

ALLELOPATHIC EFFECT OF DIGERA MURICATA (L.) MART. ON SEEDS OF MAIZE

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ABSTRACT

In nature, no plant is unproductive; in reality weeds are essential from the perspective of medicinal, allelopathic and food values. Weed infestation in crop fields cause loss to agriculture production. Thus, we were concentrated on allelopathic effect of a dominant weed in various crop fields i.e Digera muricata(L.) Mart. of Amaranthaceae family on “Kaveri” variety of Maize crop which is cultivating in several fields. To determine allelopathic effect on germination of selected crop aqueous leaf, stem and root extracts (0.0, 0.5, 1.0 and 5.0%) of the selected dominant weed Digera muricata was used. The present study revealed an inhibitory effect in seed germination at all concentrations of leaf, stem and root extracts. There was no effect on root growth at lower concentrations, but higher concentration (5%) was shown an inhibitory effect. Inhibitory effect on stem length was shown at all concentrations. But it was suggested to allow the growth of useful weeds for sustainable development of the country under Performance payments for environmental services (PES) schemes.

Keywords: Allelopathy, Agriculture, Inhibition effect, Sustainable development, PES scheme etc.

INTRODUCTION

Recent studies have indicated that increased weed diversity may have a positive impact on the functioning of agro-ecosystems (Albrecht, 2003; Norris & Kogan, 2005; Franke et al., 2009). Individual weed species are known to differ in their ecological function in terms of providing resources for beneficial invertebrates and seed eating birds (Hawes et al., 2003; Storkey, 2006) as well as in their obstruction to crop production (Boatman et al., 2003; Storkey & Westbury, 2007). Besides that most of the weeds are foragers and having medicinal uses. Thus, weeds are the most intriguing and immeasurable plants in the world for ecologically minded weed scientists. No plant is unproductive in nature; in reality weeds are essential from the perspective of medicinal, allelopathic and food values. Quite a number of plants considered as weeds in modern science have significant value in ethno botany.

It has been estimated that, in general, weed infestation in crop fields cause 5% loss to agriculture production in most developed countries, 10% loss in less developed countries, and 25% loss in the least developed countries. Thus, we were studied an allelopathic effect of Digera muricata (L.) Mart. of Amaranthaceae leaf extracts on seed germination, root and shoot lengths on maize.

MATERIALS & METHODS:

Selection of Crop: There were no earlier allelopathic studies on maize. So, we were selected Maize crop variety “Kaveri” for study. It is a high yielding, early mature and drought resistant variety.

Selection of a Weed: The weeds encountered in the field sites of the crop fields were carefully collected and identified. After completing the weed collection from the crop fields, the specimens were identified with the help of authentic regional floras, monographs and other relevant literature and consequently the correct names were provided to each plant. Domination of the weeds is

studied by using quadrat method. For this study 1m. X 1 m. size quadrates are laid down at random. Their number is depended on the cultivated area. This study was carried out to provide baseline information about weeds of the study area. To select the weed species for allelopathic studies, sum of total number of individuals for all species was taken into consideration.

Allelopathic Effect Study

To determine allelopathic effect of dominant weed on germination of selected crop seeds i.e. on maize, the following standard methods were used. Aqueous leaf, stem and root extracts (0.0, 0.5, 1.0 and 5.0%) of the selected dominant weed *Digera muricata* was prepared. Petri plates were taken and sown with 10 seeds of test crop and then irrigated with aqueous leaf extracts. The control plates were irrigated with distilled water. The experiment was designed as completely randomized design (C.R.D.) with three replications. The results were analyzed by standard deviation method and graphical representation was given to the germination rate, growth of root and stem on 3rd, 5th and 7th day of the experiment.

RESULTS

The dominant species was identified as *Digera muricata* (L.) Mart. of Amaranthaceae with the presence of highest Total Number of Individuals (TNI value) – 1790.

Effect by Leaf Extracts

The study revealed 100% germination of maize seeds in control. It was observed a gradual decrease in the percentage of seed germination in 0.5%, 1% and 5% concentrations of leaf extract of *D. muricata* on 3rd day, 5th day and 7th day. These results were given in figure -1.

Figure-2 was indicated the allelopathic effect of leaf extracts on growth of maize roots. It was shown no effect at 0.5% and 1% concentrations on 3rd, 5th and 7th day. There was a gradual decrease at 5% concentrations on 3rd, 5th and 7th day.

Figure-3 was indicated the allelopathic effect of leaf extracts on shoot growth of maize. There was a gradual decrease in growth on 3rd day, 5th day and 7th day at all concentrations that were taken than the control. At 5% concentration, there was a great decrease on all the three observed dates.

Effect by Stem Extracts

Figure - 4 was indicated the allelopathic effect of stem extracts on germination of maize seeds. It was observed 90% seed germination in control on the entire three observed days. 50% germination was observed in 0.5% concentration on all the three observed days. In 1% concentration 20% germination was there, whereas in 5% concentration, there was no germination on all the three observed days.

Figure - 5 was indicated the allelopathic effect of stem extracts on root growth of maize seeds. It was shown root growth in all the seeds in control on all the three observed days. In 0.5% concentration, 20% seeds were shown growth on 3rd day, and it was increased to 25 % on 5th and 7th day. In 1% concentration, 5% seeds were shown growth on 3rd day and was increased to 8 to 10% on 5th and 7th days. In 5% concentration, there was no root growth on all the three days.

Figure – 6 was indicated the allelopathic effect of stem extracts on shoot growth of maize seeds. It was observed shoot growth in all the seeds on all the three days in control. In 0.5% concentration, 20% seeds were shown shoot growth on all the three observed days. In 1% concentration, no growth was observed on 3rd day, whereas on 5th and 7th day, 5% seeds were shown shoot growth. In 5% concentrations no shoot growth was observed on all the three observed days.

Effect by Root Extracts

Figure - 7 was indicated the allelopathic effect of root extracts on germination of maize seeds. It was shown 98% germination in controls on all three tested days. At 0.5% and 1% concentrations on 3rd day, 5th day and 7th day 50% and 10% germination was observed, and there was no germination at 5% concentration on all three observed days.

Figure - 8 was indicated the allelopathic effect of root extracts on root growth of maize seeds. It was shown 30% root growth at 0.5% concentration, and 10% growth at 1% concentration. And no root growth at 5% concentration on all the three observed days.

Figure – 9 was indicated the allelopathic effect of root extracts on shoot growth of maize seeds. It was shown 18% shoot growth at 0.5% concentration on 3rd day and 22% shoot growth at 1% concentration on 5th and 7th days. There was no shoot growth at 5% concentration on all the three days.

Figure 1: Allelopathic effect of leaf extracts on seed germination of maize

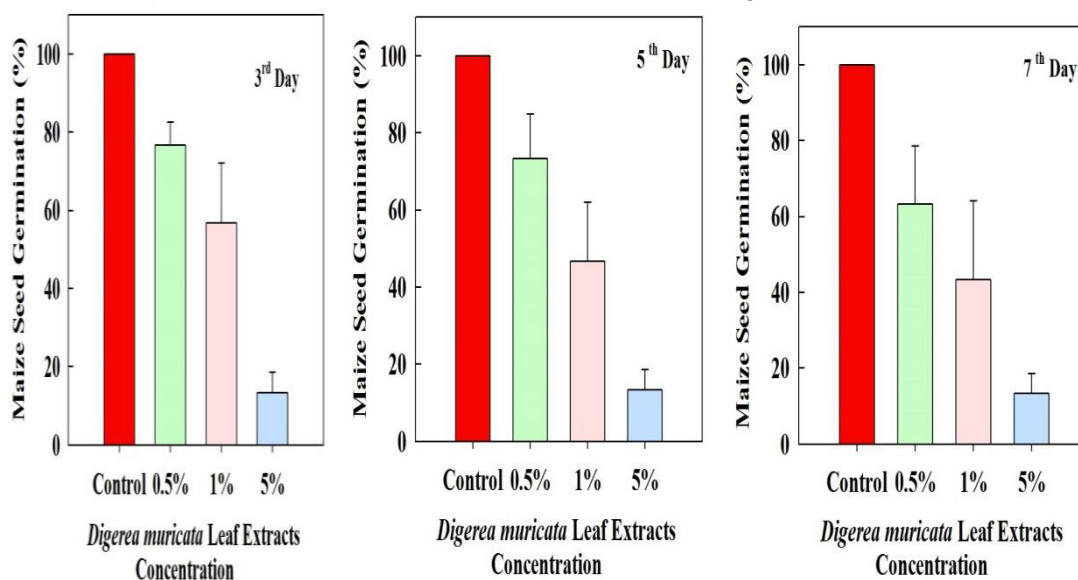


Figure-2: Allelopathic effect of leaf extracts on maize root growth

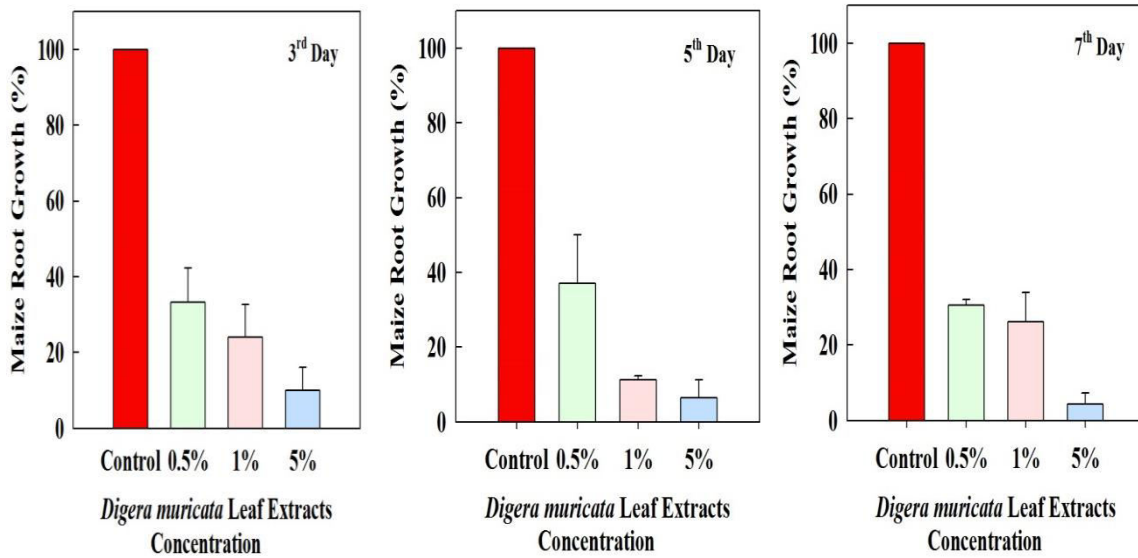


Figure – 3: Allelopathic effect of leaf extract on shoot growth of Maize crop

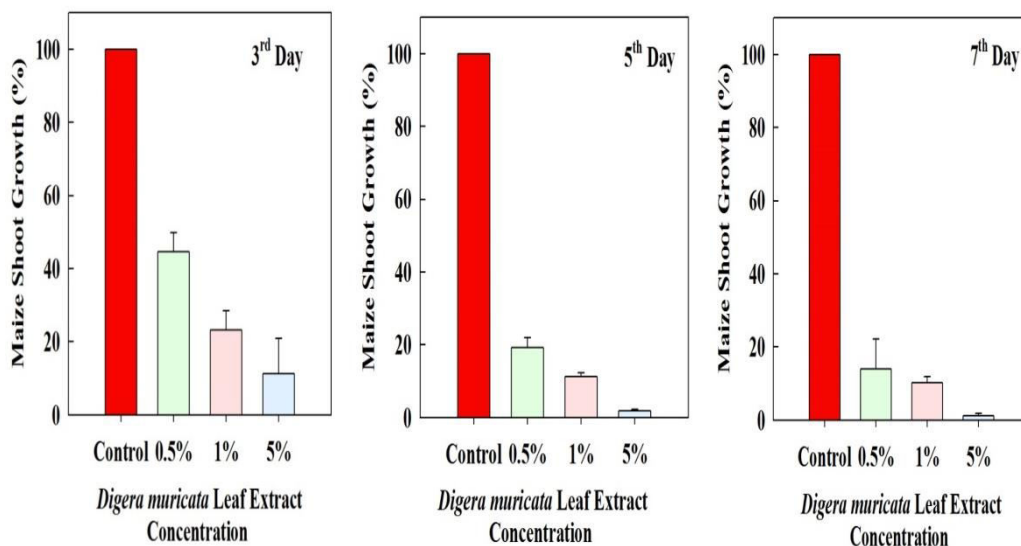


Figure -4: Allelopathic effect of stem extracts on seed germination of Maize

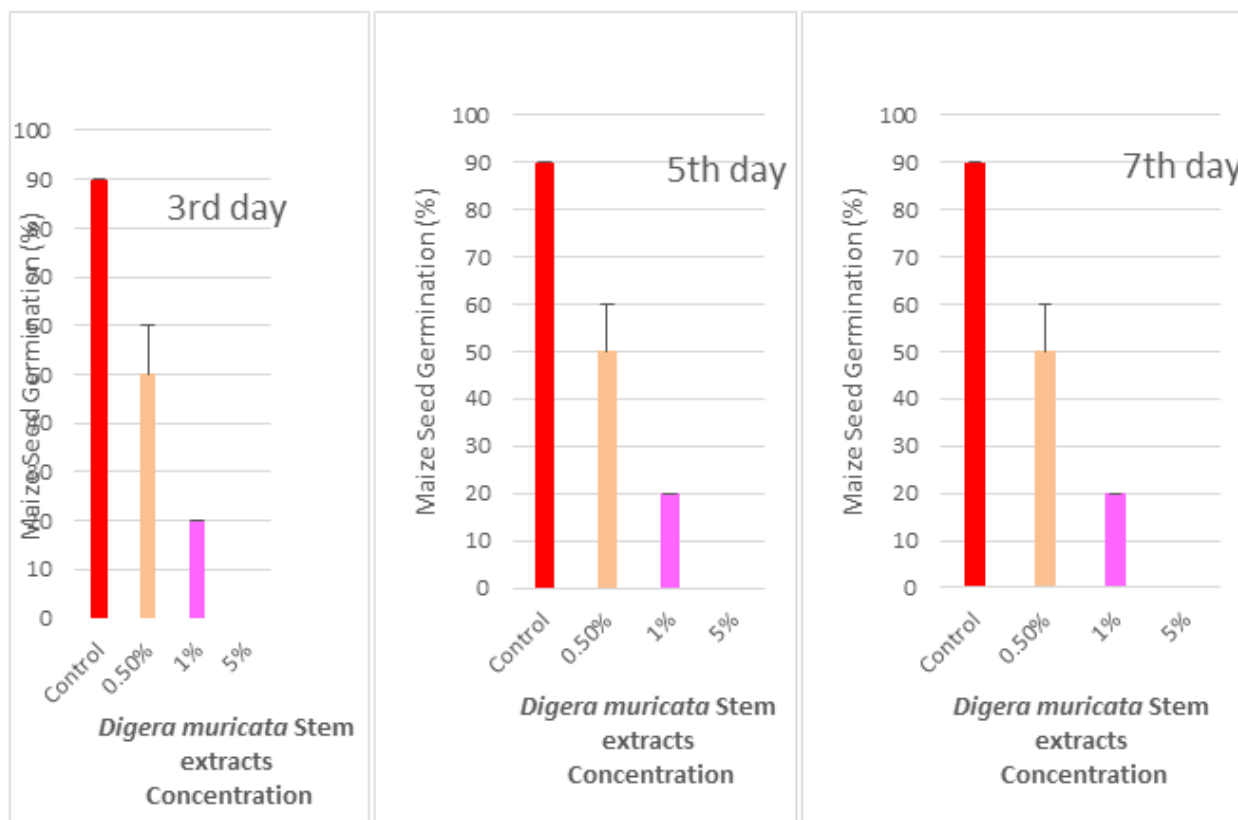


Figure -5: Allelopathic effect of Stem extracts on Root Growth of Maize

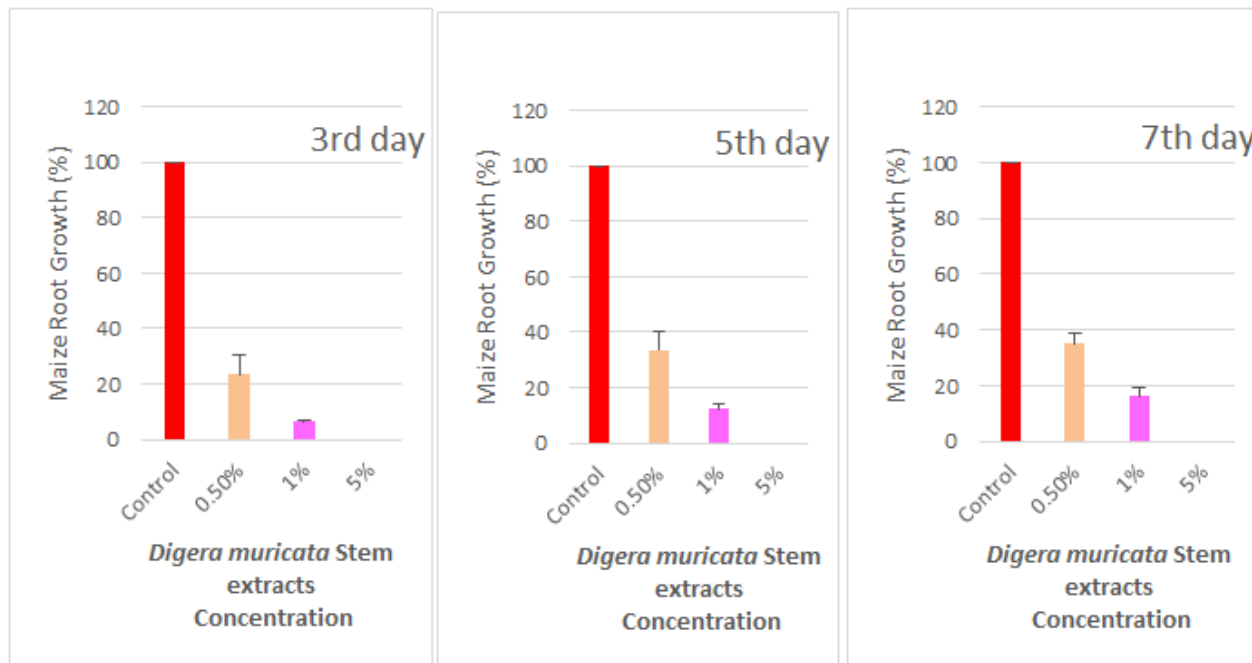


Figure -6: Allelopathic effect of Stem extracts on Shoot Growth of Maize

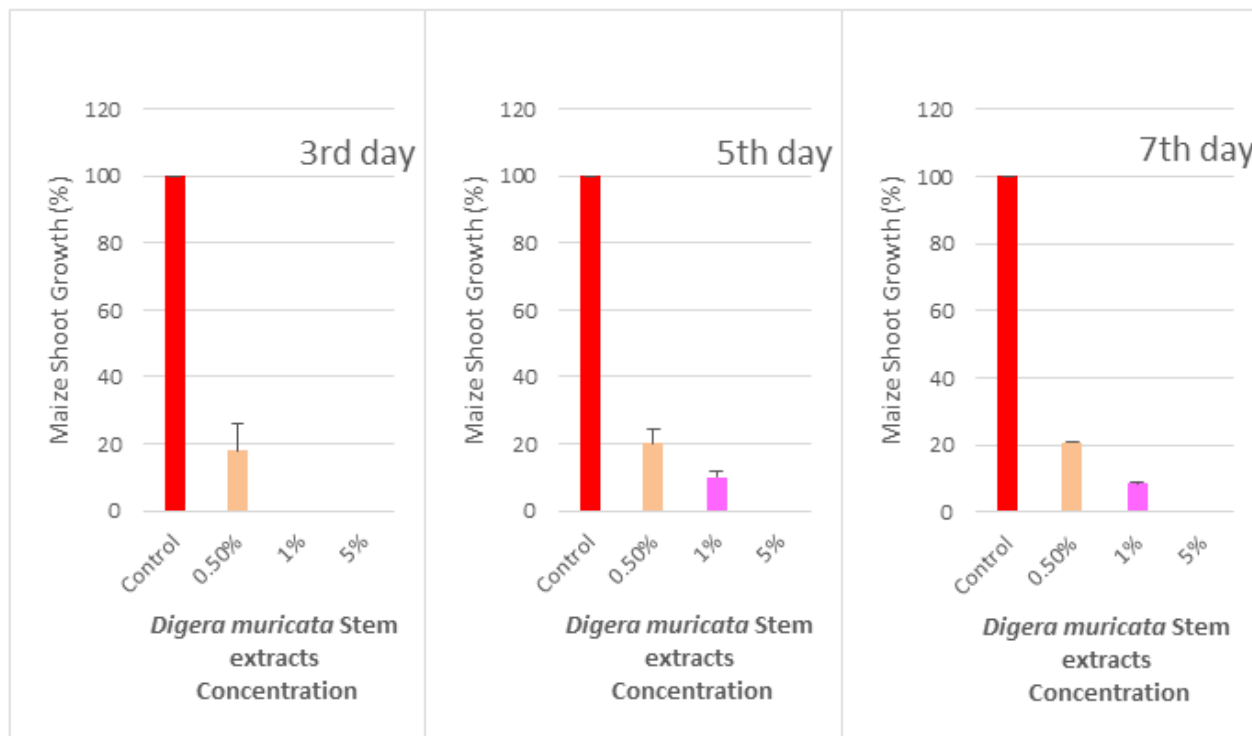


Figure -7: Allelopathic effect of Root extracts on seed germination of Maize

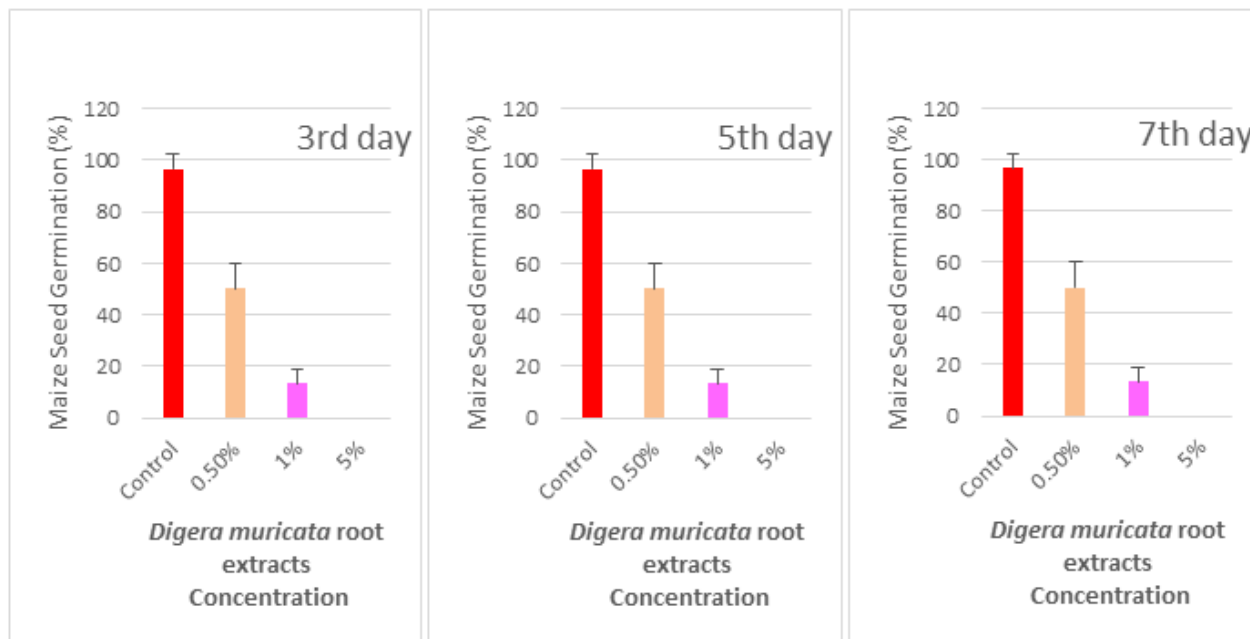


Figure -8: Allelopathic effect of Root extracts on Root Growth of Maize

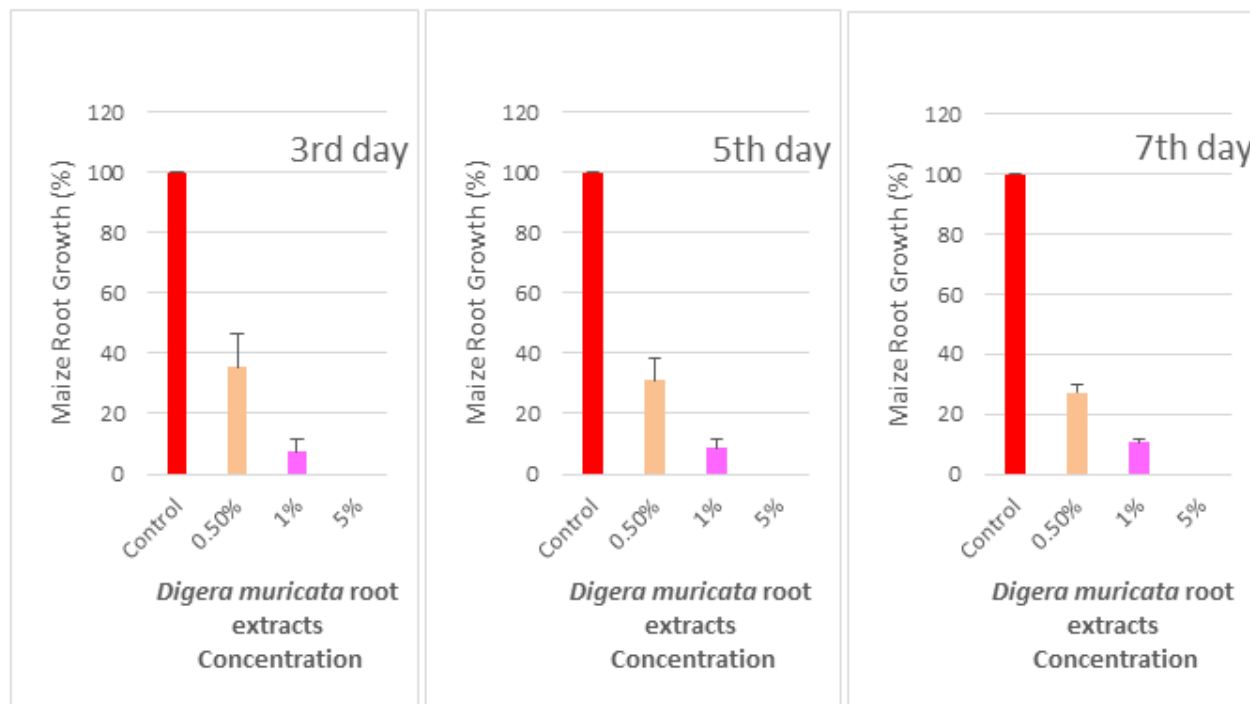
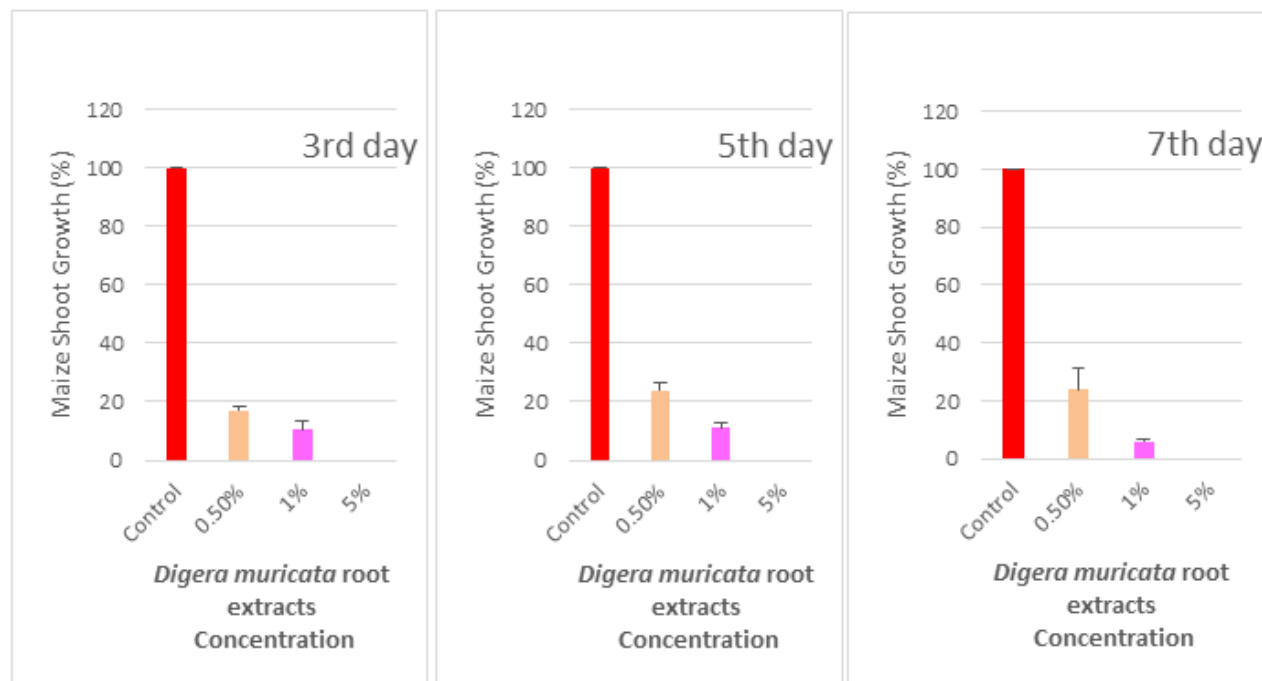


Figure -9: Allelopathic effect of Root extracts on Shoot Growth of Maize

DISCUSSION

Allelopathy means “mutual harm” is one of the valuable biological devices to understand the crop weed interaction. They often affect germination dynamics and growth of crop (Kadioglu et al., 2005). The term „Allelopathy” was explained by Rice (1984) as “any direct or indirect harmful or

beneficial effect by one plant on another through production of chemical compounds that escape into the environment.” Allelochemicals are produced by plants as end products, byproducts and metabolites and are contained in the stem, leaves, roots, flowers, inflorescence, fruits and seeds of the plants. But foliar leachates have been considered to be most phyto toxic in nature. It is due to greater metabolic activity of production of more metabolites (Xuan et al. 2004). Inderjit (1996) described the allelochemicals as water soluble secondary metabolites that produced at a mature stage of the plants as a defense mechanism. Alam & Islam (2002) said that they inhibits the growth of the newly emerges, propagules and young plants. Generally plants get in touch with the allelochemicals in soil (Patrick and Koch, 1958; Einhelling and Eckrich, 1984). Allelopathic effects may be species specific and their influence can be positive (stimulatory) or negative (inhibitory) (Mc Ewan et al. 2010).

There were no earlier allelopathic studies on maize. The present study revealed an inhibitory effect in seed germination at all concentrations of leaf, stem and root extracts of *D.muricata*. There was no effect on root growth at lower concentrations, but higher concentration (5%) was shown an inhibitory effect on root growth. Inhibitory effect on stem length was shown at all concentrations. Totally the effect was very less (19.24%) on maize seeds.

CONCLUSION

Weeds are managing the complexity of interacting trophic levels within and around the crop fields. Naeem Khan et al. (2013) were studied on nutritional composition of *D.muricata* and reported the presence of ash content as – 18.14%, Crude protein content as – 8.75% , Crude Lipid content as – 5.0%, Crude fiber content as – 41%, Carbohydrate content as – 13.31%, energy – 140 k.cal. / 100 g., Vitamin B2. as – 2.04mg./100g. Due to presence of sufficient nutrients these leaves are recommended as a good source in diet. Thus, it was suggested to the

government authorities to provide some economic incentives to the farmers to recover the loss caused due to allelopathic effect of weeds on certain crops in Performance payments for environmental services (PES) schemes to allow the growth of useful weeds for sustainable development of the country.

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