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Evaluation of Botanicals Against Leafhopper, *Empoasca Kerri* (Pruthi) on Greengram

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Abstract

Greengram (*Vigna radiate* L.) is a major source protein and plays a vital role in a balanced diet. The experiment conducted at Agriculture Research Farm, School of Agriculture, Lovely Professional University to screen botanicals against leafhopper, *Empoasca kerri* on greengram during the summer season of 2018. The present experiment resulted that the incidence of *E. kerri* started from 17th SMW and reached a peak in 21st SMW during the summer season. Environment factors like temperature, minimum relative humidity and maximum wind speed had exhibited statistically non-significant positive correlation and the rest of the factors (maximum relative humidity, minimum wind speed and rainfall) showed a negative correlation with leafhopper population. Application of thiomethaxam 25WG @ 0.004% was found significantly effective in leafhopper population decline at both sprayings. Among the botanicals, neem oil @ 3% and madar leaf extract @ 3% also had the potential to control leafhopper population of greengram. Botanical oils and extracts can be used in combination with low concentration of synthetic insecticides to reduce chemical pressure.

Key words: Botanicals, thiomethaxam 25WG, leaf extracts, leafhopper

Introduction

Greengram (*Vigna radiate L.*) is one of the important members in pulses belongs to family Fabaceae which commonly cultivated in summer season (Kahraman *et al.* 2014). Many species of insect pests damage to greengram crop and classified as sucking pest, pod feeders, foliage feeders, stem feeders and storage feeders based on their feeding appearance among these sucking pest are causes more damage the crop. They suck the sap which affects photosynthesis process of plant and reduce the vigour but also transmit the diseases (Hossain, 2010). In field condition, 60-64 insects were reported on mungbean among theses leaf hopper (*Empoasca kerripurthi*), spotted caterpillar (*Maruca testulalis* Geyer), bihar hairy caterpillar (*Diacrisia obliqua* WIK), galerucid beetle (*Mdhurasia obscurella Jacoby),* whitefly (*Bemesia tabaci* Genn), lycaenid borer, (*Euchrysops cnezus* Fabr), stemfly (*Ophiomyia*

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(*Melanagromyza*) *phaseoli* (Tryon) and Black aphid (*Aphis craccivora* Koch) considered as harmful and major pests (Lal, 2008; Beeraganni, 2012). Estimated an average percent yield loss due to broad mite (85%), white fly (84%), podbugs (89%), bean flower thrips (75%), spotted pod borer (50%) and blister beetle (36%) however unfavourable environmental condition also responsible for yield loss (Kabir *et al.*, 1996; Beeraganni ,2012; Duraimurgan and Tyagi, 2014). The economic crop loss in potato was 54 % (Johnson et al., 1986) 26% in soyabean (Nasruddin et al., 2014), 48.57% in groundnut (Dabhade et al., 2012), 10% in pegionpea (Rachappa et al.,2018) due to major insect pests including leafhopper (*Empoasca* spp.).

Farmers are solely depends on synthetic pesticides due to easily available in local market and quick response but did not considered its disadvantages like outbreak of secondary pests, declining of natural enemies, polluting environment and health hazard to human, aquatic life, bird, animal, natural enemies and pollinator (NRC 2000; Perry *et al.*, 1998). As per global demand, the acceptability of bio-pesticides application in the agriculture field gradually increases due to zero residues in crops, quick degradation and eco-friendly. About 350 insecticidal compounds that act feeding deterrent and growth inhibitors to more than 800 insects had been received by different plant species (Raghavendra *et al.* 2016) which maintain the sustainability of agriculture ecosystem. Many researchers were reported that the application of bio-pesticides (Iqbal *et al.,* 2015; Singh *et al.*,2010; Malagatti *et al*., 2014; Kalinkar *et al*., 2014) as well as natural enemies (Wahegbam et al., 2018) had potential to minimize pest population and safe to environment. Therefore, the current research was intended to evaluate botanical extracts and oil concentration for sustainable management of leafhopper, *Empoasca kerri*.

Materials and methods

An experiment conducted at Agriculture Research Farm, School of Agriculture, LPU during 2017-18 to evaluate botanicals against leafhopper of mungbean. A mungbean cultivar TMT-37 was grown in field condition in the 2^{nd} week of March. The experiment arranged in RBD with seven treatments including a control plot replicated four times. Application of synthetic chemical, botanical oils and leaf extracts considered as treatments of experiments viz. T_1= Neem oil @ 3%, T_2= Karanj oil @ 3%, T_3= Eucalyptus oil, T_4= datura leaf extract, T_5= Madar leaf extract, T_6= Thiamethoxam 25 WG @ 0.04% and T_7= untreated. Dried leaves were grinded with the help of electric grinding machine to make in fine powder and then kept

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overnight in water and the required amount leaf extracts were used in experiments. Data were recorded from randomly selected five plants from trifoliate leaves (upper, lower and middle level) from each treatment at before and after (1, 3, 5, 7 and 15 days) spraying. The count data of insect pest were subjected to square root transformation before analysis as for normalized the data. Necessary analysis like ANOVA and correlation was done by SPSS of statistical packages (22.0 version).

Result

Total fourteen arthropods were observed during present investigation of crop period. Among these ash weevil (*Myllocerus spp.*), bean fly (*Ophiomyia phaseoli*), black vine weevil (*Otiorhynchus sulcatus*), red cotton bug (*Dysdercus spp.*), blue butterfly (*Lampidae boeticus*), squash bug (*Cletus spp.*), whitefly (*Bemisia tabaci*), pod borer (*H. armigera*), green stink bug (*Nezara viridula*), and jassids (*Emposca kerri*) were observed in present study and caused damage to mungbean at different crop stage. In beneficial insects, lady bird beetle (*Coccinella septempunctata* and *C. transversalis*), spider, wasp (*Braconid* spp.), and honey bee (*Apis mellifera*) were recorded during research period.

An average leafhopper population ranged from 1.84 – 27.12 with overall mean was 18.06 per five plants. The incidence started from 17th SMW and reached the peak in 21st SMW (Fig. 1). Positive correlation exhibited with maximum (r=0.198) and minimum (r=0.281) temperature, minimum relative humidity (r=0.108), minimum wind speed (r= 0.750) found positive correlation while maximum relative humidity (r= -0.033), minimum wind speed (r = -0.306) and rainfall (r= -0.046) were observed negative correlation with leafhopper population (Fig 1).

At first spraying the leafhopper population ranged from 8.55 to 19.55, 13.20 to 21.40, 12.45 to 20.55, 10.70 to 20.20, 9.80 to 19.90, 7.30 to 20.20 and 20.10 to 29.54 per five plant in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 respectively (Table 1). Average population of leafhopper ranged from 7.65 to 18.25, 11.25 to 18.15, 10.65 to 20.60, 10.00 to 18.75, 9.60 to 20.00, 6.20 to 19.80 and 15.80 to 22.25 per five plants in T_1, T_2, T_3, T_4, T_5, T_6 and T_7 respectively after second spraying (Table 2). Applications of all the treatments during the first and second spray were found statically significant ($p<0.05\%$) in declining the pest population. Thiamethoxam 25 WG @ 0.004% was found superior for reduction the population of leafhopper of mungbean. Among the botanical insecticides, neem oil @ 3% was found most effectively controlled of leafhopper pest population followed by madar leaf extract @ 3%, datura leaf extract @ 3%, eucalyptus oil @ 3% and karanj oil @ 3%. Among the oils, neem oil @ 3%

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was found superior than other oil application while madar leaf extract @ 3% was found most effective among the leaf extract treatments against leafhopper population.

Maximum population (47.72% and 58.18%) of leafhopper was reduced in application thiamethoxam 25 WG @ 0.004% while minimum (27.78% and 22.89%) population declined over control by karanj oil @3% after first and second spraying respectively (Fig 2 and 3). The treatments were arranged in descending order of its effectivity Thiamethoxam 25 WG @ 0.004% > Neem oil @ 3% >Madar leaf extract @ 3 % >Datura leaf extract @ 3% > Eucalyptus oil @ 3% >Karanj oil @ 3% at first spraying (Fig 2) and similar trends found in second spraying (Fig 3).

Discussion

Greengram is one of the important pulses crops and its yield are greatly decreased by the complex effect of biotic and abiotic factors of which biotic like insect pest, diseases and others are important. An estimated 200 insect pests (Talekar, 1990), 60 (Beeraganni, 2012) and 64 (Lal, 2008) belong to different insect orders reported in the different agro-climatic zone. In the present study, a total of ten pests (*Myllocerus spp.*, *Ophiomyia phaseoli*, *Otiorhynchus sulcatus, Dysdercus spp., Lampidae boeticus*, *Cletus spp.*, *Bemisia tabaci*, *Helicoverpa armigera*, *Nezara viridula and Emposca kerri*) were recorded from mungbean cv. TMT37 crop during *kharif* season and considered as a major pest. A total ten insect pests and three natural enemies were found colonizing the mungbean crop in Chaheru, Jalandhar. Population dynamics is one of the major factors to understand pest fluctuation which helps in the execution of a successful management strategy. In the present study, leafhopper incidence was started from 17th SMW which remained up to 23rd SMW and the population reached a peak at 21st SMW during kharif season. Results are in agreement with Kumar et al., (2016) who stated that the population of leafhopper incidence started from 15th SMW and peak intensity reached 20th SMW during the summer season. In the present experiment, all abiotic factors were found a statistically non-significant effect on leafhopper population. Results are in agreement with Kumar et al., (2016) who stated that the leafhopper population had found positive correlation with temperature and negative correlation with rainfall and humidity during summer season at Jabalpur, MP. Bairwa and Singh (2017) who reported that the all abiotic factors were statistically non-significant correlation with jassid population during kharif season at UP. Contrast result revealed that the peak activity reached 37th SMW and leafhopper population exhibited negative correlation

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with temperature and positive correlation with rainfall during kharif season at Banaras, Utter Pradesh (Kumar and Singh,2016) and Bikaner, Rajasthan (Veer et al., 2016). Thiamethoxam 25 WG @ 0.004% was found statistically superior in the decline of population of leafhopper. Present result in agreement with Yadav et al., (2015); Beeraganni, (2012) who found most effective in reduction of leafhopper with different concentrations of Thiamethoxam 25 WG. Among the botanical insecticides, neem oil @ 3% was found most effectively reducing leafhopper population followed by madar leaf extract @ 3%, datura leaf extract @ 3%, eucalyptus oil @ 3% and karanj oil @ 3%.). Iqbal et al., (2015) stated that the plant extracts possess significant potential toxicity against sucking pests. Karaj oil act as synergist as well as compatible with organophosphate insecticide which implied a significant role in pest management (Kalinkar et al., 2014)

Conclusion:

The overall concluded that from this study that the botanical oil (Neem oil, Eucalyptus oil, and Castor oil) and extract (Neem leaf extract, Datura leaf extract and Madar leaf extract) had potential for reducing the pest population. These botanicals could be used as an alternative way of chemical management practices which reduced chemical consumption.

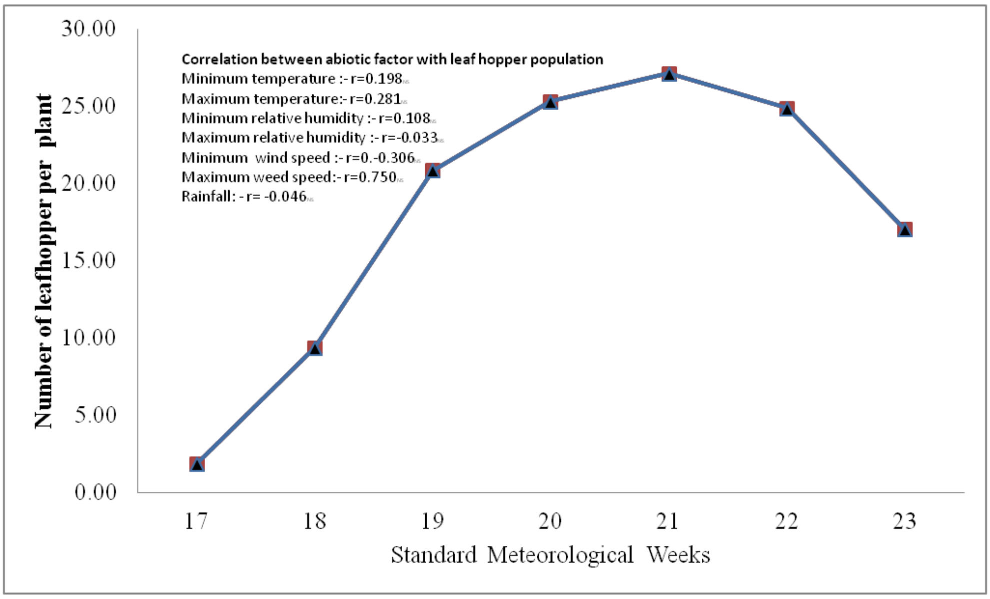

Fig 1: Population dynamics of leafhopper and its Pearson correlation with abiotic factors

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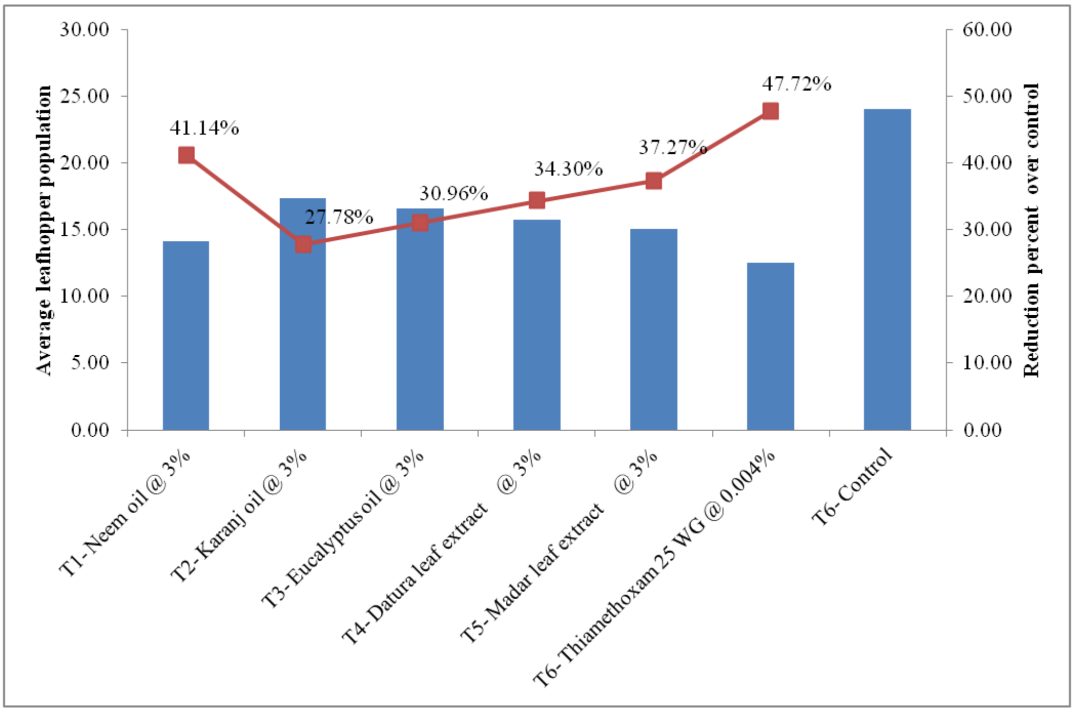

Fig 2: Average leafhopper population and reduction percentage over control at first spraying.

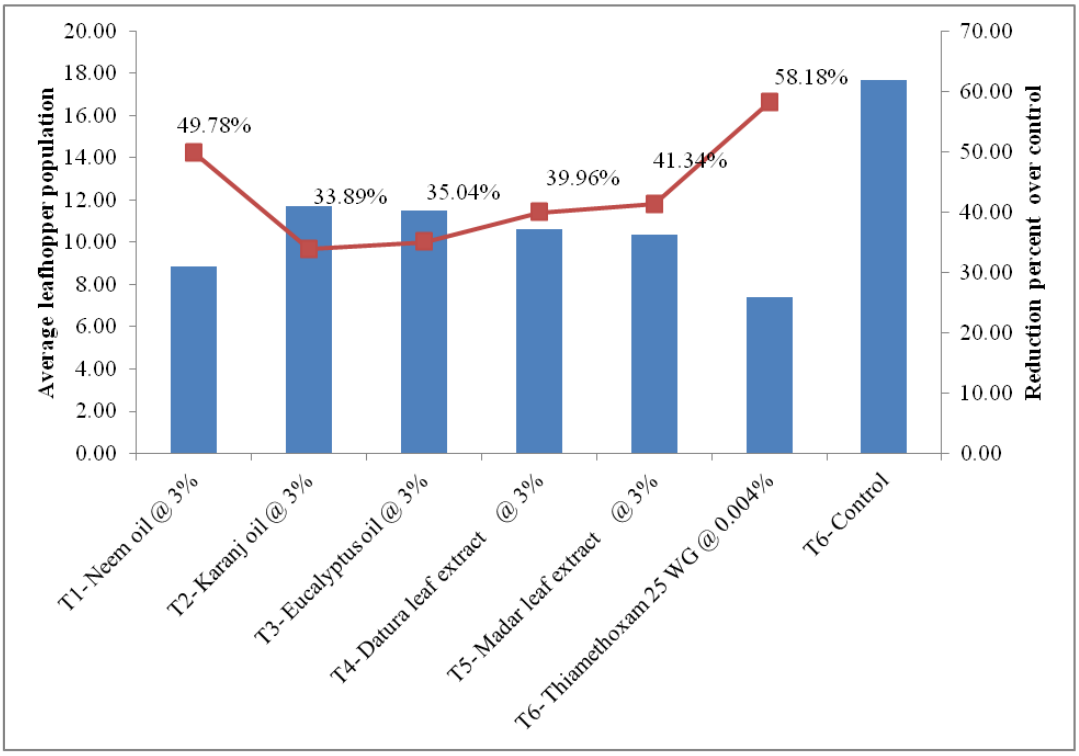

Fig 2: Average leafhopper population and reduction percentage over control at second spraying.

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Table 1- Effect of biorational insecticides against leafhopper on mungbean cv. TMB 37 during summer 2018 (First spray).

Treatments	Number of leafhopper per five plant						
	24 hr before Treatments	1DAT	3DAT	5DAT	7DAT	10DAT	15DAT
T_1- Neem oil @ 3%	19.55 (4.48)*	16.85 (4.16)	14.00 (3.80)	10.80 (3.36)	8.55 (3.00)	10.05 (3.24)	19.05 (4.42)
T_2- Karanj oil @ 3%	20.15 (4.54)	19.70 (4.49)	17.65 (4.26)	14.80 (3.91)	13.20 (3.70)	14.40 (3.86)	21.40 (4.68)
T_3- Eucalyptus oil @ 3%	19.20 (4.44)	19.05 (4.42)	16.85 (4.16)	14.55 (3.88)	12.45 (3.60)	13.30 (3.71)	20.55 (4.58)
T_4- Datura leaf extract @ 3%	20.20 (4.55)	18.20 (4.32)	16.45 (4.12)	13.60 (3.75)	10.70 (3.35)	11.50 (3.46)	19.70 (4.49)
T_5- Madar leaf extract @ 3%	19.90 (4.51)	17.30 (4.22)	15.35 (3.98)	12.55 (3.61)	9.80 (3.21)	11.70 (3.49)	18.75 (4.38)
T_6- Thiamethoxam 25 WG @ 0.004%	20.20 (4.55)	14.30 (3.84)	10.65 (3.34)	8.40 (2.98)	7.30 (2.79)	9.60 (3.18)	17.35 (4.22)
T_7- Control	20.10 (4.54)	20.70 (4.60)	21.75 (4.72)	23.80 (4.93)	25.05 (5.05)	27.10 (5.25)	29.45 (5.47)
SEm (±)	0.073	0.048	0.069	0.078	0.081	0.087	0.129
CD ($p<0.05$)	-	0.141	0.205	0.231	0.240	0.259	0.384

*figure in parenthesis to square root transformation, DAT- days after treatments

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Table 2- Effect of biorational insecticides against leafhopper on mungbean cv. TMB 37 during summer 2018 (Second spray).

Treatments	Number of leafhopper per plant					
	24 hr before Spraying	1DAT	3DAT	5DAT	7DAT	10DAT
T_1- Neem oil @ 3%	18.25 (4.41)*	15.75 (4.03)	13.40 (3.71)	10.55 (3.32)	8.70 (3.03)	7.65 (2.85)
T_2- Karanj oil @ 3%	19.70 (4.49)	18.75 (4.39)	18.40 (4.34)	14.05 (3.81)	12.20 (3.56)	11.25 (3.43)
T_3- Eucalyptus oil @ 3%	20.6 (4.70)	17.95 (4.29)	18.10 (4.31)	14.20 (3.81)	12.30 (3.57)	10.65 (3.34)
T_4- Datura leaf extract @ 3%	18.75 (4.50)	17.00 (4.18)	16.90 (4.17)	12.90 (3.66)	10.75 (3.35)	10.00 (3.24)
T_5- Madar leaf extract @ 3%	20.00 (4.64)	16.30 (4.09)	16.70 (4.15)	12.50 (3.60)	10.75 (3.35)	9.60 (3.18)
T_6- Thiamethoxam 25WG @ 0.004%	19.80 (4.61)	13.80 (3.78)	10.55 (3.32)	8.50 (3.00)	7.15 (2.76)	6.20 (2.59)
T_7- Control	22.25 (5.47)	24.15 (4.96)	26.05 (5.14)	27.90 (5.33)	20.60 (4.59)	15.80 (4.04)
SEm (±)	0.131	0.102	0.126	0.107	0.068	0.051
CD ($p<0.05$)	-	0.302	0.374	0.317	0.202	0.153

*figure in parenthesis to square root transformation, DAT- days after treatments

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References:

Beeraganni M. K (2012). Population dynamics and chemicals control of insect pest of mungbean, *M.Sc thesis submitted to Agricultural Entomology Department, N. M. College of Agriculture, Gujarat Agricultural University*. p-127.

Dabhade P. L., Bapodra J. G., Jethva R. T., Rathod R. T. and Dhabi M. V. (2012). Estimation of yield losses due to major insect pests of groundnut in Gujarat. Legume Res., 35(4): 354-356.

Duraimurugan, P. and Tyagi, K. (2014). Pest spectra, succession and its yield losses in mungbean and urdbean under changing climate scenario. *Agricultural Research Communication Centre*, 37(**2**):212-222.

Iqbal, J., Ali, H., Hassan, M. W. and Jamil, M. (2015). Evaluation of indigenous plant extracts against sucking insect pests of okra crop. *Pakistan Entomologist*, 37(**1**): 39-44.

Johnson K. B., Radcliffe E. B. and Teng P. S. (1986). Effect of interacting populations of Alternaria soloni, Verticillium dahliae, and the potato leafhopper (Empoasca fabae) on potato yield. Phytopathol., 76: 1046-1052.

Kabir, K. H., Baksh, M. E., Rouf, F. M. A., Karim, M. A. and Ahmed, A. (1996). Insecticide usage pattern on vegetables at farmers' level of Jossore region in Bangladesh: A survey finding. *Bangladesh Journal of Agricultural Research*, 21(**2**): 241-254.

Kalinkar, A. S., Raut, A. M. and Undirwade, D. B. (2014). Effect of Synergist in Combination with Organophosphate against *Helicoverpa armigera* Hubner of Different Strain. *Trends in Biosciences.* **7**(18): 2719-2722.

Kumar, D., Shukla, A. and Bondre, C.M., (2016) Succession and Incidence of Insect Pest on Green gram (*Vigna radiata* L. Wilzek) during Summer Season. *Advances*, 5(5); 1782-1784.

Kumar, M. and Singh P.S. (2016) Population dynamics of major insect pest of blackgram [*Vigna Mungo* (L.) Hepper] in relation to weather parameters. *International Journal of Agriculture, Environment and Biotechnology*. : 9(4): 673-677. DOI 10.5958/2230-732X.2016.00088.7

Lal, S.S. (2008) A review of insect pests of mungbean and their control in India. *Tropical Pest Management*, 31(**2**): 105-114.

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Malagatti, S.Y., Undirwade, D. B., Raut, A. M. and Bagade, A. B. (2014) Biorational management of churda murda disease vectors on Chilli. *Journal of Plant Disease Sciences.* **9** (2):219-225.

Nasruddin A., Abdul F., Muhammad S. B. and Ahwiyah E. S. (2014) Potential damages, seasonal abundance and distribution of Empoasca terminalis Distant (Homoptera: Cicadellidae) on soybean in South Sulawesi. Indonesian. J. Entomol., 11(2): 93-102.

National Research Council. (2000). *The future role of pesticides in US agriculture*. *National Academies Press*, p 301.

Perry, A. S., Yamamoto, I., Ishaaya, I. and Perry, R. Y. (1998) Insecticide in agriculture and Environemnt Retrospects and prospects Berlin: *Springer Verlag*, p261.

Rachappa, V., Yelshetty, N. and Yelshetty, S. (2018) Assessment of crop loss due to leafhopper,(Empoasca kerri Pruthi) in pigeonpea. *Legume Research: An International Journal*, *41*(1); 155-158.

Raghavendra, K. V., Gowthami, R., Leperkshi, N. M., Dhananivetha, M. and Shashank, R. (2016) Use of botanicals by farmers for integrated pest management of crops in Karnatka. *Asian Agri-History,* 20(**3**): 73-180.

Singh, G., Dhaka, S. S., Ali, N., Arvind, Y. and Singh, R. (2010) Efficacy of insecticides and bio-pesticides against *Helicoverpa armigera* on *Vigna mungo*. *Annals of Plant Protection Sciences*, 18(**1**):225-227.

Talekar, N. S. (1990) Agromyzid flies of food legumes in the tropics. Wiley Eastern Limited, New Delhi.

Veer, S. and Keshav, M. (2016) Population dynamics of major sucking pests of green gram, *Vigna radiata* (L.) Wilczek. *Journal of Experimental Zoology, India*, *19*(2), 1043-1046.

Wahengbam, J., Raut, A.M., Mandal, S.K and A Najitha Banu (2018) Efficacy of new generation insecticides against *Trichogramma chilonis* Ishii and *Trichogramma pretiosum* Riley. *Journal of Entomology and Zoology Studies*. **6** (1): 1361-1365.

Yadav, S.K., Patel, S., Agnihotri, M. and Bisht, R.S. (2015) Efficacy of insecticides and bio-pesticides against sucking pests in Black gram. *Annals of Plant Protection Sciences*, *23*(2), 223-226.