the seeds were washed with distilled water for many times to remove the mercuric chloride. The seeds were soaked in different concentrations of extracts for 24 hours. The experiment was done in 12 cm petri-dishes line with sterile cotton. Each petri-dishes contained 10 normal sized seeds, while seeds distilled water were maintained as control separately, which were irrigated with 20 ml distilled water on alternative days. The experimental design was a randomized entire block with 3 replications for each treatment and control. Ten days old plantlets were used for measurement of seed germination percentage, radicle and plumule length, fresh weight and dry weight. For determination of plumule and radicle dry weight these parts were dried in an air forced oven at 60°C for 24 hours. Each treatment of this experiment was carried out with 3 replications and repeated twice. The data obtained were subjected to analysis of variance (ANOVA).

III. Results and discussion

The allelopathic effect of *Argemone mexicana* on the germination of *Sorghum* is shown in Fig 1. The present study leaf aqueous extract of *Argemone mexicana* on *Sorghum bicolor* seeds showed a moderate reduction in all parameters. The deduct in percent *S.bicolor* seed germination in the *A.mexicana* extract treatments ranged between 18 to 76% compared to 89% germination in the control. The seed germination, plumule length and radicle length was inhibited in all concentrations (Table 1). The inhibitory outcome was increased with increasing concentrations of the extracts and inhibition of the radicles was greater than that of the plumules. The inhibitory consequence was concentration dependent. All the maximum concentration studied, a highest of 29% and 40 of reduction in seed germination was noticed in leaf extracts on *S.bicolor.* Alike trend was followed in plumule and radicle length *S. bicolor* a maximum of 49% and 30% reduction was recorded in radicle and plumule respectively.

The degree of retardation also increased with the elevate in the concentrations of the extracts. Statistical analysis at five percent level (t-test) revealed that, apart from comparison between 5 and 25 g extract concentrations, there were no indicative differences in the development length of radicle in the varying extract concentrations as well as those of the control. The leaf extracts of *A.mexicana* also caused important reduction in seedling development of *S.bicolor*. The extracts not only decreased the radicle and plumule length of *S.bicolor* seedlings but also decreased the fresh and dry weight. The reduction of biomass was correlated with reduction in seedling development. The reduction in the fresh and dry weight may be due to stunted and meagre vegetative development of *S.bicolor.*

Paul and Begum (2010) reported that allelopathic effect of *Argemone mexicana* on germination and seedling growth characteristics of Lentil (*Lens culinaris*). In another research, the extracts of leaves, roots, stems and unripe fruit of *Argemone mexicana* were growth regulatory and root extract was more phytotoxic (Pande *et al.,* 1980). Some modern investigations indicating the allelopathic/ phytotoxic determine of aqueous extracts of weeds contain *Cardaria draba* (Kiemnec and Mcinnis, 2002), *Raphanus raphanistrum* (Norsworthy, 2003), *Lucerne varities* (Zhihua and Yixin, 2005), *Baccharis dracunculifolia* (Gusman *et al.,* 2008), *Calotropis procera* (Samreen *et al.,* 2009), *Chenopodium murale* (Bahish *et al.,* 2007), *Acacia auriculiformis* (Bora *et al.,* 1999), *Centella asiatica* (Alagesaboopathi, 2010), *Andrographis lineata* (Alagesaboopathi and Tamilazhagan, 2010), *Lantana camara* (Muhammad Kamal Hossain and Nazmul Alam, 2010), *Andrographis paniculata* (Alagesaboopathi, 2011), *Sesbania grandiflora* (Chinnappan Alagesaboopathi and Mahalingam Deivanai, 2011), *Tectona grandis* (Manimegalai and Manikandan, 2010), *Euphorbia thiamifolia* (Kumbhar and Dabgar, 2011), *Jatropha curcas* (Rajila and Vijayakumar, 2011) and *Tinospora cordifolia* (Abdul Raoof and Siddiqui, 2012). Mushraf Khan *et al.,* (2011) reported that allelopathic potential of *Rhazya stricta* Decne on germination of *Pennisetum typhoides*. All these investigations indicated the discharge of phototoxic chemicals during the preparation of aqueous extracts. The found inhibitory effect in seed germination, plumule length and radicle length and other primary parameters.

IV. Conclusion

The aqueous leaf extracts of *A.mexicana* showed inhibitory produces on seed germination, plumule length, radicle length, fresh and dry weight of *S.bicolor.* The *A.mexicana* leaf extracts inhibited the germination and development of *S.bicolor* in the present study. Hence, they must have been trustworthy for the inhibition of seed germination, progress and dry matter accumulation of radicle and plumule of *S.bicolor* progressively reduced with the heighten in the concentration of the extract. Further investigations are suggested to isolate and qualitive putative allelochemicals in *A.mexicana* and the interaction that could be indicative for the noticed inhibition of seed germination and plant evolution. The present work provides the evidence of *Argemone mexicana* has allelopathic potential. It is also suggested that Sorghum should not be planted near to *Argemone mexicana* due to unfavourable effects on its growth.

Acknowledgement

The author is thankful to Prof.C.S. Suriyanarayanan, Head of the Department of Botany, Government Arts College (Autonomous), Salem, Tamilnadu. India for providing necessary laboratory facilities to carry out the research work.

References

[1] Abdul Raoof, K.M. and Siddiqui, M.B. (2012). Allelopathic effect of aqueous extracts of different parts of *Tinospora cordifolia* (Willd.) Miers on some weed plants. J.Agri.Ext. Rural Dev. 4(6):115-119.
[2] Alagesaboopathi, C. (2009). Ethnomedicinal plants and their utilization by villagers in Kumaragiri Hills of Salem district of Tamilnadu, India. Aft. J. Tradit. Complement. Altern. Med. 6(3), 222-227.
[3] Alagesaboopathi, C. (2010). Allelopathic effects of *Centella asiatica* aqueous extracts on Pearl Millet (*Pennisetum typhoides* L.) and Cowpea (*Vigna unguiculata* Walp.). Pak.J.Weed.Sci.Res.16:67-71.
[4] Alagesaboopathi, C. (2011). Allelopathic effects of *Andrographis paniculata* Nees on germination of *Sesamum indicum* L. Asian J.Exp.Biol.Sci.2:147-150.
[5] Alagesaboopathi, C. and Tamilazhagan, S. (2010). Allelopathic potential of *Andrographis lineata* Nees on germination and seedling growth of blackgram and greengram. Crop Res. 40:182-185.
[6] Batish, D.R., Lavanya, K. Singh, H.P. and Kohil, R.K. (2007). Root mediated allelopathic interference of Nettle-leaed Goosefoot (*Chenopodium murale*) on Wheat (*Triticum aestivum*). J.Agron.Crop.Sci. 193:37-44.
[7] Bhattacharjee, I., Chatterjee, S.K., Chatterjee, S. and Chandra, G. (2006). Antibacterial potential of *Argemone mexicana* solvent extracts against some pathogenic bacteria. Mem Inst Oswaldo Cruze Rio de Janeiro. 6, 645-648.
[8] Bora, I.P., Singh, J. and Borthakur, R. (1999). Allelopathic effects of leaf extract of leaf of *Acacia auriculiformis* on seed germination of some agricultural crops. Ann. For. 1:143-146.
[9] Chandhuri Rai, D., Pal, C. and Tarafdar, C.R. (1985). Less known uses of some plants from the tribal areas of Orissa. Bull. Bot. Surv. India. 17, 132-136.
[10] Cheema, Z.A. and Khaliq, A. (2000). Use of *Sorghum* allelopathic properties to control weeds in irrigated wheat in a semiarid region of Punjab. Agriculture Ecosystem and Environment. 79(23):105-112.
[11] Chinnappan Alagesaboopathi and Mahalingam Deivanai. (2011). Allelopathic potential of *Sesbania grandiflora* Pers. on germination of *Cajanus cajan* Millsp. (Redgram) varieties. International Journal of Biosciences. 1(5):51-55.
[12] Chopra, P.N., Nayar, S.L. and Chopra, I.C. (1986). Glossary of Indian Medicinal Plants (Including the supplement), Council of Scientific and Industrial Research, New Delhi.
[13] Chou, C.H. (1999). Roles of allelopathy in plant biodiversity and sustainable agriculture. Critical Rev. Plant Sci. 18:609-636.
[14] Das, G.K. and Murthy, P.N. (2010). Evaluation of *Argemone mexicana* Linn. Leaves for wound healing activity. J. Nat. Prod. Plant Resour. 1(1), 46-56.
[15] Das, P.K. and Misra, M.K. (1987). Some medicinal plants used by the tribals of Deomali and adjacent areas of Koraput district, Orissa, Indian Journal of Forestry. 10, 301-303.
[16] Eldridge, J. (1995). Bush medicine in the Exumas and Long Island, Bahamas. A field study. Econ. Bot. 29, 317-332.
[17] Fujii, Y., Shibuya, T., Nakatani, K., Itani, T., Hiradate, S. and Parvez, M.M. (2004). Assessment method for allelopathic effect from leaf litter leachates. Weed Biol. Manag., 4:19-23.
[18] Gupta, R,S., Dixit, V.P. and Dobhal, M.P. (1990). Antifertility studies of isoquioline alkaloids with special emphasis on structure activity relationship Fitoterapia 61(1), 67-71.
[19] Gusman, G.S., Bittencourt, A.H.C. and Vestena, S. (2008). Allelopathy of *Baccharis drancunculifolia* D.C. on the germination and development of cultivated species. Acta Scientiarum Biol.Sci.30:119-125.
[20] Han, C.M., Pan, K.W., Wu, N., Wang, J.C. and Li, W. (2008). Allelopathic effect of ginger on seed germination and seedling growth of soybean and chive. Sci.Hortic. 116(3):330-336.
[21] Kala, C.P. (2005). Ethnomedicinal botany of Apatani in the Eastern Himalayan region of India. J. Ethnobiol. Ethnomedicine. 1, 11.
[22] Kiemnec, G.L. and Mcinnis, M.L. (2002). Hoary cress (*Cardaria draba*) root extract reduces germination and root growth of five plant species. Weed Technol. 16:231-234.
[23] Kumbhar, B.A. and Dabgar, Y.B. (2011). Allelopathic effects of aqueous extracts of *Euphorbia thiamifolia* L. on germination and seedling growth of *Cajanus cajan* L. J.BioSci. Res. 2(2):62-66.
[24] Li, H.Y., Pan, K.W., Lin, Q. and Wang, J.C. (2009). Effect of enhanced ultraviolet-B on allelopathic potential of *Zanthoxylum bungeanum. Sci. Hortic.* 119(3):310-314.
[25] Manimegalai, A. and Manikandan, T. (2010). Allelopathic effect of *Tectona grandis* leaves extract on antioxidant enzymes in *Vigna munga* and *Vigna radiata*. Asian Journal of Science and Technology. 3:67-69.
[26] Muhammad Kamal Hossain and Nazmul Alam, M.D. (2010). Allelopathic effects of *Lantana camara* leaf extract on germination and growth behaviour of some agricultural and forest in Bangladesh. Pak.J.Weed.Sci. Res. 16(2):217-226.
[27] Mukherjee, A. and Namahata, D. (1990). Medicinal plant lore of the tribals of Sundargarh District, Orissa, Ethnobotany. 1(2), 57-60.
[28] Musharaf Khan, Farrukh Hussain and Shahana Musharaf. (2011). Allelopathic potential of *Rhazya stricta* Decne on germination of *Pennisetum typhoides.* International Journal of Biosciences. 1(4):80-85.

[29] Norsworthy, J.K. (2003). Allelopathic potential of Wild radish (*Raphanus raphanistrum*). Weed Technol.17:7-13.
[30] Pande, P.C., Dublish, P.K. and Jain, D.K. (1980). Effects of extracts of *Argemone mexicana* Linn. on seed germination and seedling growth of *Abelmoschus esculentus* Ser. Bangladesh J.Bot. 9:67-71.
[31] Panghal, M., Arya, V., Yadav, S., Kumar, S. and Yadav, J.P. (2010). Indigenous knowledge of medicinal plants used by saperas community of Khetawas, Jhajjar district. Haryana, India. J. Ethnobiot. Ethnomed. 6, 10.
[32] Paul, N.K. and Begum, N. (2010). Allelopathic effect of *Argemone mexicana* L. on germination and seedling growth characteristics of Lenti (*Lens culinaris*). J. Bio. Sci. 18:146-147.
[33] Prusti, A.B. and Mishra A. (2005). Interesting medico-botanical claims by Khouds of Nayagarh district of Orissa. Plant Sci. Res. 27(182), 16-23.
[34] Rejila, S. and Vijayakumar, N. (2011). Allelopathic effect of *Jatropha curcas* on selected intercropping plants (Green Chilli and Segame). Journal of Phytology. 3(5):1-3.
[35] Rice, E.L. (1984). Allelopathy, 2nd Ed. Academic Press, New York, p.1-67.
[36] Samreen, U., Hussain, F. and Sher, Z. 2009. Allelopathic potential of *Calotropis procera.* Ait.Pak.J.Pl.Sci. 15:7-14.
[37] Taiwo, L.B. and Makinde, J.O. (2005). Influence of water extract of Mexican sunflower (*Tithonia diversifolia*) on growth of Cowpea (*Vigna unguiculata*). Afr. J. Biotechnol. 4(4):355-360.
[38] Terzi, I. (2008). Allelopathic effects of Juglone and decomposed walnut leaf juice on muskmelon and cucumber seed germination and seedling growth. Afr. J. Biotechnol. 7(12):1870-1874.
[39] Travlos, I.S., Economou, G., Kanatas, P.J. and Tzakou, O. (2007). Aspects of the allelopathic potential of horseweed (*Conyza albida*). Int. J. Agric. Res. 2:397-401.
[40] Vyryan, J.R. (2002). Allelochemicals as leads for new herbicides and agrochemicals. Tetrahedron. 58:1631-1646.
[41] Zeng, R.S., Mallik, A.V. and Luo, S.M. (2008). Allelopathy in sustainable Agriculture and Forestry, Springer-Verlag, Germany. pp.412.
[42] Zhihua, L. and Yixin, S. (2005). Studies on allelopathic effects of aqueous extracts of roots of different *Lucerne* varieties. Grass. China. 27(4):39-46.

Table 1 Effects of *Argemone mexicana* aqueous extracts of leaf on germination and seedling development of *Sorghum bicolor*. Values are mean ± SE of 10 samples

Extracts concentration (%)	Germination (%)	Radicle length (cm)	Plumule length (cm)	Fresh weight (g)	Dry weight (g)
Control	89±7.2	6.2±0.4	6.8±0.6	0±0.712	0±0.31
5	76±4.6	4.9±0.8	5.4±0.8	0±0.079	0±0.04
10	61±8.5	4.2±0.5	4.6±0.2	0±0.58	0±0.03
15	50±8.7	3.6±0.7	4.1±0.5	0±0.60	0±0.02
20	34±5.3	2.4±0.3	2.9±0.2	0±0.48	0±0.02
25	18±9.1	1.4±0.2	1.5±0.1	0±0.45	0±0.02

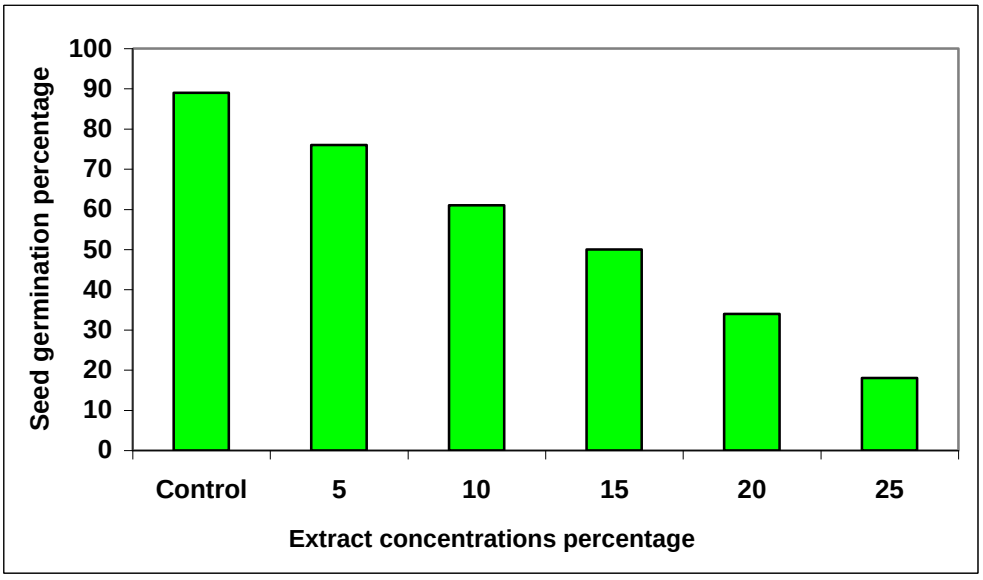

Fig 1 Effects of aqueous extracts of *Argemone mexicana* on seed germination of *Sorghum bicolor*.