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## **Efficacy of plant leaf extracts against mustard aphid *Lipaphis erysimi* (Kalt.) under field condition**

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### **ABSTRACT**

The bio-efficacy of five plant leaf extracts were tested in Morang-2 variety of Rapeseed against Mustard aphid (*Lipaphis erysimi* Kalt.) during November to March, 2016/17 at research field of Institute of Agriculture and Animal Science (IAAS), Lamjung Campus, Lamjung, Nepal. The plant leaf extracts were prepared by decomposing chopped leaves of Neem, Bakaino, Hattibar, Khirro, and Bojho in cow urine for one month period. Total five extracts were prepared, one by mixing all the leaf while remaining four extracts were prepared excluding one ingredient in each mixture but keeping Tobacco and Bojho in all five extracts. The experiment was laid out in Randomized Completely Block Design using five botanical extracts, chemical (Cypermethrin 10% EC) and control which were replicated thrice. The Rapeseed plant was sprayed with prepared extracts at 30 days after sowing (DAS), 45 DAS and 60 DAS and aphid number counted after 5, 10 and 15 days of each spray from 10 cm apical shoot. The greatest reduction of aphid population was found in chemical followed by complete mixture treated plots but their reduction was not statistically different. While control and plant extracts of without Neem treated plots had resulted less reduction in the number of aphid. Grain yield was also found highest (1436.75 kg/ha) in complete mixture treated plots indicating complete mixture of plant extracts might be the best alternative for aphid management in Rapeseed. It is concluded that all the plant extracts showed insecticidal properties against aphid in rapeseed crop and successfully be integrated, as a part of Integrated Pest Management.

**Keywords:** Efficacy, Cypermethrin, Mustard aphid, Plant extracts and Rapeseed, *Lipaphis erysimi*

## 1. INTRODUCTION

Rapeseed (*Brassica campestris* L. var. *tori*; Family: Brassicaceae) is the best oilseed crop and has the highest acreage among all the oilseed crops grown in the country i.e.85% (Ghimire *et al.*, 2000). In Nepal, the total area under Rapeseed cultivation is 173254 ha, its production is 152263 mt and productivity is 879 kg/ha. Many oilseeds crops are grown in Nepal, among them Rapeseed is the main one and supplies almost 80% of vegetables oil in Nepalese diet (Dhakai, 1985-1991). In spite of the importance of oilseed crops, the average productivity (0.87 t/ha) in Nepal is low as compared to that of the world of 1.28 t/ha. Among many factors responsible for low yield, the insect pests play a significant role in reducing the yield and this crop is attacked by about 25 species of insect pests resulting in both quantitative and qualitative losses varying from 45-50% (Pradhan *et al.*, 1960). Among them Mustard aphid is the most destructive insect pest (Biswas *et al.*, 2000). The yield losses of 27-69% due to attack of aphid (Bakhetia and Brar, 1983) and 15% reduction in it's oil content (Verma and Singh, 1987).

Chemical insecticides still remain the key tool for the control of this pest. Farmers spray insecticides in their fields indiscriminately which causes phytotoxicity, resistancy in pest, destruction of beneficial organisms, disruption of agro-ecosystem, human health hazards and environmental pollution (McIntyre *et al.*, 1989). With several investigations, application traditional organic insecticides recommended as the best alternative to control Mustard aphid (Bakhetia, 1984 and Khurana *et al.*, 1989). Botanicals are comparatively less toxic, less expensive, and also safe for beneficial organisms. Among 2400 species of Bio-active plants in world, almost 324 are found in Nepal. These abundant naturally occurring biologically active plants appear to have a prominent role for the development of future commercial pesticide in Nepal, not only for increased productivity but for the safety to the environment and public health.

Therefore, present investigation was undertaken in this direction for assaying the insecticidal properties of different plant leaf extracts against mustard aphid.

## 2. MATERIALS AND METHOD

The experiment was conducted at horticultural farm of Institute of Agriculture and Animal Science (IAAS), Lamjung campus (mid-hills) during the winter season 2016/17. Seeds of Rapeseed variety Morang-2 were sown on 21<sup>st</sup> November in 2m×2.1m size plots following RCB design with 7 treatments and 3 replications.

### 2. 1. Preparation of extract

The leaves of Neem (*Azadiractin indica*), Bakaino (*Melia azedirach*), Hattibar (*Agave americana*), Khirro (*Sapium insigne*), Bojho (*Acorus calamus*), and Tobacco (*Nicotiana tabaccum*) were chopped separately of 1-2 cm long. These chopped leaves of Neem, Bakaino, Hattibar, Khirro @ 150 g while Bojho and Tobacco leaf @ 75g were used for preparation of extracts in fresh cow urine (3 liter in each extract). Total five extracts were prepared, one by mixing all the leaf while remaining four extracts were prepared excluding one ingredient in each mixture but keeping Tobacco and Bojho in all five extracts. The prepared extracts were decomposed for 1 month period by mixing it once in each week.

## 2. 2. Treatment details

**Table 1.** Details of Treatments applied in the experiment

Treatment	Treatment Name
T1	Mixture of All plant's leaves Extract (Neem, Bakaino, Hattibar and Khirro) (Water Extract)
T2	Mixture of All plant's leaves Extract without Neem (Water extract)
T3	Mixture of All plant's leaves Extract without Bakaino (Water extract)
T4	Mixture of All plant's leaves Extract without Hattibar (Water extract)
T5	Mixture of All plant's leaves Extract without Khirro (Water extract)
T6	Chemical i.e. Cypermethrin 10% EC
T7	Control

## 2. 3. Field preparation and crop management

Field was prepared by ploughing, disking and leveling and seeds were sown in each plot with spacing of 30 cm RR and 10 cm PP. All the crop management practices were followed as recommended by MOAD.

## 2. 4. Preparation of spray

The well decomposed plant extract was filtered with muslin cloth and then mixed the filtrate with water at 1:4 ration while Cypermethrin 10% EC @ 1.5 ml/liter of water and then sprayed with the help of hand sprayer (2 lit capacity) at 15 days interval after 1 month (30 days) of sowing for three times i.e. 30DAS, 45DAS and 60DAS. The spray was prepared as below;

- 1<sup>st</sup> Spray (30 DAS):1200 ml water and 300 ml plant leaf extract
- 2<sup>nd</sup> Spray (45 DAS):1600 ml water and 400 ml plant leaf extract
- 3<sup>rd</sup> Spray (60 DAS):2000 ml water and 500 ml plant leaf extract

Similarly, Chemical i.e. Cypermethrin was prepared as below;

- 1<sup>st</sup> Spray (30 DAS):1.5 ml chemical/ 1 liter of water
- 2<sup>nd</sup> Spray (45 DAS): 3 ml chemical / 2 liter water
- 3<sup>rd</sup> Spray (60 DAS):4 ml chemical/2.5 liter water

2. 5. Observations

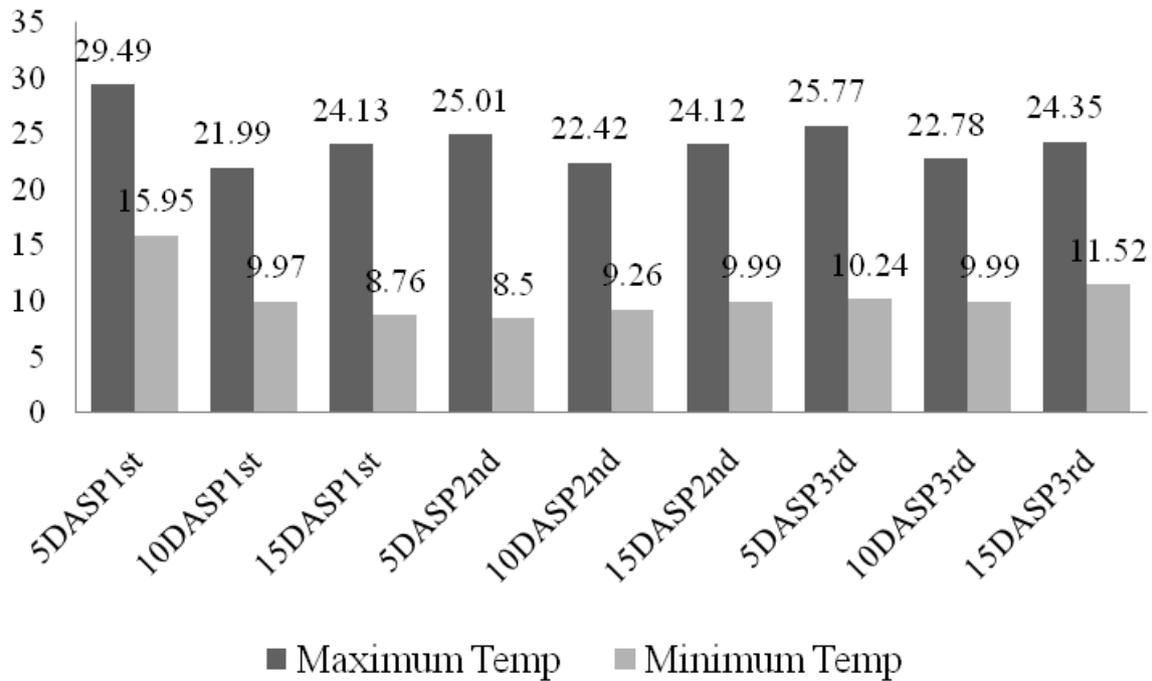


Figure 1. Maximum and Minimum temperature (°C) at different spraying of leaf extracts

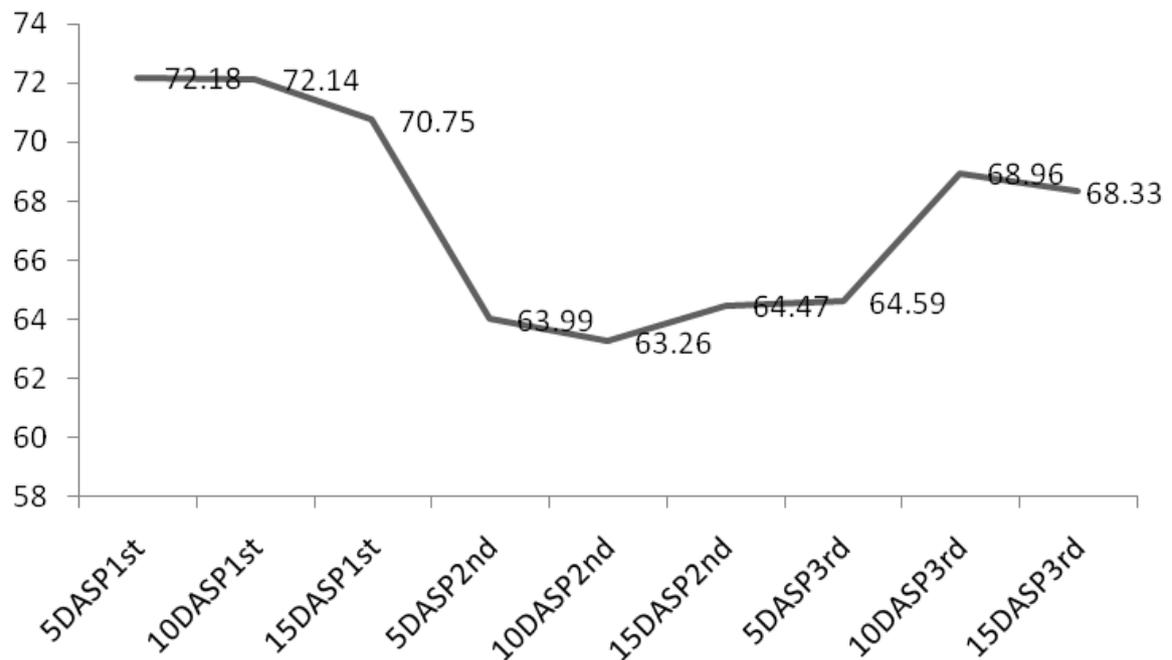
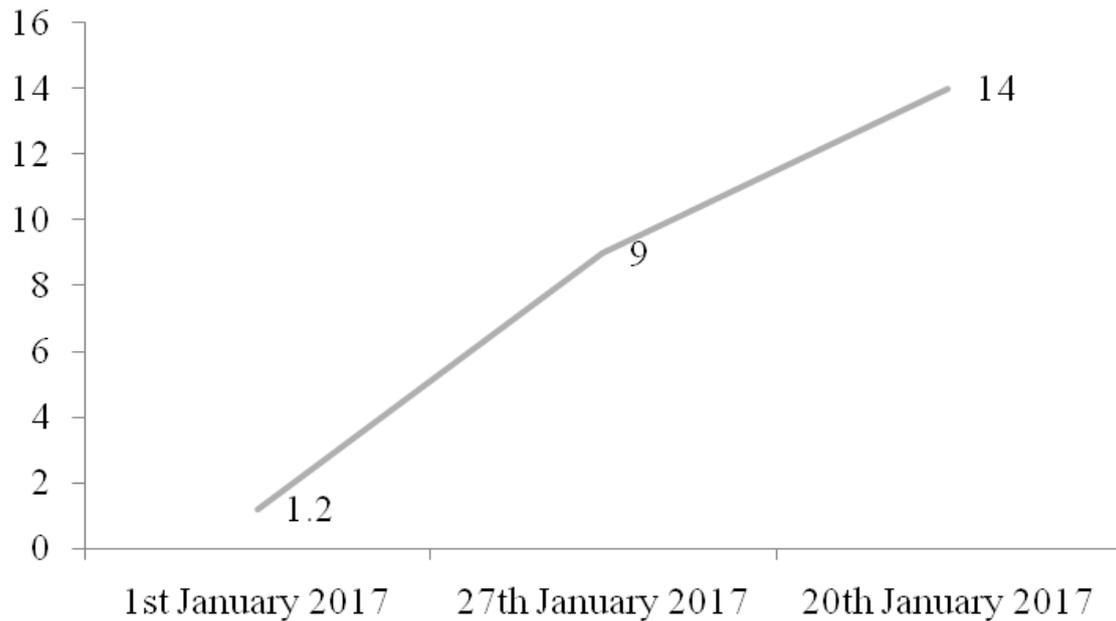


Figure 2. Relative Humidity (%) at different spraying of leaf extracts.

The population of Mustard aphid was observed and recorded at 5<sup>th</sup>, 10<sup>th</sup> and 15<sup>th</sup> days of each spray from 10 cm apical twig (centre branch) of randomly selected 5 plants of each plot. The data on weather variables such as temperature, RH % and rainfall from sowing to harvesting were also taken by installing respective devices on research site. All the observed data were subjected to ANOVA using IBM SPSS windows version 20 and GEN STAT 15ED.



**Figure 3.** Rainfall (mm) at different spraying of leaf extracts

### 3. RESULTS AND DISCUSSION

#### 3. 1. Effect of Plant extracts on reduction of aphid after first spray

**Table 2.** Reduction of Aphid number after first spray

Treatments	Mean no. of aphid/plant (10 cm apical shoot)		
	5DASp	10DASp	15DASp
Complete Mixture	1.60 <sup>ab</sup>	1.73 <sup>ab</sup>	1.20 <sup>a</sup>
W/O Neem	4.67 <sup>ab</sup>	7.20 <sup>b</sup>	10.67 <sup>bc</sup>
W/O Bakaino	4.53 <sup>ab</sup>	6.00 <sup>ab</sup>	5.13 <sup>ab</sup>
W/O Hattibar	3.53 <sup>ab</sup>	4.53 <sup>ab</sup>	3.87 <sup>ab</sup>

W/O Khirro	2.47 <sup>ab</sup>	3.53 <sup>ab</sup>	2.73 <sup>ab</sup>
Chemical	0.00 <sup>a</sup>	0.20 <sup>a</sup>	0.07 <sup>a</sup>
Control	9.27 <sup>b</sup>	14.27 <sup>c</sup>	14.87 <sup>c</sup>
Grand Mean	3.72	5.35	5.5
F test	*	**	**
SEM ±	1.58	1.26	1.6
LSD (p = 0.05)	4.87	3.87	4.94
CV (%)	73.6	40.7	50.5

DASp: Days after spraying, W/O: without

During first spray, chemical treated plot was found to be almost free from attack of mustard aphid while control plot showed highest incidence of aphid in all readings. Among plant extracts, Complete mixture reduces aphid statically same as chemical. Biswas (2013) was also found that chemical treated plot has minimum number of aphid than locally prepared plant extracts and control treatments.

### 3. 2. Effect of Plant extracts on reduction of aphid after second spray

**Table 3.** Reduction of Aphid number after second spray

Treatments	Mean no. of aphid /plant(10 cm apical shoot)		
	5DASp	10DASp	15DASp
Complete Mixture	0.20 <sup>a</sup>	0.66 <sup>a</sup>	0.20 <sup>a</sup>
W/O Neem	4.80 <sup>b</sup>	9.47 <sup>b</sup>	9.66 <sup>b</sup>
W/O Bakaino	3.60 <sup>ab</sup>	4.33 <sup>ab</sup>	5.20 <sup>ab</sup>
W/O Hattibar	1.73 <sup>ab</sup>	2.53 <sup>a</sup>	3.73 <sup>a</sup>
W/O Khirro	0.80 <sup>a</sup>	1.67 <sup>a</sup>	1.13 <sup>a</sup>
Chemical	0.07 <sup>a</sup>	0.67 <sup>a</sup>	0.00 <sup>a</sup>
Control	9.87 <sup>c</sup>	18.47 <sup>c</sup>	18.00 <sup>c</sup>

Grand Mean	3.01	5.31	5.42
F test	**	**	**
SEM ±	0.80	1.09	1.10
LSD (p = 0.05)	2.48	3.35	3.40
CV (%)	46.5	35.5	35.3

DASp: Days after spraying, W/O: without

During Second Spray, all together of aphid count in each treatment increases as compare to previous spray reading. The trend of aphid incidence was the same which reflects that complete mixture can better control mustard aphid than other selected extracts. Along with this, it was also analyzed that effectiveness of plant extracts decreased with passing time of spray which can be justified by increased in aphid count from 5 DASp to 15 DASp. Bhatt and GC (2005) also reported that effectiveness of botanicals to reduce aphid population was significantly higher until 5 days of spray and decreases gradually after that. Kafle (2015) also found that the effectiveness of insecticides decreased with increasing time of spray.

### 3. 3. Effect of Plant extracts on reduction of aphid after third spray

**Table 4.** Reduction of Aphid number after third spray

Treatments	Mean no. of aphid /plant(10 cm apical shoot)		
	5DASp	10DASp	15DASp
Complete Mixture	0.13 <sup>ab</sup>	0.13 <sup>a</sup>	0.20 <sup>a</sup>
W/O Neem	4.40 <sup>bc</sup>	5.93 <sup>bc</sup>	4.20 <sup>b</sup>
W/O Bakaino	2.60 <sup>ab</sup>	1.8 <sup>ab</sup>	2.66 <sup>ab</sup>
W/O Hattibar	0.53 <sup>ab</sup>	1.13 <sup>ab</sup>	1.60 <sup>ab</sup>
W/O Khirro	0.00 <sup>a</sup>	0.46 <sup>a</sup>	0.06 <sup>ab</sup>
Chemical	0.00 <sup>a</sup>	0.00 <sup>a</sup>	0.00 <sup>a</sup>
Control	7.80 <sup>c</sup>	7.80 <sup>c</sup>	8.20 <sup>c</sup>
Grand Mean	2.21	2.47	2.56

F test	**	**	**
SEM ±	0.86	1.10	0.64
LSD(p = 0.05)	2.67	3.39	1.99
CV (%)	68	77.4	43.7

DASp: Days after spraying, W/O: without

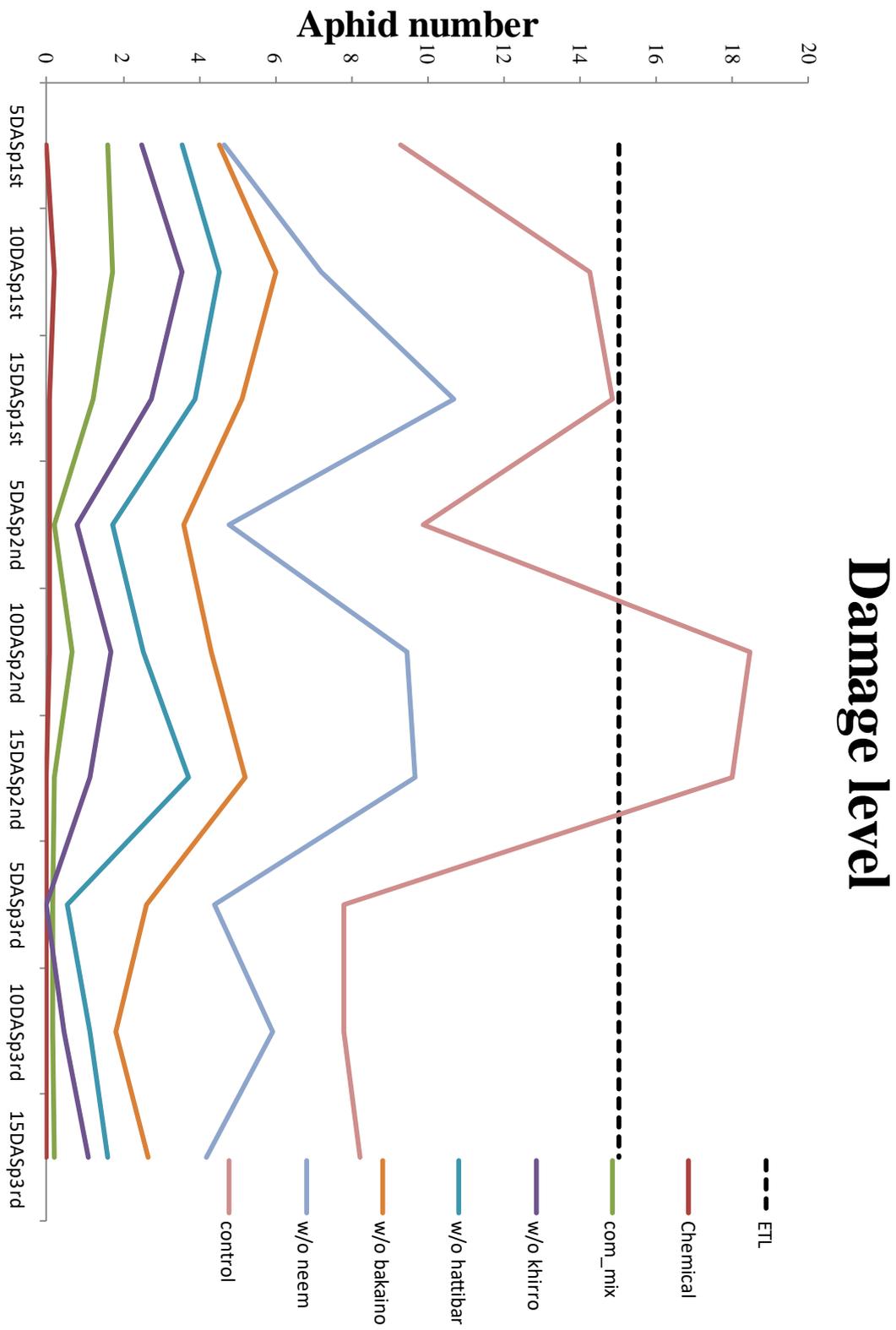
During third spray also chemical and complete mixture resulted maximum aphid reduction than other treatments and had statically similar effect while W/O Neem and control treated plots showed least effectiveness, remaining other extracts had statically similar effect. The result revealed that excluding Neem from the extract mixture (i.e. W/O Neem), effect was same as the control which signifies that Neem in mixture must be needed for effective result. Saikia *et al.* (2000) also reported that leaf extract of Neem in the plant extracts caused significant mortality of aphid which results almost same effect as chemical. Sable *et al.*, (2014) found that chemical was highly effective with knockdown effect in controlling aphid followed by Neem and its mixture. The earlier works on the use of plant extracts has been also concluded same result by Pandey *et al.* (1987).

### 3. 4. Damage level of Aphid infestation

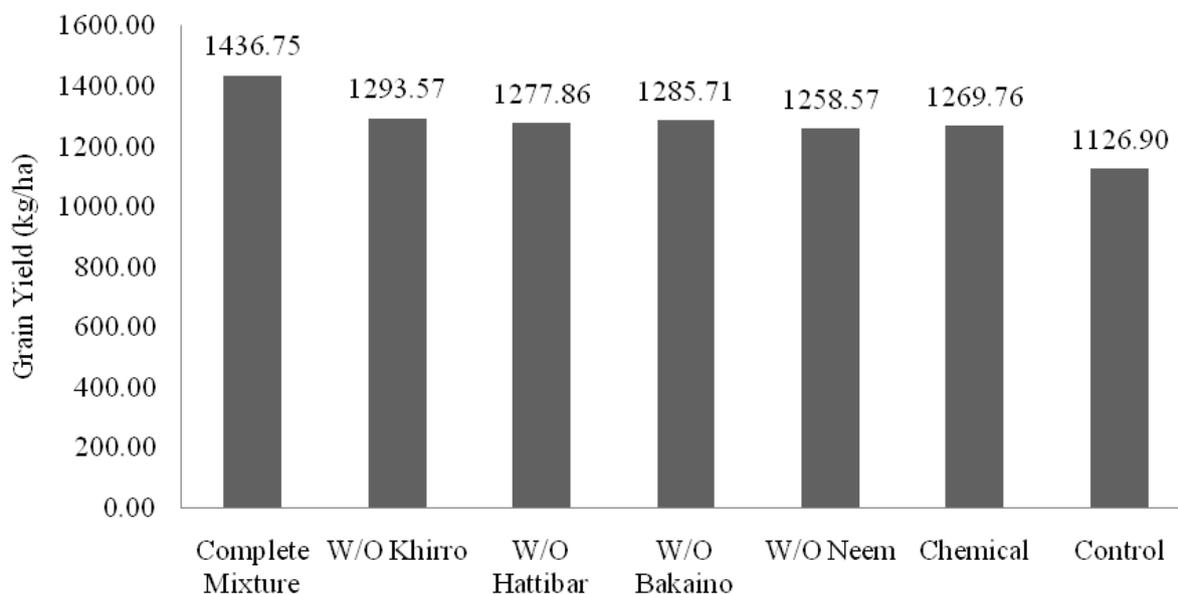
The Economic threshold Level (ETL) was fixed at 15 aphids/plant of 10 cm twig, as referenced from literature (Saunakiya and Tiwari, 2014). The observations taken during each spray found that at 15DASp1st, 10DASp2nd and 15DASp3rd crosses the boundary of ETL by trend line of control while in other treatments, the line was found to be far below the ETL. It represents that, the number of aphids doesn't reaches even to ETL with the application of selected plant extracts except in control (Figure 4).

### 3. 5. Grain Yield of Rapeseed

Highest grain yield was found in complete mixture (1436.75 kg/ha) and Least in control (1126.90 kg/ha) which is also supported by Biswas (2013). Complete mixture had more yield (but not statically different) even than chemical which was highly effective to reduce aphid population, because of more number of pollinators and availability of nutrients through complete mixture. The plots treated with plant extracts and chemical showed that their yield is statically at par, it is because of less no of aphid than ETL (15 aphids/plant of 10 cm twig) in those plots during all the spray which leads to almost similar yield (Figure 5).



**Figure 4.** Relation between Aphid Populations with Economic Threshold Level (ETL)



**Figure 5.** Mean grain yield of Rapeseed under different treatments

#### 4. CONCLUSION

In all the three spray, complete mixture gave the best results next to chemical as both aphid number reduction and yield were greatest in the plants received this treatment among the all tested plant extracts. Although plant extract of complete mixture failed to reduce about maximum aphid population like chemical (Cypermethrin 10% EC), but use of complete mixture is an eco-friendly management tactics of aphid. It is locally available, safe for the pollinators and natural enemies and also safe for environment. Along with this, the abundance of plant having insecticidal property in Nepal makes it as emerging solution against Mustard aphid.

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