



Efficacy of different botanical Materials against APHID *TOXOPTERA AURANTII* on tea (*Camellia sinensis* L.) cuttings under high shade nursery

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Abstract

Experiment was conducted at National Tea Research Institute, Shinkiari, Mansehra-Pakistan during 2010-11 with the objectives to examine the efficacy of some botanical products neem extract, garlic extract and tobacco extract on aphid infestation on growing shoots and their control at nursery stage. The mortality of aphid on tea cutting significantly affected under botanical pesticides application after 24 hours. Tobacco extract at 2% caused highest mortality of 98% of aphid, where its population reduces up to 5% per treatment over the population of 386. The observation on infestation of aphid after 72 hours showed that Tobacco extract at 2% showed highest efficacy against the target insect and resulted mortality of 96% whereas its population reduced in 11% treatment. Neem extract at 2% ranked second in relation to efficacy against the target insect with mortality of 68% whereas the efficacy of garlic extract at 2% was the minimum with lowest mortality i.e. 66%. It was observed that the entire botanical pesticides showed high efficacy against aphid and spray with tobacco extract effectively control aphid population followed by neem extract and garlic extract remained least effective against aphid.

Key words: Aphid. botanical. *Camellia sinensis*. Pakistan. tea nursery.

Introduction

Tea (*Camellia sinensis* L.) is one of the most useable beverages worldwide. Tea plant can be propagated either through seed or cuttings. In most tea growing countries, the existing tea populations were established from seedling with plants of varied mixture with a high proportion of low yielding types. The nursery plants propagated by tea cuttings are true to type but their survival percentage both in the nursery as well as in the field after planting is less as compared to seedlings. It is reported that the period around September/October as the most suitable time for raising tea cutting under plastic sheet in the tea growing areas of Pakistan [1]. Tea production contributes greatly to the economy and the job opportunities for many countries of Asia and Africa due to its large scale production, trade and marketing. Pakistan has a long history of tea drinking and it is perhaps among the few countries where tea has attained the status of basic food due to its non-alcoholic features. While it is used as a source of entertainment by all segments of the society, it is essentially required at the breakfast specially in the urban areas of Pakistan. The trend of tea drinking in the country is tremendously increasing due to the popularity of drink and rapid growth in population. During 2009-10 Pakistan imported 95219 tons of black tea costing Rs. 21622 million with highest share from Kenya (60.95%) while the green tea import was 913.72 tons with 64.46% from China [2]. While Pakistan is 3rd largest importer of tea in the world [3].

For the last few decades due to awareness of harmful effects of pesticides on environment, alternate methods of pest control with extremely safe pesticides are being advocated world over. The dependence on chemical pesticides results in several ecological and physiological problems for beneficial insects, human being and animals. The need to identify alternate methods to manage pests is evident. There is a renewed interest in the use of botanical insecticides for crop protection.

In spite of development of various modern synthetic insecticides, heavy losses of tea crop are recorded by the attack of pests and diseases. In recent years, the use of pesticides, particularly of insecticides, has become a very common. Excessive and indiscriminate use of these toxicants has unlimited hazards for human beings and every naturally growing population [4]. The tea crop and other edible parts of plants are directly exposed to the applied pesticides and are usually consumed before the plant system is able to get rid of pesticide residues or the latter is diluted to the non-toxic level [5]. Spraying of pesticide liberate a fair volume of harmful vapours in the atmosphere and consequently create a certain degree of atmospheric pollution [6]. However, some chemicals have posed some serious problems to health and environmental safety, because of their high toxicity and prolonged persistence [7]. Extracts from plant origin containing insecticidal properties are indigenously available and are considered comparatively safe for environment & public health. It has been reported that over 2000 plant species belonging to about 170 natural families are known to have insecticidal properties [8]. Botanical pesticides are biodegradable [9] and their use in crop protection is a practical sustainable alternative. It maintains biological diversity of predators [10], and reduces environmental contamination and human health hazards. Research on the active ingredients, pesticide preparations, application rates and environmental impact of botanical pesticides are a prerequisite [11] for sustainable agriculture. Botanical pesticides are unique because they can be produced easily by farmers and small industries [12]. The tea aphid, *Toxoptera aurantii* infests tender shoot and foliage of the tea plant. Its continuous feeding makes the leaf wrinkled forming a boat shaped structure and at times result in retarded growth of the plant. Severe infestation leads to delayed recovery of the plant with the consequent effect on poor crop productivity [13]. Detailed aspects of aphids infesting tea under the climatic conditions of Southern India have been studied by [14, 15].

Aphids feed by sucking sap from tender plant leaves. This often causes the plants to become deformed, the leaves curled and shrivelled and, in some cases, galls are formed on the leaves [16]. In most cases the black citrus aphid is a pest of tea wherever it is found. This pest congregates on the tender young shoots, flower buds and the undersides of young leaves. They are not known to feed on the older and tougher plant tissues [17]. On tea it causes some leaf distortion and malformation of growth of leaves and tips of shoots. It is often more a serious pest in nurseries.

Keeping in view of the use of plant products to fight and reduce the losses caused by agricultural pests and diseases. The neem tree *Azadirachta indica* is also a source of unique natural products for IPM, medicine, industry and other purposes. It was vital to carried out the present study to examine the efficacy of some botanical products against aphid at the early stage on young tea plants because of its severance attack at this stage.

2. Materials and methods

2.1. Experimental Plan: The experiment was carried out at National Tea Research Institute (NTRI) Shinkiari, Mansehra-Pakistan during 2010-11, to assess the efficacy of different botanical pesticides against aphid. Tea cuttings of 3.5 cm size (node + bud) were obtained from indigenous tea variety (*Camellia sinensis* L.) "Qi-Men" of China from NTRI Tea garden during the 2nd week of September, 2010 and inserted in soil filled polythene tubes. Experiment was laid out in a randomized complete block design having 03 replications kept in high shade nursery tunnels of NTRI, Shinkiari. Three hundred cuttings per treatment were excised. All the cultural practices kept uniform as and when required. On appearance of aphid at 03 leaves + bud stage, the following botanical pesticides were used to compare their effectiveness in relation to control the insect pest.

- i. Neem extract 2%
- ii. Garlic extract 2%
- iii. Tobacco extract 2%

The population of aphid before spraying the above botanical pesticides on tea cutting was recorded with magnifying glass, while the post treatment observations on population of aphid were also observed by the same procedure after 24 hours, 72 hours, one week and two weeks of spray. Material used are as follows:

2.2. Neem Extract: The neem extract was prepared by grinding dry neem seeds and 01 g neem powder was mixed in 20 ml of boiled water, along with detergent powder and prepare the neem solution. Detergent powder was used for proper absorption of neem powder by plant leaves sprayed.

2.3. *Garlic Extract:* For preparation of garlic extract, 50 gram dried garlic is grinded in grinding machine and kept in water for 24 hours, by using muslin cloth the solution was filtered and sprayed at the rate of 50 ml of solution in 2.5 lit of water.

2.4. *Tobacco Extract:* The leaves of tobacco were kept in 500ml of tap water for overnight. After 24 hours prepared solution was filtered and sprayed on experiment. The spraying with botanical pesticides on tea cutting was done in the morning time by Knapsack sprayer. After spraying with each botanical pesticide the spraying machine was thoroughly washed to avoid any residual effects from the preceding products sprayed. The observation on the incidence of aphids were recorded as per planned schedule. For this purpose, observations were recorded on three leaves. The post treatment observations started after 15 days of spray.

2.5. *Treatments:* The observations and data were recorded at morning hours (8-10 am) the population of the insect were examined by magnifying glass, however microscope were also utilized for counting. The treatments are as under:

- T1 24 hours before treatment (Control)
- T2 24 hours after treatment
- T3 72 hours after treatment
- T4 One week after treatment
- T5 Two week after treatment

2.6. *Data Analysis:* The data recorded were analyzed statistically to record the level of significance ($P < 0.01$) for variation. L.S.D test were also employed to compare the average population under different botanical pesticides [18].

3. Results and discussion

3.1. Efficacy of botanical pesticides after 24 hours of spray:

The results (Table 1) indicated that the mortality of aphid on tea cutting varied significantly ($P < 0.01$) for botanical pesticides after 24 hours of their application and spraying tea cutting with tobacco extract (2%) caused highest mortality (98%) of aphid, where its population reduce to 5% treatment over pre treatment population of 386 (Figure 1).

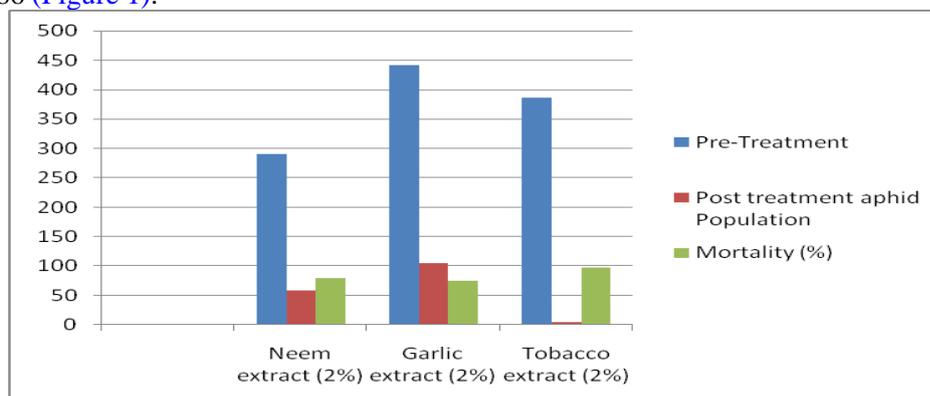


Figure 1: Efficacy of various botanical pesticides after 24 hours spray interval presented in graph for comparison.

Neem extract (2%) ranked second in relation to efficacy against aphid with insect mortality 80%. Garlic extract (2%) was least effective against aphid with mortality of 75%.

Table 1: Efficacy of various botanical pesticides with 24 hours of spray interval

Botanical Pesticides	Pre-Treatment aphid population	Post treatment aphid population	Mortality (%)
Neem extract (2%)	290 c	58b	80bc
Garlic extract (2%)	441ab	105a	75c
Tobacco extract (2%)	386ab	05c	98a

Level of significance ($P < 0.01$)

3.2. Efficacy of botanical pesticides after 72 hours of spray

The observation on infestation of aphid after 72 hours was also recorded and results are presented in Table 2. The insect population showed that there was a significant ($P < 0.01$) in mortality of aphid in case of different botanical pesticides after 72 hours of treatment.

Table 2: Efficacy of various botanical pesticides with 72 hours of spray interval

Botanical Pesticides	Pre-Treatment aphid Population	Post treatment aphid Population	Mortality (%)
Neem extract (2%)	290 c	90 b	68 b
Garlic extract (2%)	441 ab	146 a	66 b
Tobacco extract (2%)	386 ab	11 c	96 a

Level of significance ($P < 0.01$)

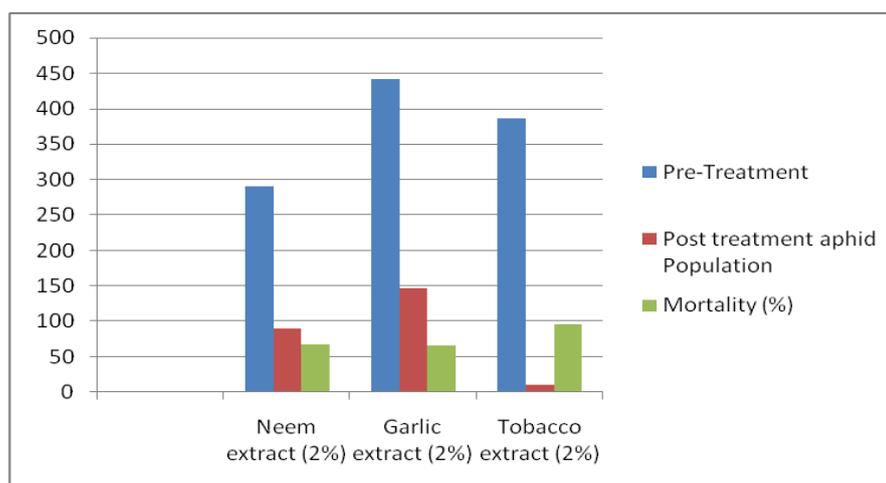


Figure 2: Efficacy of various botanical pesticides after 72 hours spray interval presented in graph for comparison.

Tobacco extract (2%) showed highest efficacy against the target insect and resulted mortality of 96% whereas its population reduced 11/treatment. Count of 386/treatment. Neem extract (2%) ranked second in relation to efficacy against the target insect with mortality of 68% where as the efficacy of garlic extract (2%) was minimum with lowest mortality i.e. 66% (Figure 2).

3.3. Efficacy of botanical pesticides after one week of spray

Aphid infestation on tea after one week of spray was recorded and results are given in Table 3. The results indicated that there was a significant ($P < 0.01$) variation in insect mortality in different botanical pesticides after one week of spray. Tobacco extract sustained its efficacy against the target insect and caused highest mortality i.e. 93%.

Least efficacy against aphid was observed in case of garlic extract (2%) with the lowest mortality of 60%. It was observed that all the botanical pesticides lost their efficacy after one week of spray and aphid population was found increasing as compared to observations recorded after 24 hours and 72 hours of treatment. However, tobacco extract proved its high efficacy against aphid in experiment treated with tobacco extract had negligible aphid population after one week of spray (Figure 3).

Table 3: Efficacy of various botanical pesticides with one week of spray interval.

Botanical Pesticides	Pre-Treatment aphid population	Post treatment aphid population	Mortality (%)
Neem extract (2%)	290 c	94 b	66 b
Garlic extract (2%)	441 ab	171 a	60 b
Tobacco extract (2%)	386 ab	23 c	93 a

Level of significance ($P < 0.01$)

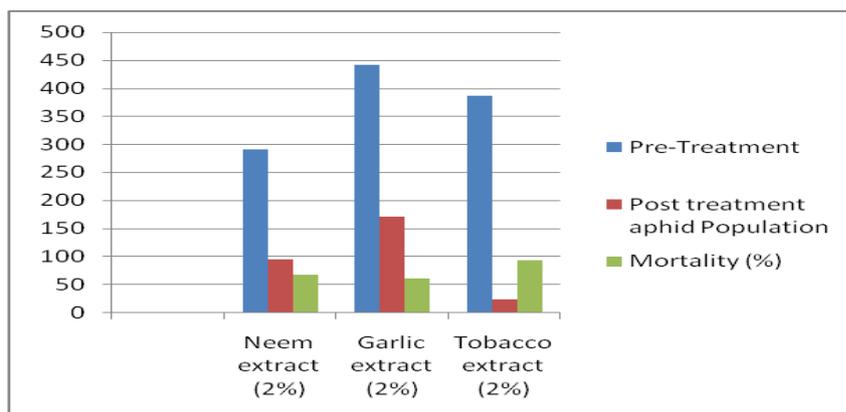


Figure 3: Efficacy of various botanical pesticides after one week spray interval presented in graph for comparison.

3.4. Efficacy of botanical pesticides after Two week of spray:

The efficacy of various botanical pesticides against the aphid on tea plants after two weeks of their spray was examined and results are presented in table 4 which exhibited that the efficacy of different pesticides varied significantly ($P < 0.01$).

Table 4: Efficacy of various botanical pesticides with Two week of spray interval.

Botanical Pesticides	Pre-Treatment aphid Population	Post treatment aphid Population	Mortality (%)
Neem extract (2%)	290 c	112 b	61 b
Garlic extract (2%)	441 ab	209 a	52 b
Tobacco extract (2%)	386 ab	41 c	89 a

Level of significance ($P < 0.01$)

Tobacco extract (2%) showed its superiority in relation to efficacy against aphid on tea and resulted highest insect mortality i.e. 89%. (Figure 4).

Neem extract sustained its position against the target insect with the mortality of 61%. Least efficacy against was observed in case of garlic extract (2%) with the lowest mortality of 52%. The results indicated that all the botanical pesticides lost their efficacy after two weeks of spray and aphid population started building up after 72 hours, one week and two weeks of treatment. However, insect population under tobacco extract was yet negligible.

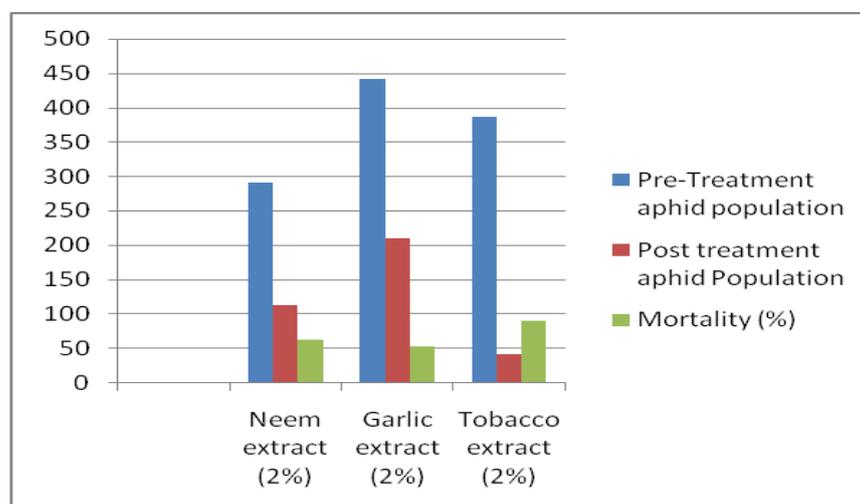


Figure 4: Efficacy of various botanical pesticides after two week spray interval presented in graph for comparison.

Many scientists have developed ways of making their own extracts (sprays) from plant such as neem extract, garlic extract, tobacco extract, hot pepper and many others. These are low in cost locally available and have proved to be very effective for the control of insect pests. The results of botanicals were reported by Muraleedharan, [19] Roy, et al., [20]. From the present study it may be concluded that the application of plant extracts (neem extract, garlic extract, tobacco extract) to reduced the aphid population. These results regarding mortality of aphid are in accordance with the work reported [21]. The scale up studies are required to understand the mechanism(s) of solvent extracted from plants and used against aphid which will be helpful in replacing the pesticides harmful to the environment and the human beings.

Conclusions

It was concluded that the natural pesticides have potential for use in agriculture sector of plant protection. The entire botanical pesticides showed high efficacy against aphid and spray with tobacco extract effectively control aphid population followed by neem extract and garlic extract remained least effective against aphid. The cost benefit ratio of the botanical material used proved economical for the end users and would be applicable without any extra burden on the farmers. Whereas the pesticide used are easily affordable for the low-income farmers.

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