Plant Archives Volume 20 No. 1, 2020 pp. 1515-1520 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EVALUATION OF THE EFFICIENCY OF AQUEOUS AND ALCOHOLIC EXTRACT OF THEVETIA (*THEVETIA PERUVIANA*) AND ITS COMPARISON WITH PESTICIDE ORTUS IN CONTROLLING THE BROAD MITE *POLYPHAGOTARSONEMUS LATUS* (BANKS) (ACARI: TARSONEMIDAE), ON KARISMA PEPPER IN GREENHOUSE

Tadmur A. Malik and Feryal B. Hermize

Dept., of Plant protection, College of Agriculture Engineering Sciences, University of Baghdad, Iraq

Abstract

The experiment was conducted in one of the greenhouses of the Plant Protection Department / College of Agricultural Engineering Sciences / University of Baghdad / Jadiriya to evaluate the efficacy of the alcoholic and aqueous extract of the plant Thevetia (*Thevetia peruviana*)and compare it with the pesticide Ortus on the stages of the broad mite (*Polyphagotarsonemus latus*) on sweet pepper Karisma. The results showed that the alcoholic extract was superior to the aqueous extract against all stages of the broad mite after three weeks of treatment. The relative efficiency of the alcoholic and aqueous extracts was 80.38% and 75.94% respectively on egg stage, whereas the pesticide Ortus was 87.5% at the larvae stage a relative efficiency of 86.17%, 78.63% for the alcoholic and aqueous extracts respectively and 90.33% for the pesticide. The relative efficiency of the nymphs was 86.94% and 80.39% for the alcoholic and aqueous extracts respectively, whereas the pesticide Ortus was 91.72%. The relative efficacy of adult was 87.22%, 80.22% and 91.78% for alcoholic, aqueous and Ortus extracts respectively.

Key words : *Thevetia peruviana*, *Polyphagotarsonemus latus*, Ortus.

Introduction

The sweet pepper *Capsicum annuum* L. is a plant belonging to the Solanaceae family. Pepper comes third after tomato and potatoes as important vegetable plants belonging to Solanaceae family (Mohammadi and Meshal, 1989; Bhattacharjee and Rahman, 2017). In Iraq, peppers are grown in open cultivation at the beginning of spring, and protected agriculture at the beginning of autumn (Jaafar, 2017). The total cultivated area in 2015 reached 14100 dunums in Iraq with a total production of 2026.8 tons (286 kg / dunum) (Central Organization for Statistics and Information Technology, 2015). Pepper plant affects many pests, including the dream wrist poetic *Polyphagotarsonemus latus* Banks, which is one of the important pests that affect many agricultural crops. Pepper plant is infected with many pests such as broad mites, which is an important pest that affects many agricultural crops. It affects more than 60 plant families and is an economically important pest (Gerson, 1992; Grinberg *et al.,* 2005; Peña and Campbell, 2005). This broad mite affects the cotton plants, tomatoes, potatoes, cucumbers, eggplants and peppers in open and protected cultivation (AL- Jubouri, 2000 and Ani, 2004, Moraes and Flechtmann, 2008). The broad mite feed on the lower surface of the leaves of the plants they infect. As the injury wrap the edges of the affected leaves down and thus cracks the leaves as you age, they have a rough appearance and different shapes, and that the injury is of a bronze color and cause the feeding of the broad mite on many families to the occurrence of damage, including wrapping the leaves suddenly, severe infection may stop plants from growing and lead to their death (Ashraf *et al.,* 2011; Rattanatip and Chandrapatya, 2013).

Many pesticides from different groups have been used to reduce pest damage to agricultural crops. Due to attention to the quality and safety of food product and

increased contamination of food, soil and water. As well as led to the killing of Natural Enemies and turned secondary pests to the primary such as broad mite, considering pests that affect protected agriculture (Oraibi, 2007 and Naimi *et al.,* 2012). The indiscriminate use of pesticides has led to the emergence of resistance and therefore to the search for alternatives to control pests and maintain biological balance and cleanliness of the environment. Recent trends in the use of natural compounds are safer, nontoxic, or low toxic to human, plant, and animals (Monteiro *et al.,* 2015). The *Thevetia peruviana* belongs to the Apocynaceae family and is called the yellow dafla or Pila kanher. It is characterized by the fact that all its parts are toxic and that the native of this plant is Central and South America (Britto and Gracelin, 2011). It was found in studies conducted that the Thevetia plants contains secondary compounds such as alkaloids, glycosides, phenolic compounds and tannins (Patil *et al.,* 2007; Patrick *et al.,* 2010, Kumar, 2012). This study was conducted to determine the relative efficiency of the aqueous and alcoholic extract of the Thevetia plants on the stages of the broad mite of pepper plant in greenhouses.

Materials and Methods

Leaves Collection of Thevetia plants

Leaves were collected from the gardens of the College of Agricultural Engineering Sciences / University of Baghdad / Jadiriya, the leaves were healthy and free from insect and disease injuries, wash thoroughly with distilled water to remove dust, spread on blotting paper at laboratory temperature under fan air, it was left several days with continuous flipping until it dried and prevented it from rotting. Fresh Thevetia leaves were extracted to extract the active substances of this plant as they were milled using an electric blender. So it became a fine powder then sieved with sieve size 50 mesh. Then placed in plastic containers and kept in the refrigerator at a temperature of 4-8 ° C until the extraction process.

Extraction

Alcoholic Extraction of Thevetia

For the extraction process, 100 g of dry plant powder was weighed and crushed in empty petri dishes. The dish was weighed empty and then 100 g of powder was weighed. It was placed in a glass flask of 1000 volumes and 400 ml of ethyl alcohol concentrating 96% was added at the laboratory temperature and its nozzle was sealed. beaker containing the extract was shake using electric shaker several times, and then left for 72 hours with repeated shaking from time to time. After shaking, the extract was filtered using a Buchner funnel and a piece of boring cloth, and then filtered again with the filter paper (Whatman No.1). Air discharged to get the pure solution without impurities. Put the pure solution with Rotary Evaporator With Vacum Pump At 45°C to dispose of the solvent and for obtaining dry matter until the residual volume of the extract became 50 ml (Harborne, 1973).

Aqueous extraction of Thevetia

Hundred gm of dry plant powder was crushed and placed in a 1000 ml glass beaker. distilled water was added to the glass beaker to cover the amount of the powder, it was 300 ml and its nozzle was tightly closed**.** The beaker containing the extract was shaken by electric shaker several times and then left for 72 hours with repeated shaking process from time to time. After shaking, the extract was filtered using a Buchner funnel and a piece of boring cloth, and then filtered again with the filter paper (Whatman No.1). Air discharged to get the pure solution without impurities. The extract was then placed in oven at 40 ° C until the sample was completely dry and the remaining volume was 50 ml. Alcohol and aqueous extracts were placed in sterile and labeled glass bottles and kept in the refrigerator at 4 ° C until used (Harborne, 1973; Khanzada *et al.*, 2006). The extraction was conducted at the Central Laboratory of the College of Agricultural Engineering Sciences - University of Baghdad.

Plastic House Experiment

The experiment was carried out in one of the greenhouses / Plant Protection Department / College of Agricultural Engineering Sciences / Baghdad University for the growing season 2018 – 2019, An area of 25 x 9 m as it was 25 m long and 9 m wide. Plowing, and smoothing operations were carried out and the plastic house was divided into 5 furrows, the distance between furrows and 70 cm. Drip water system was installed for watering and covered furrows with black polyethylene nylon, divided furrows into three replications each replicate contains four experimental units length of each 3 m. The seeds of sweet pepper var. Karisma were planted in the nursery on 25/7/2018, seedlings were transported from the nursery and planted in the plastic house on 9/9/2018, the distance between plants were 40 cm. Irrigation, weeding and fertilization were carried out weekly as recommended. The layout of the experiment was according to complete randomized design with three replications. The treatment was carried out with water and alcoholic extract of the Thevetia plant and the pesticide Ortus and spraying with distilled water only as control treatment on 18/11/2018. The number of mite stages was increasing and reach the

peak at this date. Water and alcoholic extracts at 6% concentration were used, Ortus 1 ml / L according to the recommended dose concentration. Samples were taken 10 leaves taken randomly / experimental unit and three replicates for each treatment. The leaves were placed in nylon bags marked for testing in the laboratory and for estimating relative efficiency, the equation of Henderson and Tilton (1955) was used. Readings were taken one day before spraying and 1, 3, 7, 10, 14, 21 days after treatment.

Results and Discussion

The results of the evaluation of the efficiency of alcoholic and aqueous extracts with Ortus pesticide showed that the superiority of alcoholic extract over aqueous extract with a significant difference at the stage of egg table 1, the relative efficiency rate was 80.38% and the lowest for aqueous extract was 75.94%, and the efficiency of the pesticide Ortus was 87.50%. The results also showed that there was impacts on the duration of the efficiency of the three treatments were all affected since the first day, but the effect began to clear after three days of treatment. The superiority of the alcoholic extract was observed, followed by the aqueous extract, whereas, the relative efficiency of pesticide Ortus was 87.67%. After seven days of treatment, the efficiency of the alcoholic extract was 87.67% and the aqueous extract was 86.33%. The comparative pesticide Ortus was 94.67%. On the tenth day of treatment, their efficacy rate was 97.00% and 92.00% for alcoholic and aqueous extract respectively, while the comparative pesticide Ortus was 99.00%. The superiority of the alcoholic extract continued after 14 and 21 days of treatment with relative efficiency of 99.33% and 100.00% respectively, while the aqueous extract was 95.33% and 97.67% respectively. In comparison, the comparative Ortus was 100.00% for samples taken after 14 and 21 days of treatment.

The results of table 2 showed the efficacy of the extracts on the larvae stage, the relative efficiency rates of alcoholic and aqueous extracts were 86.17%, 78.63% and significantly different. Whereas, the relative efficiency of pesticide Ortus was 90.33%. The alcoholic extract exceeded the aqueous extract with

Table 1: Relative efficiency of the extracts of the *Th. peruviana* on the egg of Broad mite *P.latus*.

The average	Percentage corrected after day treatment						Treatment
	21	14	10	7	3	1	
75.94	97.67	95.33	92.00	86.33	56.33	26.67	Aqueous Extract Eextract
80.38	100.00	99.33	97.00	87.67	64.67	35.00	Alcoholic Eextract
87.50	100.00	100.00	99.00	94.67	87.67	43.67	Ortus
	99.22	98.22	92.00	89.56	69.56	63.67	The average
LSD 0.05 Treatment × Days = 2.11			LSD 0.05 Days =1.22			LSD 0.05 Treatment =0.86	

Table 2: Relative efficiency of the extracts of the *Th. peruviana* on the larvae of Broad mite *P.latus*.

The average	Percentage corrected after day treatment						Treatment
	21	14	10	7	3	1	
78.63	97.67	94.67	86.33	77.67	62.67	53.00	Aqueous Extract Eextract
86.17	100.00	98.67	92.00	86.00	74.00	66.00	Alcoholic Extract
90.33	100.00	100.00	92.33	92.00	85.67	72.00	Ortus
	99.22	97.78	90.22	89.56	74.11	63.67	The average
LSD 0.05 Treatment × Days = 2.60			LSD 0.05 Days =1.50			LSD 0.05 Treatment =1.06	

Table 3: Relative efficiency of the extracts of the *Th. peruviana* on the nymph of Broad mite *P.latus*.

The average	Percentage corrected after day treatment						Treatment
	21	14	10	7	3	1	
80.39	98.33	95.00	89.33	78.00	66.67	55.00	Aqueous Extract Eextract
86.94	100.00	99.67	93.33	87.00	76.67	65.00	Alcoholic Extract
91.72	100.00	100.00	96.00	94.00	87.67	72.67	Ortus
	99.44	95.00	92.89	86.33	66.67	64.22	The average
LSD 0.05 Treatment × Days = 2.42			LSD 0.05 Days =1.40			LSD 0.05 Treatment =0.99	

Table 4: Relative efficiency of the extracts of the *Th. peruviana* on the adult of Broad mite *P.latus*.

The average	Percentage corrected after day treatment						Treatment
	21	14	10	7	3	1	
80.22	98.33	95.00	89.67	78.33	67.00	53.00	Aqueous Extract Eextract
87.22	100.00	99.67	93.00	87.33	77.33	66.00	Alcoholic Extract
91.78	100.00	100.00	98.33	95.00	84.33	73.00	Ortus
	99.44	98.22	93.67	86.89	76.22	64.00	The average
LSD 0.05 Treatment × Days = 2.07			LSD 0.05 Days =1.19			LSD 0.05 Treatment =0.84	

significant differences with an average efficiency of 74.00% and 62.67% respectively. The pesticide Ortus had an average efficiency of 85.67%. After seven days of treatment, the efficiency rate of alcoholic and aqueous extracts was 87.67% and 86.33%, respectively, The pesticide Ortus had an average efficiency of 94.67%. The efficacy of the extracts continued to affect the larva role as their efficacy on the tenth day of treatment was 92.00%, 86.33% for alcoholic extract and aqueous extract respectively, with significant differences, whereas the pesticide Ortus had an efficiency rate of 92.33%. The superiority of the alcoholic extract continued after 14 and 21 days of treatment with a efficiency of 98.67% and 100.00% respectively. The efficiency of the aqueous extract was 94.67% and 97.67% respectively. In comparison, the comparative Ortus was 100.00% for samples taken after 14 and 21 days of treatment.

The results of table 3 showed the efficacy of the extracts on the nymph stage, the relative efficiency rates of alcoholic and aqueous extracts were 86.94%, 80.39% respectively and significantly different. Whereas, the relative efficiency of pesticide Ortus was 91.72%. The results also showed that the effect of the extracts was from the first day of treatment but its effect was evident on the third day of treatment as the alcohol extract exceeded the aqueous extract 76.67% and 66.67% respectively. The relative efficiency of pesticide Ortus was 87.67%. On the seventh day, the efficiency of the extractors was 87.00% and 78.00% respectively, while the efficiency of the pesticide Ortus was 94.00%. On the tenth day, the efficiency of alcohol and aqueous extracts were 93.33% and 89.33% respectively, whereas for pesticide Ortus was 96.00%. The efficacy of the extracts continued after 14 and 21 days of treatment as they were 99.67% and 100.00% respectively for the alcoholic extract, while the aqueous extract was 95.00% and 98.33% respectively. In comparison, the pesticide Ortus was 100.00% efficacy for samples taken after 14 and 21 days of treatment.

The relative efficacy in the effect of alcoholic and aqueous extracts on the adult stage showed that their efficiency were 87.22% and 80.22% respectively (Table 4). The relative efficiency of the pesticide Ortus was 91.78%.

The results also showed that the effect of the extracts was from the first day of treatment but its effect was evident on the third day of treatment as the alcohol extract significantly exceeded the aqueous extract with relative efficiency of 77.33% and 67.00% respectively. The relative efficiency of pesticide Ortus was 84.6733%. On the seventh day of the treatment, the efficiency of the extracts was 87.33% and 78.33% respectively, while the efficiency of the pesticide Ortus was 95.00%. On the tenth day, the efficiency of alcohol and aqueous extracts were 93.00% and 89.67% respectively, whereas for pesticide Ortus was 98.33%. The efficacy of the extracts continued after 14 and 21 days of treatment as they were 99.67% and 100.00% respectively for the alcoholic extract, while the aqueous extract was 95.00% and 98.33% respectively. In comparison, the pesticide Ortus was 100.00% efficacy for samples taken after 14 and 21 days of treatment.

It is noted from these results that the extracts had an effect on all growth stages of the broad mites and the effect may be through contact and cause nervous shock or affect the functioning of the necessary enzymes responsible for an important biological process causing the metabolism to stop and then death, or the reason may be that Thevchia extracts contain secondary compounds such as Flavonoids, Glycosides and turbines Khan *et al.*, (1998), when using Thevchia seeds and leaves, found that they had a fatal effect on all growth stages of *confused flour beetle* (*Tribolium castaneum*), and all parts of the Thevchia plant contain many toxins, so it was used as a pesticide including insecticide, fungi, rodents and bacteria (Ambang *et al.*, 2005). The most important of these toxins are Thevetin A, B, Peruvoside, Nerrifolin, Thevetoxin and Rivoside (Gata-Gonçalves *et al.*, 2003; Save *et al.*, 2015). This is found by Kumar *et al.*, (2011) that high concentrations of Thevchia plant extracts have a role in reducing the incidence of adult tick infestation in farm animals when evaluating its efficacy on experiment animals. It was also found that Thevchia plant extracts work similar to the growth inhibitors, they had an impact on the lives of mosquito larvae in *Anopheles stephensi* and *Aedes aegypti*, the malaria parasite (Suresh *et al.*, 2013). The leaf extract of Thevetia plants has a fatal effect on adult of *Holotrichia serrata*, which has reduced the incidence of insect infection (Theurkar, 2014). It was also found that the leaf extract was effective in influencing the larval phases of *Aedes aegypti* mosquitoes, it was found that the mortality rate was high in the first, second, third and fourth larval stage and the pupa stage when using high concentrations of the extract (Sathish *et al.*, 2015). The pesticide Ortus effect is by contact, causing rapid neurological shock and has a role in inhibiting the transfer of electrons in cell mitochondria, it is therefore effective from the first days of the treatment. This is what Saadi (2017) found when using the pesticide Ortus in the field evaluation on the two-spot spider mite with Oberon and Abamactin pesticides, it showed high efficiency in mortality of all spider mite growth stages since the first day of treatment.

References

Al-Jubouri, I.J. (2000). The biology of fertilized and virgin females of the poetic wrist *Polyphagotarsonemus latus* (Banks) under different temperatures. *Journal of Iraqi Agriculture*, **5(7):** 100-105.

Jafar, S.A.R. (2017). Effect of number of spayind and foliar fertilizer Micronite 35 on growth and yield of pepper *capsicum annuum* L. in unheated greenhouse. *Journal of Iraqi Agricultural Sciences*, **48(1):** 248-255.

Central Organization for Statistics and Information Technology. 2015. Secondary crops and vegetables. Directorate of Agricultural Statistics. Ministry of Planning and Development Cooperation, Republic of Iraq.

Al-Ani, L.Q. (2004). Ecological and Biological Study of the broad mite *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) on potatoes in Central Iraq. Master Thesis. Department of Plant Protection College of Agriculture. University of Baghdad, 80.

Al-Saadi, A.E.A. (2017). Mechanism resistance of three zucchini varities to two-spot mite *Tetranychus urtiae* Koch (Acariformes: Tetranychidae) and the efficiency of some pesticides in combating it. Master Thesis. Department of Plant Protection College of Agriculture. University of Baghdad.

Oraibi, A.G. (2007). Effect of crude extract of *Melia azedarach* L. on *polyphagotarsonums latus* B. in vitro. Master Thesis, College of Science, Al - Nahrain University, 64.

Al-Mohammedi, F.M. and A.J.J. Meshaal (1989). Vegetable production. Ministry of Higher Education and Scientific Research. Baghdad University. College of Agriculture, 423.

Al-Naimi, K.T., H. Kazem, J. Al-Jubouri and H.I. Ali (2012). Population density and percent of infestation by the Eriophyid mite *Aceria ficus* (Cotte) (Acariformes: Eriophyidae) on figs and its control by plant extracts in vitro. *Journal of Iraqi Agricultural Sciences*, **43(5):** 69-76.

Ambang, Z., D.J. Ngoh, B. Ndongo and B. Djile (2005). Effect des extraits bruts des graines du laurier jaune (*Thevetia peruviana* Pers) sur les charançons (*Sitophilus zeamais* Motsch), ravageurs des stocks. In: Omokolo ND (ed). Yaounde: Cameroon.

Ashraf, A.M., A.M. Taha, A.R.I. Hanafy and G.M. Hassan (2011). Biology and control of the broad mite *Polyphagotarsonemus latus* (Banks, 1904) (Acari: Tarsonemidae). *International Journal OfEnvironmental Science and Engineering (IJESE)*, **1:** 26 -34.

Bhattacharjee, S. and Rahman (2017). Screening of certain chilli germplasm against yellow mite, *Polyphagotarsonemus latus* (Banks). *Internat. J. Plant Protec*., **10(2):** 320-323, DOI :10.15740/HAS/IJPP/ 10.2/320-323.

Britto, A.J.D. and D.H.S. Gracelin (2011). Screening of a Few Flowers for their Phytochemical Constituents. *Life Sci. Leaflets*., **20:** 866-871.

Gata-Gonçalves, L., J.M. Nogueira, O. Matos and R. Bruno de Sousa (2003). Photoactive extracts from *Thevetia peruviana* with antifungal properties against *Cladosporium cucumerinum*. *Journal of Photochemistry and Photobiology Biology*, **70(1):** 51-4.

Gerson, U. (1992). Biology and control of the broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae). *Exp. Appl. Acarol*., **13:** 163-178.

Grinberg, M., R. Perl-Treves, E. Palevsky, I. Shomer and V. Soroker (2005). Interaction between cucumber plants and the broad mite, *Polyphagotarsonemus latus*: from damage to defense gene expression. *Entomologia Experimentalis et Applicata*, **115:** 135-144.

Harborne, I.B. (1973). Phytochemical methods A guide to modern techniques of plant analysis. 2nd Edition, Chapman and Hall, London, 279.

Henderson, C.F. and E.W. Telton (1955). Test with acaricides against the brown wheat mite. *J. Econ. Entomol*., **48:** 157-161.

Khan, A.R., A. Khatun, R. Sultana and M.N. Islam (1998). Toxicity of *Thevetia peruviana* seed extracts on *Tribolium castaneum* (Herbst) adults. *Tribolium Inf Bull.*, **38:** 271-274.

Khanzada, Sh. A., Sh M. Iqbal and A. Akram (2006). In vitro efficacy of plant leaf extracts against Sclerotium rolfsii Saac. *Mycopath*., **4(1):** 51-53.

Kumar, A., S. Singh, K. Mahour and V.S. Vihan (2011). InVitro and in vivo Acaricidal activity of some indigenous plants under organized and farmer flock. *Pharmacologyonline*, **3:** 361-369.

Kumar, P., K. Pankaj, G. Jasmin, S. Prabodh and P. Rakesh (2012). Pharmacognostic and Preliminary Physiochemical Investigations of *Thevetia peruviana* (Pers.) K. Schum. *Flowers IJRPS*, **2(1):** 100-108.

Monteiro, B.V.M.G.C., J.E.M. Gondim, H.A.A. Olivera, Siqueira and J.M. Sousa (2015). Monitoring *Tetranychus urticae* Koch(Acari : Tetranychidae) resistance to abamectin in vineyards in the Lower Middle Sao Francisco Valley. *Crop Protection*, **69:** 90-96.

Moraes, G.J. and C.H.W. Flechtmann (2008). Manual de Acarologia – Acarologia básica e ácaros de plantas cultivadas no Brasil. Ribeirão Preto: Ed. Holos., 308.

Patil, H.S. R., H.K. Makari and H. Gurumurthy (2007). In vitro antimicrobial activity of ethanol extract of *Thevetia peruviana* Electr. *J. Environ. Agric. Food Chem*., **6:** 2318-2322.

Patrick,G., Kareru, J.M. Keriko, G.M. Kenji and A.N. Gachanja (2010). Anti-termite and antimicrobial properties of paint made from *Thevetia peruviana* (Pers.) Schum. oil extract. *Afr. J. Pharm. Pharmacol.*, **4(2):** 87- 89.

Peña, J.E. and C.W. Campbell (2005). Broad mite. University of Florida, Institute of Food and Agricultural Sciences. Fact sheet ENY–618.

Rattanatip, J., N. Siri and A. Chandrapatya (2013). Relationship of broad mite population and effectiveness of predatory mite to leaf curl symptoms of Chilli. *Thai. Journal of Agricultural Science*, **46:** 191-199.

Save, S.A., R.S. Lokhande1 and A.S. Chowdhary (2015). Determination of 1, 2-Benzenedicarboxylic acid, bis (2-ethylhexyl) ester from the twigs of *Thevetia peruviana* as a Colwell Biomarker. *JIPBS*, **2:(3):** 349-362.

Suresh, Y.S.P. Singh and P.K. Mittal (2013). Toxicity of *Thevetia peruviana* (yellow oleander) against larvae of *Anopheles stephensi* and *Aedes aegypti* vectors of malaria and dengue. *Journal of Entomology and Zoology Studies*, **1(6):** 85-87.

Sathish, V., S. Umavathi, Y. Thangam and R. Mathivanan (2015). Analysis of phytochemical components and larvicidal activity of *Thevetia peruviana* against the chickungunya vector *Aedes aegypti* (L). *Int. J. Curr. Microbiol. Appl. Sci*., **4:** 33-39.

Theurkar, S.V., S.B. Patil, M.K. Ghadage, D.N. Birhade and A.N. Gaikwad (2014). Investigation on effect of *Thevetia peruviana* Pers on the mortalty of *Holotricha serrata* (Fab) adult (Coleoptera : Scarabaiedae. *Res. J. Pharm.*, **5(3):** 212 -214.