



Comparative evaluation of water extracts and hot water extracts of botanicals against sucking pests on *Capsicum annuum*

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Abstract

Capsicum annuum is important vegetable and spice crop in India. Majority of the sucking pests in this crop are long lasting and cause more crop loss than borers and leaf feeders. The major key sucking pests are Thrips (*Scirtothrips dorsalis* Hood), Green peach aphid (*Myzus persicae* Sulzer), Cotton aphid (*Aphis gossypii* Glover) and Yellow mite (*Polyphagotarsonemus latus* Banks). Multimode of action is the speciality of botanicals. The bioassay studies were to explore the comparative evaluation of water extracts and hot water extracts of botanicals against sucking pests on *Capsicum annuum* in laboratory conditions. The botanicals Leaf powder of Sivanarvemba (*Indigofera aspalathoides*), Plant powder of Narrow leaved milkwort (*Polygala elongata*), Plant powder of Birthwort (*Aristolochia bracteolata*), Leaf powder of Green chirayta (*Andrographis paniculata*) and Leaf powder of Lippia (*Phyla nodiflora*) were tested against major sap feeders with three various concentrations of 1%, 3% and 5%. The observations were made on the mortality of test insects at 6h, 24h and 48h respectively. Two different types of bioassay viz., onplant and poison food bioassay were conducted. Results revealed that the Lippia 5% and green chirayta 5% showed with high mortality in both type of bioassays.

Keywords: *Capsicum annuum*, sucking pests, onplant, poison food bioassay, lippia

Introduction

Chilli is important vegetable and spice crop in India. Globally, chilli is cultivated in 20.20 MH with the production of 37.62 MT. India is contributing for about 38% in world chilli production (Geetha and Selvarani, 2017) [7]. Majority of the sucking pests in this crop are long lasting and cause more crop loss than borers and leaf feeders (Ikisan, 2021) [10]. The major key sucking pests are Thrips (*Scirtothrips dorsalis* Hood), Green peach aphid (*Myzus persicae* Sulzer), Cotton aphid (*Aphis gossypii* Glover) and Yellow mite (*Polyphagotarsonemus latus* Banks). Chilli thrips is highly polyphagous and documented on over hundred hosts from about forty different families. It causes an economic loss of 25 to 80 per cent under various situations. Aphids known to cause 20-30% yield loss but depending upon the degree of attack, the yield reduction may go up to 63% in chilli. Infested plants turn pale with sticky appearance. Yellow mite nymphs and adults desap in large numbers from the undersurface of leaves and make petioles of the lower leaves extremely elongated with narrow lamina and it turns rough and brittle called murda disease (Kannan *et al.*, 2016) [12]. Nowadays, farmers repeatedly going for many spray of chemical pesticides. Most of the synthetic chemicals are persistent, highly toxic, resurgence inducing and harmful to natural enemies, pollinators and birds (Cork *et al.*, 2003) [3]. There is a great demand at the global level for botanicals, which is considered as a viable alternative to chemicals. Multimode of action is the speciality of botanicals (Dua *et al.*, 2009) [6].

Materials and methods

The present research studies entitled as “Comparative evaluation of water extracts and hot water extracts of

botanicals against sucking pests on *Capsicum annuum*” was carried out on 2021 in Phyto-Insecticides Research Laboratory Department of Entomology, Annamalai University, Chidambaram, Tamil Nadu, India.

Culturing of test insects

Fifteen days old seedlings of chilli pepper (Var. Co-1) raised in the nursery were planted in poly cups, of 200 ml capacity containing the mixture of red soil, sand and compost at the ratio of 1:2:1, @ one seedling per cup and watered daily. After one week, the plants raised in poly cups were kept in nylon mesh netted insect cages (45 × 45 × 45 cm) and infested with thrips that collected from chilli field in and around Annamalai nagar. Fresh seedlings were introduced into the nylon mesh netted insect cages whenever the old seedlings started withering. The thrips migrated to new seedlings on their own and established within a day. Then the old withered seedlings removed from the cage. Thus a continuous culture of thrips was maintained under 27±2°C temperature and 70±5%RH with a 12:12 (L:D) photoperiod in the screen house and used in laboratory bioassays. The procedure described above was followed for aphids and mites culturing also.

Preparation of botanicals

The botanicals Leaf powder of Sivanarvemba (*Indigofera aspalathoides*), Plant powder of Narrow leaved milkwort (*Polygala elongata*), Plant powder of Birthwort (*Aristolochia bracteolata*), Leaf powder of Green chirayta (*Andrographis paniculata*) and Leaf powder of Lippia (*Phyla nodiflora*) were tested against major sap feeders with three various concentrations of 1%, 3% and 5%. Water

extracts of the leaf or plant powders of Sivonarvembu, Narrow leaved milkwort, Birthwort, Green chirayta and Lippia were obtained by following standard procedure. To get 1, 3 and 5% concentrations of water extract, 1, 3 and 5g of respective powder was weighed and packed in whatman No. 1 filter paper. Then the thimbles were soaked in 100ml of water for 24h. After soaking, the thimbles were removed carefully and the extracts filtered using whatman No. 1 filter paper. Fresh extracts were used in the experiments. Similarly, hot water (50 to 55°C) extracts were prepared.

Bio-efficacy test

Bio-efficacy test of On plant bioassay fifteen days old, chilli pepper seedlings (var. Co 1) raised in the poly cups were used for the bioassay. Plants raised in the cups thinned out and one seedling at the centre was retained per cup. Paper disc was placed under each plant. Then twenty numbers of second stage nymphs of respective insects were identified with the help of hand lens and released onto the leaves using camel hairbrush (No.1) and then wrapped with mylar film. After 1h, the plants were sprayed with desired concentration of the respective botanical. Approximately 1 ml of the spray solution was directed per plant using atomizer. After treatment, the open end of the mylar cage was secured with gada cloth. Observations were made on the mortality of test insects at 6, 24 and 48h after treatment. Hand lens of 10X used to count the dead insects that fell on the paper disc kept under seedling. The percent mortality was worked out. Bio-efficacy test of poison food bioassay the procedure described above was followed but the test insects released after spraying the respective concentration of respective botanical (Balamurugan and Arivudainambi, 2021)^[1].

Statistical analysis

Statistical analysis of data recorded in the experiments subjected to analysis of variance (ANOVA) under randomized block design by adopting the procedures described by Gomez and Gomez (1984)^[9]. Necessary data transformation made before analysis and the computer based IRRISAT package used for the calculation.

Result and discussion

Among the water extracts of plant and leaf powders, four treatments such as birthwort @ 5%, green chirayta @ 5% and lippia @ 3% and 5% recorded more than 60% mortality under on plant assay. But by following poison food assay, eight treatments like sivonarvembu @ 5%, Narrow leaved milkwort @ 5%, birthwort @ 5%, green chirayta @ 3% and 5% and lippia @ 1%, 3% and 5% registered above 60% mortality over control. The maximum mortality over control of around 70% was caused by Lippia @ 5% in both the assays. This was followed by green chirayta @ 5% in exerting mortality under both the assays. Similarly, the hot water extracts of Lippia and green chirayta showed higher mortality rate over control among all the treatments (Fig. 1 and 2). Sathua *et al.* (2017)^[21] showed 64.50% mortality thrips when treated with NSKE 5%. Maria Packiam *et al.* (2013) showed the combination of pongam and neem oil had significantly effect on *S. dorsalis* population than neem oil alone. Our results are in accordance with the findings of Leibebe *et al.* (2015)^[13] who reported lower efficacy of neem products against thrips. Meena and Tayde (2017)^[16] showed 55.78% mortality of thrips in pongam oil and this treatment reported on par with neem oil (55.64%) and NSKE (53.03%).

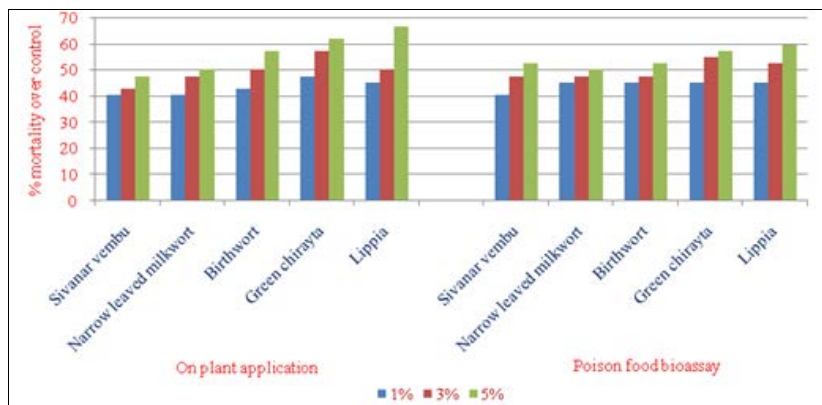


Fig 1: Insecticidal efficacy of water extracts against thrips

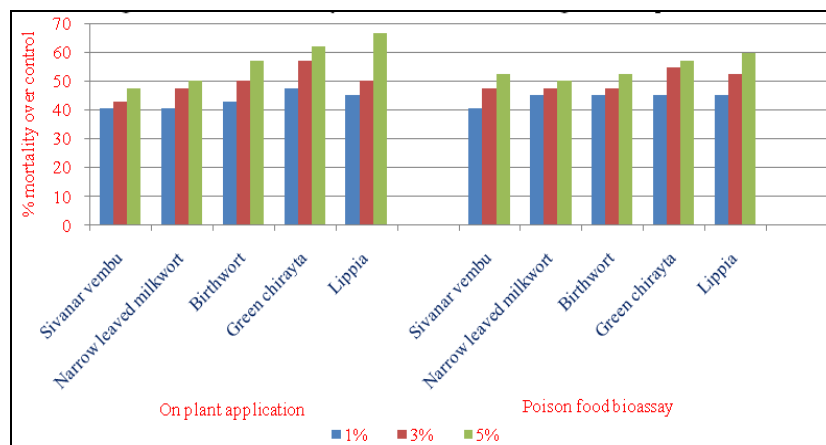


Fig 2: Insecticidal efficacy of hot water extracts against thrips

From the water extracts of plant and leaf powders, green chirayta @ 5% and lippia @ 5% showed more than 70% mortality in on plant application and narrow leaved milkwort 1%, 3% and 5% performed least against aphids. Similarly, in hot water extracts green chirayta @ 5% and lippia @ 5% showed more than 65% mortality in on plant application and sivanar vembu performed least in both type of assays. On plant application showed better effect when compared to poison food bioassay in both type of extracts (Fig. 3 and 4). Extracts of various plants were shown effective by the authors viz., Chandrashekaraih and Sannaveerappanavar (2013) [2], Yankova *et al.* (2014) [26],

Prabal *et al.* (2000) [18], Wajid Hasan and Singh (2008) [25], Sohail *et al.* (2012) [23], Milenkovic *et al.* (2013) [17], Razmjou *et al.* (2016) [20] and Ebadollahi *et al.* (2017) [20] against aphids in earlier studies and this supports our idea. Isman (2000) [11] indicated that the less effectiveness of neem to *M. persicae* was due to the developed nine-fold resistance to azadiractin. This might be the reason for less effectiveness of neem in our study. Godase and Patel (2001) [8] recorded significantly lower population of aphids (11.29 per/leaf) in plots treated with neem cake (1.7 t/ha) whereas the maximum aphids (40.29 /9 leaves) were recorded in plots treated with higher levels of nitrogen (200 kg N/ ha).

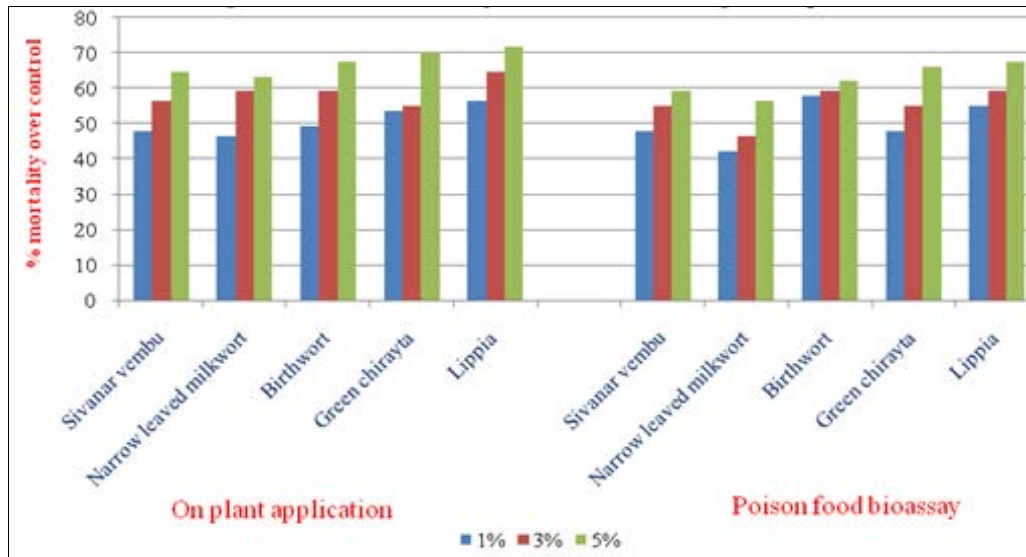


Fig 3: Insecticidal efficacy of water extracts against aphids

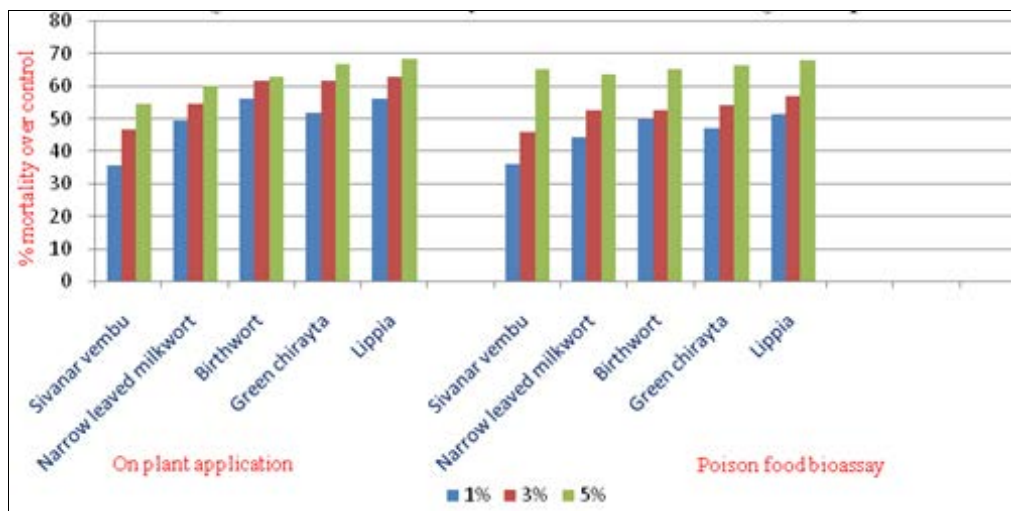


Fig 4: insecticidal efficacy of hot Water extracts against aphids

Among the both type of extracts of plant and leaf powders, On plant application showed better effect when compared to poison food bioassay. Lippia @ 5% showed more than 70% mortality over control. Sivamar vembu @ 5% and green chirayta @ 5% showed more than 55% mortality over control in on plant application against yellow mites. Similarly, in hot water extracts three treatments birthwort @ 5%, green chirayta @ 5% and lippia @ 5% recorded more than 60% mortality under on plant assay (Fig. 5 and 6). Sanjay reddy (2003) reported higher mortality of the yellow mites when treated with NSKE (2.5%) + cow urine. Smitha and Giraddi (2003) [22] reported the synergistic effect of

plant oil with dicofol. The findings of Sunitha (2007) [24] showed that two applications of 5% leaf aqueous extracts of *Aloe sp.*, *Sanseiveria sp.* and Lippia significantly reduced (67-68%) the chilli mite population followed by the treatments NSKE 5% and monocrotophos 0.04% and this is in confirmation with our findings. Though the research findings published by Medelaine Venzon *et al.* (2008) [14], Dimetry *et al.* (2012) [5], Rahman *et al.* (2016) [19] and Devi *et al.* (2017) [4] clearly shown the higher efficacy of neem products against mites, our results failed to have affirmation with their findings.

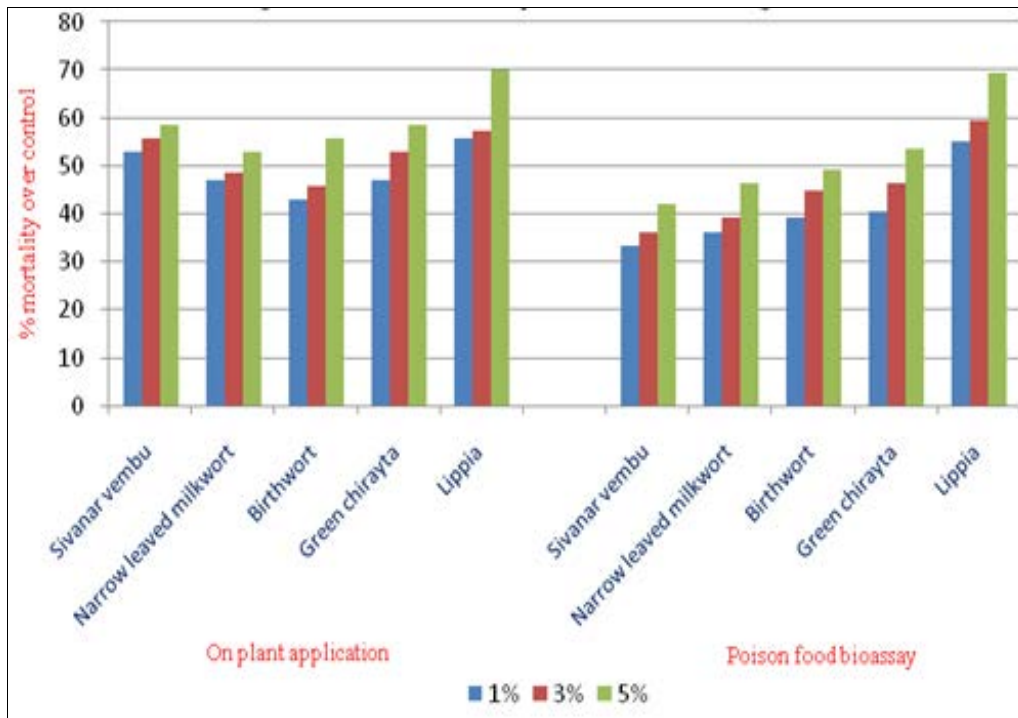


Fig 5: Insecticidal efficacy of water extracts against mites

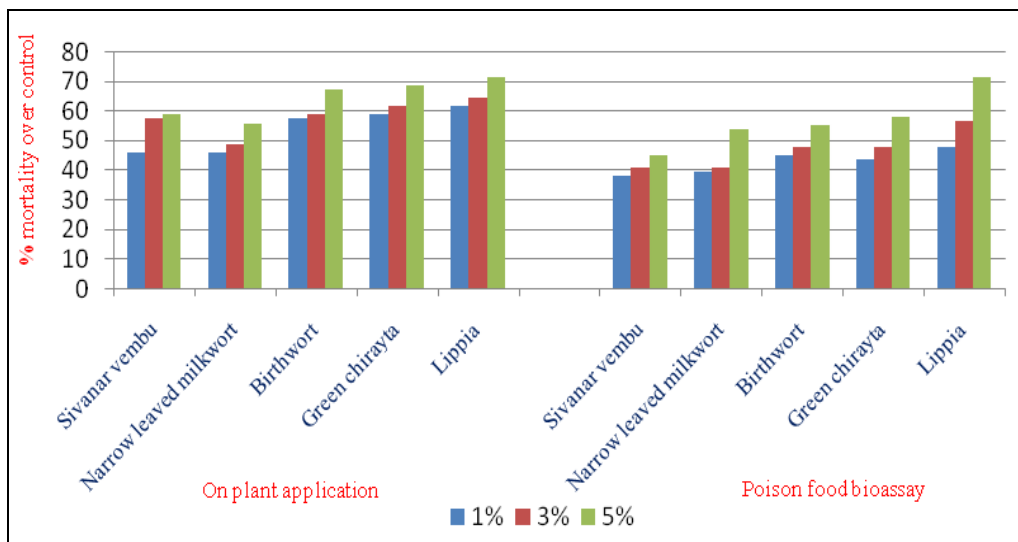


Fig 6: Insecticidal efficacy of hot water extracts against mites

Conclusion

Based on the overall efficacy, lippia @ 5% and green chirayta @ 5% concentration showed better effect on both the type of bioassays. The present findings showed that lippia @ 5% and green chirayta @ 5% can be tested in fields and developed as commercial formulations in future for the management of sucking pests on chilli.

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