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Short Communication

Control of Cabbage Aphid *Brevicoryne brassicae* (Homoptera: Aphididae) through Allelopathic Water Extracts

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Abstract. Laboratory experiments were conducted to evaluate the effect of sorghum, sunflower, brassica and mulberry water extracts on mortality of cabbage aphid *Brevicoryne brassicae* (L.) (Homoptera: Aphididae) which damages the canola crop. The aphids were collected from canola field and applied with different concentrations of allelopathic water extracts or their combinations under laboratory conditions. Allelopathic water extracts of crops such as sorghum, brassica, sorghum + mulberry, sorghum + sunflower and sunflower alone were effective in controlling the aphid. The higher concentrations of these extracts (8 or 16%) were most effective in controlling aphid (>50%) at 24 h after application.

Keywords: allelopathy, cabbage aphid, control, water extracts

Canola (*Brassica napus* L.) crop is among the important sources of edible oil in Pakistan. (Naeem *et al.,* 2013; Khan *et al.,* 2012). Canola crop is damaged by different kinds of pests including weeds, insect pests and disease pathogens (McNairn *et al.,* 2014; Saeed and Razaq, 2014; Jabran *et al.,* 2010a; 2008), and cabbage aphid (*Brevicoryne brassicae*) is one of these pests (Saeed and Razaq, 2014; Razaq *et al.,* 2012). This insect feeds on upper parts of stem, leaves and reproductive structures to disturb seed set and pod filling in conola. Insect pest infestation can reduce canola yield by more than 30% (Brown *et al.,* 1999).

Application of insecticides is one way to control cabbage aphid in canola (Amer *et al.,* 2010; Lashkari *et al.,* 2007). However, aphid has evolved resistance against several insecticides in Pakistan and other parts of the world (Edwards *et al.,* 2008; Ahmad and Aslam, 2005). Also, sometimes the insecticides fail to fully control cabbage aphid in canola (Razaq *et al.,* 2014) and residues of applied insecticide may be included in food chain and badly affect the human health (Schecter *et al.,* 2010). The allelopathic potential of different plants as sorghum, sunflower, brassica, and mulberry has been reported in various studies (Jabran *et al.,* 2015; Jabran and Farooq, 2013) that can be sprayed just like insecticides (Farooq *et al.,* 2011).

The present studies were conducted with the objective to find out the effect of allelopathic water extracts from sorghum, sunflower, brassica and mulberry on mortality of cabbage aphid which severely damages canola crop in Pakistan.

Five laboratory experiments were conducted at the toxicology laboratory of Entomological Research Institute, Faisalabad, Pakistan. All the experiments were done with randomized complete block design using eight replications.

Crop herbage (sorghum, sunflower, and brassica) was harvested at maturity; mulberry leaves were collected from the mulberry tree, dried under shade and then chopped into 2 cm pieces with the help of fodder cutter. These chopped materials were used to prepare allelopathic water extracts according to methods suggested by Jabran *et al.* (2010a) and Farooq *et al.* (2008). This chopped material was soaked in the distilled water in a tub with a ratio of 1:10 (w/v) for 24 h. Water extracts were collected by passing through sieves (10 and 80 mesh). The filtrate was boiled at 100 °C for reducing the volume by 20 times. The concentrated extract was stored at room temperature and then used. The percentage of different allelopathic water extracts or their combinations used in these studies have been summarized in Table 1.

Aphids, *Brevicoryne brassicae* L. (Homoptera: Aphididae) and canola leaves were collected from canola crop grown at the Oilseed Research Area of Ayub Agricultural Research Institute, Faisalabad, Pakistan. Leaves were cut with the help of iron cutter and fitted

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Table 1: Concentrations of different water extracts used in these studies

Study-I Sorghum	Study-II Brassica	Study-III Sorghum +mulberry	Study-IV Sorghum +sunflower	Study-V Sunflower
Control	Control	Control	Control	Control
SWE-0.25%	BWE-0.25%	SOR+MUL-1%	SOR+SUN-1%	SNFWE-1%
SWE-0.5%	BWE-0.5%	SOR+MUL-2%	SOR+SUN-2%	SNFWE-2%
SWE-1%	BWE-1%	SOR+MUL-4%	SOR+SUN-4%	SNFWE-4%
SWE-2%	BWE-2%	SOR+MUL-8%	SOR+SUN-8%	SNFWE-8%
SWE-4%	BWE-4%	SOR+MUL-16%	SOR+SUN-S 16%	N F W E - 16%
SWE-6%	BWE-6%	-	-	-
SWE-8%	BWE-8%	-	-	-

SWE = Sorghum water extract; BWE = Brassica water extract; SOR+MUL = Sorghum + mulberry water extracts; SOR + SUN = Sorghum + sunflower water extracts; SNFWE = Sunflower water extract.

in plastic petri plates having a diameter of 8 cm. Leaf dip method was used to treat the plant leaves with allelopathic water extracts. Canola leaves were dipped in the respective solutions for a period of 10 sec, allowed to dry under air pressured drier, and fitted in the petri plates. All petri plates were labelled for its replication number and treatment. The leaves in control were dipped in distilled water for 10 sec. Forty aphids were dropped in eight petri plates (five in each petri plate) and allowed to feed on canola leaves for 24 h. The dead and alive aphids were counted after treatment of 24 h .

Percent mortalities in each treatment were calculated after adjusting control mortality according to Abbott (1925). Mean mortality (%) and standard errors were calculated for each treatment using Microsoft Excel Programme. The aphid mortality caused by allelopathic water extracts was presented in the form of bar graphs fitted with vertical standard error bars. Further, the data was subjected to analysis of variance test (ANOVA) using IBM SPSS Statistics 20.0 (Field, 2013). The difference among the means was calculated using Duncan's Multiple Range Test. The bar graphs were fitted with the lettering of respective treatments.

All allelopathic water extracts investigated in our studies had a significant effect on aphid mortality (Table 2). Sorghum water extract (8% concentration) caused the highest aphid mortality (63%) followed by 6% concentration of this allelopathic extract (Fig. 1). The sorghum water extracts with lower concentrations (0.25-0.5%) had the statistically same aphid mortality as noted for control while, sorghum water extracts (1-4% concentrations) caused an aphid mortality at par with 6% concentration as well as control (Fig. 1). Brassica water extracts (8, 6 and 2% concentrations) had caused highest aphid mortality (25-30%) (Fig. 1). Brassica

Table 2: Analysis of variance (p values) for indicating significance of various allelopathic water extracts on aphid mortality

	Study-I Sorghum	Study-II Brassica	Study-III Sorghum +mulberry	Study-IV Sorghum+ sunflower	Study-V Sunflower
Treat-ment	0.0001	0.002	0.0001	0.0001	0.0001

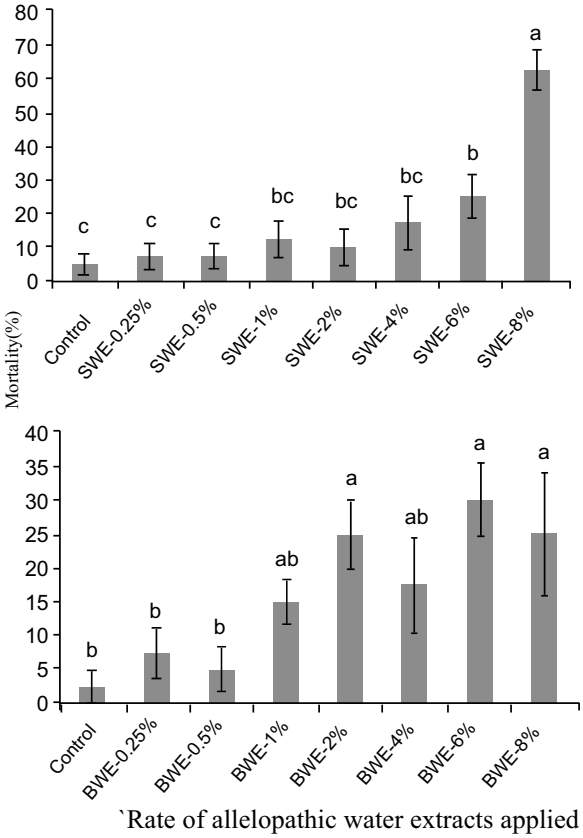

Fig. 1. Effect of sorghum and brassica alleopathic water extracts aphid mortality. SWE = Sorghum water extracts; BWE = Brassica water extracts; Bars not haring a letter in common differ significantly at $p \leq 0.01$.

water extracts (0.25 and 0.5% concentrations) had aphid mortality statistically similar with control (Fig. 1). A combination of sorghum + mulberry water extracts with 16% concentration showed highest aphid mortality compared with control and other water extract concentrations (Fig. 2). A combination of sorghum + sunflower water extract with 16% concentration resulted the highest aphid mortality followed by 8% and 4% concentrations of the same combinations (Fig. 2). For sunflower water extract, the concentrations of 16% caused significantly higher mortality over control and other treatments (Fig. 3).

The results of our studies indicated that allelopathic water extracts caused a considerable mortality (>50%) in cabbage aphid populations at 24 h after application.

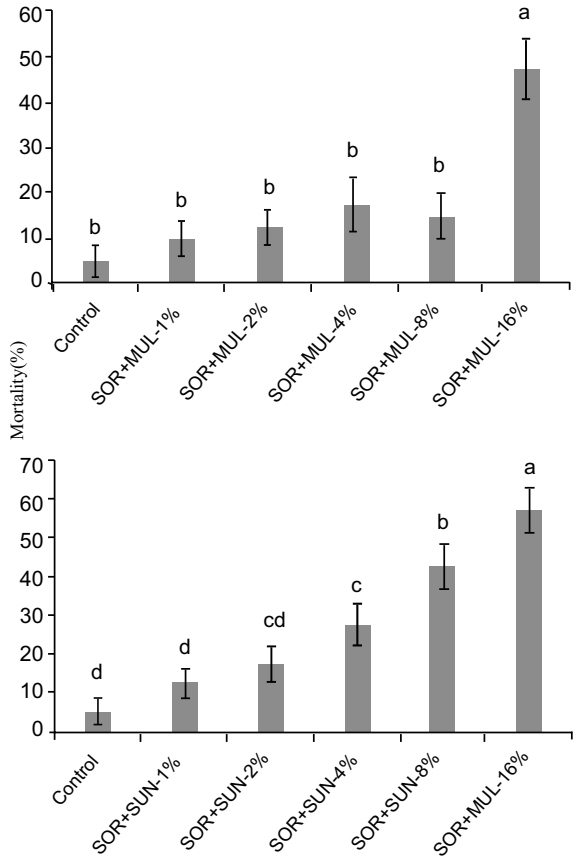

Fig. 2. Effect of sorghum + mulberry, and sorghum + sunflower allelopathic water extracts on mortality of aphid. SOR+MUL = Sorghum + mulberry water extracts; SOR+SUN = Sorghum + sunflower water extracts; Bars not sharing a letter in common differ significantly at $p \leq 0.01$.

This implies that chemicals from natural source can be applied to control cabbage aphid. This will help to avoid the addition of hazardous insecticide residues in canola oil.

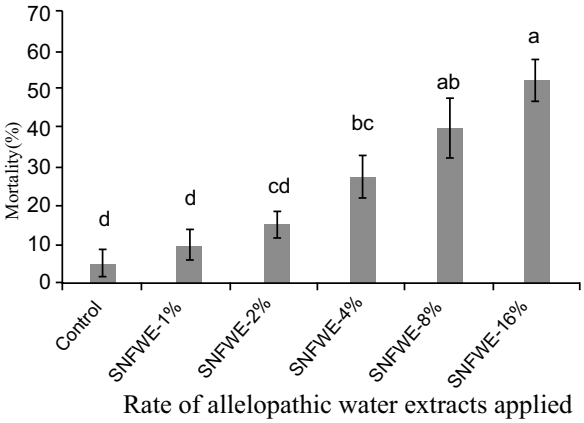

Fig. 3. Effect of sunflower allelopathic water extracts on mortality of aphid. SNFWE = Sunflower water extracts; Bars not sharing a letter in common differ significantly at $p \leq 0.01$.

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