Prevention and Control of Whitefly (*Bemisia tabaci*) in Two Selected Aquatic Plants (*Echinodorus bleheri* and *Echinodorus* 'Little bear')

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Abstract - Whitefly (*Bemisia tabaci*) is a serious plant pest that damage economically important plants including aquatic plants cultivated under greenhouse conditions all over the world. *Echinodorus bleheri* and *Echinodorus* 'Little bear' are economically important two aquatic plants species and a variety which exports from Sri Lanka. *Echinodorus bleheri* and *Echinodorus* 'Little bear' are normally cultivated as emergent plants under greenhouse conditions by using hydroponic systems. These species have more potential to infest with whiteflies and a significant rejection for export due to whitefly attack is a serious problem in aquatic plant industry. Present study was conducted to find out the most effective treatment method to prevent and control the whitefly in *E.bleheri* and *E.* 'Little bear' at the primary stage of the life cycle. In this study insecticide 0.5 L/acre [Fenobucarb – BPMC] (T1) was used as the control and three treatments were liquid soap treatment (T2), immersion the plant in water for 10 days (T3) and application of herbal [extraction] (onion peel and garlic peel) (T4) by using completely randomized design. The results obtained from the one way ANOVA revealed that there is a significant difference among treatment ($P<0.05$). The lowest mean number of eggs, pupa and adults were showed in T3. Further and the lowest egg hatching rate (0%) was obtained in T3 up to 10 days after treatment of both plant species. Hence, immersion of *E.bleheri* and *E.*'Little bear' in water (for 10 days) can be recommended as the most efficient treatment method to the control of whitefly (*Bemisia tabaci*) up to 10 days.

Keywords: Whitefly, Echinodorus, pest control, Aquatic plants

I. INTRODUCTION

Bemisia tabaci is a serious pest of economically important crops all over the world. Its importance as a field agricultural pest has grown in recent years, and it is now one of the most economically devastating pests of greenhouse crops. In recent years, traditional chemical control of whitefly species has become more challenging. In many greenhouses various insecticides are applied per week to control insect populations. As a result, resistant populations of this species can be found highly all across the world (Mohammadali *et al.*, 2019). They are plant feeders with sucking, piercing mouthparts. Adults have a body length of more than 2 mm and a wingspan of more than 3.5-4.0 mm (Byrne and Bellows, 1991). The egg, four nymphal instars (scales), and the adult make up the majority of the whitefly life cycle. At the rear of the leaf, adult female whiteflies lay 200-400 eggs in circular patterns. The eggs hatch into nymphs between 5 and 10 days after being laid, after which they move a short distance away from their egg cases and begin to feed on plant leaves, sucking sap from tissues (Perring *et al.*, 2018).

B. tabaci feeds a wide variety of ornamentals, garden plants and weeds (Abubakar *et al.*, 2022). *Echinodorus bleheri* (Withanage, Bambaranda and Jayamanne, 2013) and *Echinodorus* 'Little bear' are most prominent aquatic plants in the international market. When *E.bleheri* and *E.* 'Little bear' are normally cultivated as emergent plants under greenhouse conditions by using hydroponic systems and it has more potential to infest with whiteflies.

In Sri Lanka mainly use BPMC (Fenobucarb) as effective insecticide for control whitefly commercially. Other than that there are different organic (soap treatment, herbal extracts), chemical and mechanical (handling) methods which are used by farmers to control whitefly.

II. MATERIALS AND METHODS

This experiment was conducted under greenhouse condition in poly tunnels at Ratnasiri Fernando & Co (pvt) Ltd, Pugoda, Sri Lanka. Two months aged *Echinodorus bleheri* and two week aged *Echinodorus* 'Little bear' plant pots were randomly selected from culture tanks with newly laid whitefly eggs. These plant pots were arranges as three plants per pot.

BPMC insecticide (Control / T1), liquid soap solution (T2), immersion in water for 10 days (T3) and herbal extraction (T4) were the applied treatments. The experiment was laid out in Randomized Complete Block Design with 12 replications per one treatment including control. The insecticide used in this experiment was obtained from the local market and was sprayed at field recommended doses (0.5 L/acre). The experiment was carried out separately for two plant species. Each plant was covered with polythene cover to prevent spread of whitefly and to obtain accurate observation results. Herbal extraction was extracted from using onion peel (5g) and garlic peel (5g) and blended with 0.5 L of water. The experimental tank was covered using an insect proof net to prevent spreading whitefly. Fertilization was kept uniform throughout the experiment on all pots.

After 10 days the whitefly population in each plant was recorded early in the morning. Data were collected in the beginning (before applying treatment) and after 10 days (after applying treatment). In the abaxial side of the leaflets, the number of whitefly eggs, pupa and adults were counted in each evaluation, by slowly turning the leaflet upside-down in order to prevent the escape of the insects. The total heights of plants were measured using a tape before and after (after 10 days) applying treatments. Number of leaves were counted before and after (10 days) applying treatment (Abubakar *et al.*, 2022). The egg hatching rate was calculated by using this below formula:

*Egg hatching rate = (Number of eggs hatched/Total number of eggs) * 100%*

One-way ANOVA combined with Tukey test and paired sample t-test was carried out to understand differences between treatments ($p<0.05$). All statistical analysis were crried out using the softwares Microsoft Excel (2010) and Minitab 18.

III. RESULTS AND DISCUSSION

Table 1. Egg hatch rate% of *E.bleheri* and *E.* 'Little bear' plants treated with BPMC (control), liquid soap (T2), immersion in water (T3) and herbal extraction (T4), observed at after application of treatment

	T1 Control	T2 liquid soap	T3 Immersion in water	T4 Herbal extraction
Echinodorus bleheri	16.81a	25.28a	0	9.51a
Echinodorus 'Little bear'	10.59a	25.27a	0	13.21a

Values with different superscripts within the same column differ significantly ($p<0.05$).

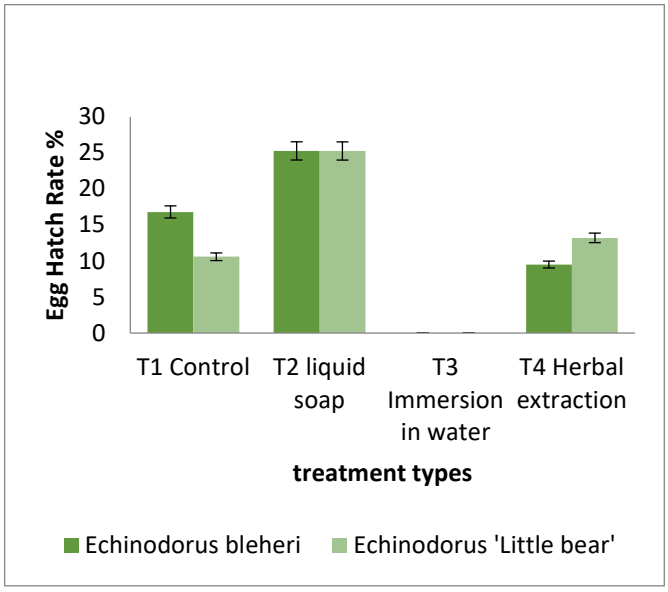

Figure 01 Egg hatch rate% of *E.bleheri* and *E.* 'Little bear' plants treated with BPMC (control), liquid soap (T2), immersion in water (T3) and herbal extraction (T4), observed at after application of treatment

As the results are shown in the above graph (Figure 01), BPMC treatment (16.81%), Liquid soap treatment (25.28%), Herbal extraction treatment (9.51%) showed higher percentages of egg hatch rate. Immersion in water (0%) showed the lowest persentages of egg hatching rate.

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IV. CONCLUSION

Considering the efficiency of prevention and control of whitefly population in the selected two plant species, the most effective and convenient method is immersion for 10 days in water. Further research should be conducted for other crops to understand whether this finding is applicable for them.

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