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SHORT COMMUNICATION

ARTEMISIA ANNUA L. AS AN ALTERNATIVE POTENTIAL WEED CONTROL OPTION

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Weeds cause great problems to humankind by interfering food production, health, economic stability and welfare. They reduce crop yield, increase the cost of production, degrade the quality of harvested product and reduce the quality of market product. They are not only problematic from agricultural point of view but are also a great threat to the plant diversity of nearby flora and their subsequent spread reducing the diversity of native plants [1]. Increasing problems related to weed control, such as herbicide resistant weeds and herbicide residues, expand the demand for organic crops, and increasing public concerns on environmental issues require alternative farming systems based on naturally occurring compounds [2, 3, 4]. Integrated weed management (IPM) is one of the most important approaches to sustain environment, improve crop production, long term protection and advance socio-economics [5]. Allelopathy, as a component of IPM, involving secondary metabolites, is produced by plants, algae, bacteria and fungi that influence the growth and development of agricultural and biological systems [5, 6]. It is one approach that can be used as an alternative method to combat pests in cropping systems [4, 7]. Allelochemicals (inhibitors) are produced by plants as end products, by-products and metabolites through volatilization, leaching, exudation and decomposition, and are contained in the stem, leaves, roots, flowers, inflorescence, fruits and seeds of the plants [8]. Though the phenomenon existed in nature since centuries and its history goes back as early as 300 B.C. [4, 9], the current researches after 1980 on medicinal plants and spices has brought out a number of herbs that have chemicals suitable for promoting or suppressing the growth and yield of surrounding plants [5, 10].

Plant species like *Artemisia dubia* Wall ex. Besser[1], *Croton bonplandianum* Ball. [8], *Euphorbia helioscopia* L.[11], *Cassia angustifolia* Vahl. [5], *Raphanus sativus, Eucalyptus camaldulensis, Juglans regia, Melia azederach, Nerium oleander, R. Sativus* and *Thymus* spp. [4], sunflower [12] and *Artemisia monosperma* Del. [13] have mentioned allelopathic. The genus Artemisia is a rich source of biologically active natural products [14]. *Artemisia annua* L., the focus species in this experiment, belongs to Asteraceae family, is a large shrub often reaching more than 2 m in height, usually single-stemmed with alternate branches. The aromatic leaves are deeply dissected and range from 2.5 cm to 5 cm in length [15]. The plant is native to Asia, most probably China and now naturalized in many countries such as United States [16]. In Africa, *Artemisia annua* has been introduced for cultivation to Cameroon, Ethiopia, Kenya, Mozambique, Tanzania, Uganda, Zambia, Ghana, Rwanda, South Africa and Madagascar - all in high-altitude regions and/or regions with a pronounced cool period. The essential oil from aerial parts of the plant has been used in cosmetics and pharmaceuticals. *Artemisia annua* is well known for its antimalarial activity, attributed to the presence of artemisinin. This compound is also mentioned phytotoxic [17, 18]. The phytotoxic effects of different parts of *Artemisia annua* on establishment and growth parameters of weed species found in Wondogenet, Ethiopia were preliminarily investigated. 30 kg of leaf, 100kg of stem, 50 kg of branch, and 76 kg of roots of artemisia were harvested from 104 m^2 experimental area of Wondo Genet Agricultural Research Center experimental station (7°05'38.47"N, 38°37'17.07"E, alt. 1771 masl) on April 26 and May 11, 2010 for dry and fresh treatments, respectively. From the harvested plant parts, 30 kg of each none dried and uniform leaves, stems and roots were taken and prepared for the experiment. While fresh leaves, stems and

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roots of artemisia were chopped properly using sickle and scissor, dried parts were grounded using traditional mortar and pestle. The grounded material was soaked in water using 15 liter plastic container @ the ratio of 1:2.4 (grounded material: water) for 24 hours.

In all treatment receiving experimental plots and pots, the extracts (solution together with the extracted material) of different plant parts were applied uniformly. For dry treatment, the harvested materials were dried under the shade for 8 days, which was regulated through gravimetric moisture analysis method. Both the dried and fresh materials were chopped in to pieces to increase the surface area for extraction, and easy application. During this period pulverized materials were regularly mixed to facilitate uniform air circulation. The pot experiment was conducted between May 27 and August 14, 2010. A uniform pot (plastic container) with a volume of 8000 m^3 was used. The soil for pot filling was brought from a depth of 15-30 cm from the same area where the field observation trial was laid out. 150 gram of leaf, stem and root was used for each pot, either in dry or aqueous extract forms. The field observation trial was laid out in the experimental area of Wondo Genet Agricultural Research Center, where serious weed infestation was prevailed during 2009/2010. The experimental soil was Luvisol with pH value raging between 5.2 and 7.7 [19], and plot size was $4m^2$. Factorial combination of artemisia products (dry leaf powder (LDP), dry leaf aqueous extract (LDE), fresh leaf powder (LFP), fresh leaf aqueous extract (LFE), dry stem powder (SDP), dry stem aqueous extract (SDE), fresh stem powder (SFP), fresh stem aqueous extract (SFE), dry root powder (RDP), dry root aqueous extract (RDE), fresh root powder (RFP) and fresh root aqueous extract (RFE)) and application methods (applied on the plowed plots and on the unplowed weedy plots) were used in three replications. Mean separation was done using LSD as illustrated by [20]. Two grass weeds named “Engicha”, *Cyperus spp*. L. and “Serdo”, *Cynodon sp*., and seven broad leaved weeds “Chegogit”, *Bidens pilosa*; “Mech”, *Guizotia scabra (Vis.) Chiov*..; “Wofanqur”, *Commelina latifolia*; “Aluma”, *Amaranthus spp*.; “Abadabo”, *Galinsoga parviflora*; “Yeberae-chew”, *Oxalis spp*. and “Atsefaris”, *Datura stramonium* were recorded in the pots and experimental fields. The number of weed species in each pot ranged from one in SDE to five each in LFP and LDP. There was a highly significant ($p < 0.01$) weed stand count difference between treatments. Number of weed stands in a pot ranged from one to 34. The lowest was recorded with SDE (one), which is statistically at par with RDE (three), SFE (six), RFE (eight) and LFE (nine). The highest weed stand count was registered in LFP (34) and control (31), which are statistically similar with LDP (21), SFP (23), RFP (27) and SDP (20). When different part of the plant considered, stem and root have shown similar trend than leaf. Accordingly for stem and root, dried parts have given significantly higher result than wet parts; and extracts have performed better than powders. In the case of leaf, while extracts are better than powders, dried leaf gave high response than fresh leaf only when they are extracted. Fresh aerial weight of weeds was significantly altered by different weed control treatments used. The lowest weed aerial weight was recorded with SDE (1.52 g pot^{-1}), and it was statistically not different with RDE (2.13 g pot^{-1}), SFE (4.0 g pot^{-1}), RFE (5.4 g pot^{-1}), RDP (7.5 g pot^{-1}) and LDE (8.9 g pot^{-1}). The highest aerial weight of weeds (75.24 g pot^{-1}) was obtained under LFP and was statistically similar with the

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control (66.9 g $^{-}$pot^{-1}). While dried stem of artemisia reduced fresh aerial weight of weeds by 78% than applied in its fresh state, extracts of artemisia stem reduced 93% than its powder form. In the case of roots the reduction due to dry and extract was 69% and 77% than fresh and powder, respectively. 30% reduction of aerial biomass of weed was recorded due to application of dried leaf than fresh leaf, and the reduction goes to 82.6% when extracts of leaf applied than powder leaf. Powder and aqueous extract of different parts of artemisia significantly ($p < 0.01$) affected average weed leaf area. LFP gave significantly ($P < 0.1$) higher total leaf area of weed than other treatments, even with 8.4 % increase over the control. For other treatments, reduction of weed leaf area ranged between 48% in LDP and 96% in SDE from the control. Dry parts of artemisia have 54.5% in leaf to 85.9% in stem reduction in weed leaf area compared to fresh parts. The reduction in weed leaf area due to extracts ranged from 81% in root and leaf to 82.2% in stem than powders. As opposed to the pot experiment, in the observation trial of plowed plots, the weed controlling effect was higher for fresh and powder treatments than the dry and extracts. Further detailed studies with respect to identifying important chemical components responsible for phytotoxicity other than artemisinin are required.

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REFERENCES

1. **Paudel P, Jha PK and MB Gewali** Artemisia Dubia EX Besser (Mugwort): A weed to control weed *Scientific world* 2005; **3:** 3.

2. **Singh HP, Batish DR and RK Kohli** Allelopahtic interactions and allelochemicals: New possibilities for sustainable weed management. Critical Reviews in Plant Sciences 2005; **22**: 239-311.

3. **Waller GR** Introduction- reality and future of Allelopathy. **In**: F.A. Macias, J.C.G.Galindo, H.M.G. Molinilla, H.G. Cutler (eds.): Allelopathy: Chemistry and mode of action of allelochemicals. 2004; 1-12.

4. **Uludag A, Uremis I, Arslan M and D Gozcu** Allelopathy studies in weed science in Turkey-a review. *J. Plant Dise. and Prot* 2006: 419-426.

5. **Hussain S, Siddique SU, Jamal A, Abdul Q and Z Ahmad** Allelopathic potential of senna (*Cassia angustifolia* Vahl.) on germination and seedling characters of some major cereal crops and their associated grassy weeds. National Agricultural Research Center, *Pak.J. Bot*. 2007; **39(4)**:1145-1153.

6. **Anonymous** (International Allelopathy Society). First World Congress on Allelopathy. A science for the future. Cadiz, Spain, 1996.

7. **Inderjit K and I Keating** Allelopathy: Principles, Procedures, and Promises for Biological Control. *Adv. in Agron.* 1999; **67**: 141 – 231.

8. **Sisodia S and MB Siddiqui** Allelopathic effect by aqueous extracts of different parts of *Croton bonplandianum* Baill. on some crop and weed plants. *J. Agric. Ext. Rural Dev*. 2010; **2(1)**:022 – 028.

9. **Rice EL** Allelopathy, Second ed. Academic Press Inc. Orlando FL. 1984: 422.

10. **Dakshini KMM, Foy CL and K Inderjit** Allelopathy: one component in a multifaceted approach to ecology. In: Inderjit, C.L. Foy, K.M.M. Dakshini (eds.): Principles and Practices in Plant Ecology, Allelochemical Interactions, CRC Press, 1999: 3-14.

11. **Tanveer A, Rehman A, Javaid MM, Abbas RN, Sibtain M, Ahmad AUH, Ibin-I-Zamir MS, Chaudhary KM and A Aziz** Allelopathic potential of *Euphorbia helioscopia* L. against wheat (*Triticum aestivum* L.), chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medic.). *Turk J. Agric For*. 2010; **34**: 75-81.

12. **Naseem M, Aslam M, Asnar M and M Azhar** Allelopathic effects of sunflower water extract on weed control and wheat productivity. *Pak. J. weed Sci. Res*. 2009; **15(1)**: 107-116.

13. **Assaeed AM** Allelopathic effects of *Artemisia monosperma* DEL. On germination and seedling growth of some range plant species. *Annals of Agric. Sc., Moshtohor*. 2003; **41(4)**: 1383-1395.

14. **Maggi MAE, Mangeaud A, Carpinella MC, Ferrayoli CG, Valladares GR and SM Palacios** Laboratory Evaluation of *Artemisia annua* L. Extract and Artemisinin Activity Against *Epilachna Paenulata* and *Spodoptera Eridania*. *J.Chem. Ecolo*. 2005; **31(7)**: 1527-1536.

15. **Ferreira J and J Janick** Annual wormwood (*Artemisia annua* L.) New Crop Fact SHEET. 2009: www.hort.purdue.edu/newcrop/cropfactsheets/artemisia.pdf.

16. **Ferreira JFS, Simon JE and J Janick** *Artemisia annua*: botany, horticulture, pharmacology (a review). *Horticultural Reviews* 1997; **19**: 319-371.

17. **Duke SO, Vaughn KC, Croom EM and HN Elsohly** Artemisinin, a constituent of annual wormwood (*Artemisia annua*), is a selective phytotoxin. *Weed Sci*. 1987; **35**:499-505.

18. **Chen PK, Leather G and M Polatnick** Comparative study on artemisinin, 2,4-D, and glyphosate. *J. Agr. Food Chem*. 1991; **39**:991-994.

19. **Adugna N, Zenebe M and S Kefyalew** Site characteristics of Wondo Genet Agricultural Research Center. Ethiopian Institute of Agricultural Research, Wondo Genet Agricultural Research Center 2010.

20. **Gomez KA and AA Gomez** Statistical Procedures for Agricultural Research, 2nd ed. John Wiley and Sons, 1984: 187-215.