Evaluation of certain organic nutrient sources against mealy bug, *Coccidohystrix insolitus* (Green.) and the spotted leaf beetle, *Epilachna vigintioctopunctata* Fab. on Ashwagandha, *Withania somnifera* Dunal.

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ABSTRACT

Ashwagandha is considered as an important medicinal crop in Indian system of medicine. Ashwagandha suffers attack by several insect pests. The mealy bug, *Coccidohystrix insolitus* (Green.) and spotted leaf beetle, *Epilachna vigintioctopunctata* Fab. are found to be the key pests. Since Ashwagandha is a herbal medicine, application of synthetic chemicals leads accumulation of toxic residues. Field experiments were conducted with application of farmyard manure (FYM) (12.5 t/ha) + Azophos (2 kg/ha) + neem cake (1000 kg/ha) and need based foliar application of neem oil (3%) were found to be very effective in reducing the incidence of mealy bug and the damage of spotted leaf beetle.

Key words: Ashwagandha, *Epilachna vigintioctopunctata*, *Coccidohystrix insolitus,* eco-friendly pest management.

INTRODUCTION

Ashwagandha or Asgandh (*Withania somnifera* Dunal.) is considered an important medicinal plant. It is extensively exploited in Indian system of medicine. This solanaceous plant belongs to the genus *Withania,* which includes 23 species, of which *Withania somnifera* and *Withania coagulans* are the two species found in India that have high medicinal value. It is a household remedy and is commonly known by various local names as Ashwagandha in Sanskrit, Asgandh in Hindi, Amukkiran or kizhangu in Tamil and Winter cherry in English. It is used as a tonic in geriatrics, being efficacious in relieving hand and limb tremors of people at old age (Atal *et al.*, 1975). It has been equated to ginseng (*Panax ginseng*) of China and is popularly known as the "Indian Ginseng". The most important pharmacological use of Ashwagandha is as adaptogen with antistress antioxidant, antitumor, anti-inflammatory, mind boosting and has rejuvenating properties (Singh *et al.*, 1990).

Ashwagandha is devastated by an array of insect pests, of which *Epilachna vigintioctopunctata* F. damages the foliage heavily (Mathur and Srivastava, 1964; Parjhar *et al.*, 1997; Patra *et al.*, 2004). A study conducted in 2003 in Gurah Bramana, Kotgarhi, Rakh and Tanda, Jammu and Kashmir, India on Ashwagandha (*W. somnifera*) revealed the infestation of mango mealy bug, *Drosicha mangiferae* (Margarodidae : Hemiptera) on the foliage (Bhagat, 2004). White and waxy-coated nymphs and adults of *Coccidohystrix insolitus* (Pseudococcidae: Hemiptera) infest lower side of leaves in colonies and desap profusely (Jhansi Rani, 2001). Hence, considering its medicinal property and commercial value with rapid expansion of drug industries there is an urgent need to develop eco-friendly management practices to control the various pests devastating Ashwagandha to obtain insecticidal residue free herbal products.

MATERIALAND METHODS

The field trial was conducted at the orchard of Agricultural College and Research Institute, Madurai with Jawahar variety. All the Agronomic practices were adopted uniformly for all the treatments, the details of treatments are as follows: T_1- FYM (12.5 t/ha) + Azophos (2 kg/ha) + Neem cake (1000 kg/ha), T_2- FYM (12.5 t/ha) + Azophos (2 kg/ha) + Mahua cake (1000 kg/ha), T_3- FYM (12.5 t/ha) + Azophos (2 kg/ha) + Neem cake (1000 kg/ha) + Neem oil (3%), T_4- FYM (12.5 t/ha) + Azophos (2 kg/ha) + Mahua cake (1000 kg/ha) + Neem oil (3%), T_5- FYM (50%) + Azophos (2 kg/ha) + NPK (50%) + Neem cake (50%), T_6 - FYM (50%) + Azophos (2 kg/ha) + NPK (50%) + Mahua cake (50%), T_7 - FYM (50%) + Azophos (2 kg/ha) + NPK (50%) + Neem cake (50%) + Neem oil (3%), T_8 - FYM (50%) + Azophos (2 kg/ha)+ NPK (50%) + Mahua cake (50%) + Neem oil (3%), T_9 - NPK + Botanical (neem oil 3%), T_{10} - NPK + Malathion (2ml / litre), T_{11} - NPK alone (90:50:50 kg/ha), and T_{12} - Untreated control.

The treatment were replicated in randomized block design, the variety being Jawahar. Farmyard manure (FYM) with computed quantity was applied basally at the time of main field preparation in the respective treatments. The biofertilizer *viz.*, Azophos @ 2 kg/ha was incorporated to the soil in the respective treatments. Half of the dose of

Table 1. Effect of organic sources of nutrients and botanical on *Epilachna* beetle damage (%) (DA) and per cent reduction over NPK (PR) on Ashwagandha

Treatments	Days After Transplanting															
	15		25		35		45		55		65		75		Mean	
	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR
T_1	1.25 (6.41)^{a}	72.40	2.34 (8.79)^{a}	73.79	3.75 (11.16)^{d}	71.04	4.40 (12.10)^{cd}	70.37	5.01 (12.93)^{c}	71.33	3.74 (11.15)^{c}	70.43	2.94 (9.87)^{d}	70.12	3.35 (10.54)^{cd}	71.12
T_2	1.39 (6.77)^{a}	69.31	2.76 (9.56)^{a}	69.09	3.91 (11.40)^{d}	69.80	4.58 (12.35)^{d}	69.15	5.12 (13.07)^{c}	70.72	3.92 (11.41)^{cd}	69.01	3.10 (10.14)^{d}	68.49	3.54 (10.84)^{cd}	69.48
T_3	1.28 (6.49)^{a}	71.74	2.35 (8.81)^{a}	73.68	1.98 (8.08)^{a}	84.71	2.28 (8.68)^{a}	84.46	2.65 (9.36)^{a}	84.83	2.10 (8.33)a	83.39	1.72 (7.53)^{a}	82.52	2.05 (8.23)^{a}	82.32
T_4	1.43 (6.86)^{a}	68.43	2.78 (9.59)^{a}	68.86	2.32 (8.76)^{ab}	82.08	2.64 (9.35)^{ab}	82.22	3.22 (10.33)^{ab}	81.57	2.31 (8.74)^{ab}	81.73	1.96 (8.04)^{ab}	80.08	2.38 (8.81)^{ab}	79.48
T_5	2.18 (8.49)^{b}	51.87	4.26 (11.91)^{b}	52.29	5.62 (13.71)^{e}	56.60	6.37 (14.61)^{e}	57.10	6.75 (15.05)^{d}	61.38	4.87 (12.74)^{de}	61.50	3.93 (11.43)^{e}	60.06	4.85 (12.72)^{ef}	58.18
T_6	2.40 (8.91)^{b}	47.01	4.65 (12.45)^{b}	47.92	6.59 (14.87)^{e}	49.11	6.58 (14.86)^{e}	55.69	7.16 (15.52)^{d}	59.03	5.26 (13.25)^{e}	58.41	4.12 (11.71)^{e}	58.13	5.25 (13.24)^{f}	54.74
T_7	2.29 (8.70)^{b}	49.44	4.29 (11.95)^{b}	51.95	3.20 (10.30)^{bcd}	75.28	3.22 (10.33)^{ab}	78.31	3.82 (11.27)^{abc}	78.14	2.74 (9.52)^{ab}	77.94	2.30 (8.72)^{abc}	76.62	3.12 (10.17)^{bc}	73.10
T_8	2.42 (8.94)^{b}	47.03	4.60 (12.38)^{b}	48.48	3.28 (10.43)^{cd}	74.67	3.36 (10.56)^{bc}	77.37	4.10 (11.68)^{bc}	76.54	3.68 (10.10)^{bc}	75.62	2.47 (9.04)^{bcd}	74.89	3.32 (10.49)^{c}	71.37
T_9	4.29 (11.95)^{cd}	5.29	8.82 (17.27)^{c}	1.23	3.34 (10.53)^{d}	74.20	3.42 (10.65)^{bcd}	76.96	4.18 (11.79)^{bc}	76.08	3.14 (10.20)^{bc}	75.17	2.49 (9.07)^{bcd}	74.69	4.24 (11.88)^{de}	63.44
T_{10}	4.24 (11.88)^{cd}	6.40	8.65 (17.10)^{c}	3.13	2.39 (8.84)^{abc}	81.54	2.72 (9.49)^{ab}	81.68	3.32 (10.49)^{ab}	81.00	2.39 (8.89)^{ab}	81.10	2.04 (8.21)^{ab}	74.26	3.67 11.04)^{cd}	68.36
T_{11}	4.53 (12.28)^{d}	-	8.93 (17.38)^{c}	-	12.95 (21.09)^{f}	-	14.85 (22.66)^{f}	-	17.48 (24.71)^{e}	-	12.65 (20.83)^{g}	-	9.84 (18.28)^{g}	-	11.60 (19.91)^{g}	-
T_{12}	3.74 (11.15)^{c}	17.43	8.08 (16.51)^{c}	9.51	12.26 (20.49)^{f}	5.32	13.48 (21.54)^{f}	9.22	16.28 (23.79)^{e}	6.86	10.78 (19.16)^{f}	14.78	8.18 (16.61)^{f}	16.86	10.40 (18.81)^{g}	10.34

Figures in parentheses are arc sine transformed values

In a column, means followed by same letter(s) are not significantly different at P=0.05 (DMRT)

the total requirements of other organic amendments *viz*., neem cake, mahua cake and pungam cake were applied as basal and the remaining half was applied as top dressing in two equal splits at 20 days interval. Inorganic fertilizers in the form of urea, single super phosphate and muriate of potash at recommended were applied. Fifty per cent of total N and entire P and K were applied as basal and the rest of 50 per cent N in two equal splits as top dressing at 20 days interval. The neem oil @ 3 per cent and Malathion (2ml / litre) were sprayed in the respective treatments at 30, 45 and 60 days after transplanting (DAT).

Pest damage was assessed from ten randomly selected plants/plot. The total number of leaves and the number of scraped leaves/plant were counted to work out the per cent leaf damage. The observations were recorded at ten days interval commencing from 15th to 75th DAT besides a pretreatment count. In each plant, three leaves representing top, middle and bottom portions were selected. The total number of nymphs and adults on each leaf was recorded and the mean was worked out to express the population as mean number per three leaves. The population was recorded from 35 to 95 DAT at an interval of ten days. Root yield was recorded in kg / ha.

RESULTS AND DISCUSSION

The results of the investigation on the effect of organic sources of nutrients against the pests of Ashwagandha are presented in tables 1-3. The overall per cent damage recorded throughout the period of observation revealed that among organics imposed, FYM + Azophos + NC with

Table 2. Effect of organic sources of nutrients and botanical on Mealy bug population on Ashwagandha

Treatments	Days After Transplanting															
	35		45		55		65		75		85		95		Mean	
	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR	DA	PR
T_1	0.43 (0.65)^{cd}	70.94	0.54 (0.73)^{d}	69.31	0.61 (0.78)^{e}	70.67	0.66 (0.81)^{e}	71.55	0.69 (0.83)^{de}	74.34	0.83 (0.91)^{de}	72.69	0.47 (0.68)^{ef}	67.13	0.60 (0.77)^{de}	71.56
T_2	0.47 (0.68)^{d}	68.24	0.57 (0.75)^{d}	67.61	0.66 (0.81)^{e}	68.26	0.71 (0.84)^{e}	69.39	0.76 (0.87)^{e}	71.74	0.91 (0.95)^{e}	70.06	0.51 (0.71)^{f}	64.33 (0.80)^{e}	0.65	69.19
T_3	(0.20) (0.47)a	86.48	0.26 (0.50)^{a}	85.22	0.30 (0.54)^{a}	85.57	0.32 (0.56)^{a}	86.20	0.35 (0.59)^{a}	86.98	0.44 (0.66)^{a}	85.52	0.24 (0.48)^{a}	83.21	0.30 (0.54)^{a}	85.78
T_4	0.23 (0.47)^{a}	84.45	0.29 (0.53)^{ab}	83.52	0.34 (0.58)^{ab}	83.65	0.37 (0.60)^{ab}	84.05	0.42 (0.64)^{ab}	84.38	0.51 (0.71)^{ab}	83.22	0.29 (0.53)^{ab}	79.72	0.35 (0.59)^{abc}	57.34
T_5	0.56 (0.81)^{e}	55.40	0.76 (0.87)^{e}	56.81	0.89 (0.94)^{f}	57.21	0.99 (0.99)^{f}	57.32	1.12 (1.05)^{f}	58.36	1.26 (1.12)^{f}	58.55	0.64 (0.80)^{g}	55.24	0.90 (0.94)^{f}	57.34
T_6	0.71 (0.84)^{e}	52.02	0.81 (0.90)^{e}	53.97	0.93 (0.96)^{f}	55.28	1.04 (1.01)^{f}	55.17	1.16 (1.07)^{f}	56.87	1.46 (1.20)^{f}	51.97	0.68 (1.82)^{f}	52.44 (1.98)^{f}	0.97	54.02
T_7	0.34 (0.58)^{bc}	77.02	0.38 (0.61)^{bc}	78.40	0.46 (0.67)^{bcd}	77.88	0.49 (0.70)^{bcd}	78.87	0.54 (0.73)^{bcd}	79.92	0.64 (0.80)^{bcd}	78.94	0.37 (0.60)^{bcd}	74.12	0.46 (0.67)^{bd}	78.19
T_8	0.38 (0.61)^{cd}	74.32	0.49 (0.70)^{cd}	72.15	0.52 (0.72)^{cde}	75.00	0.55 (0.74)^{cde}	76.29	0.57 (0.76)^{cde}	78.06	0.70 (0.83)^{bcde}	76.97	0.40 (0.63)^{cde}	72.02	0.51 (0.71)^{cde}	75.82
T_9	0.41 (0.64)^{cd}	72.29	0.52 (0.72)^{d}	70.45	0.58 (0.76)^{de}	72.11	0.61 (0.78)^{de}	73.70	0.63 (0.79)^{cde}	76.57	0.75 (0.86)^{cde}	75.32	0.45 (0.67)^{def}	68.53	0.56 (0.74)^{de}	73.45
T_{10}	0.25 (0.50)^{ab}	83.10	0.32 (0.56)^{ab}	81.82	0.39 (0.62)^{abc}	81.25	0.42 (0.66)^{abcd}	81.03	0.49 (0.70)^{abc}	81.78	0.59 (0.76)^{abc}	80.59	0.33 (0.57)^{bc}	76.92	0.40 (0.63)^{abc}	81.04
T_{11}	1.48 (1.21)^{g}	-	1.76 (1.32)^{g}	-	2.08 (1.44)^{g}	-	2.32 (1.52)g	-	2.69 (1.64)^{g}	-	3.04 (1.74)^{g}	-	1.43 (1.19)^{i}	- (1.45)^{g}	2.11	-
T_{12}	1.26 (1.12)^{f}	14.86	1.52 (1.23)^{f}	13.63	1.86 (1.36)^{g}	10.57	2.04 (1.42)g	12.06	2.43 (1.55)^{g}	9.66	2.81 (1.67)^{g}	7.56	1.23 (1.10)^{h}	13.98	1.87 (1.36)^{g}	11.37

Figures in parentheses are square root transformed values

In a column, means followed by same letter(s) are not significantly different at P=0.05 (DMRT)

need based application of neem oil (3%) and FYM + Azophos + MC + neem oil (3%) were found significantly effective in reducing the damage due to *Epilachna* beetle by recording 82.32 and 79.48 per cent reduction over NPK (Table 1). The results of the present study is in accordance with the findings of Dhandapani *et al*. (1985) who reported 63 per cent reduction in the *Epilachna* beetle population due to neem oil spray. Kavitha (2004) also reported that *Epilachna* beetle damage could be significantly reduced by the application of FYM + Biofertilizer + neem cake + neem oil sprays and FYM + Biofertilizers + mahua cake + neem oil sprays. The reports on the efficacy of neem extracts and its formulations against the *Epilachna* beetle, *H. vigintioctopunctata* was reported by other workers (Jayarajan and Sundarababu, 1990; Mishra *et al*., 1990; Rao *et al*., 1992 and Reddy Venkataraimi *et al*., 1993) were also in consonance with the present investigation.

While computing through all the periods of observation revealed that FYM + Azophos + neem cake + neem oil recorded less population of mealy bug (0.30/3 leaves) which was closely followed by FYM + Azophos + mahua cake + neem oil (0.35 / 3 leaves) as against 2.11 in NPK as inorganic form treated plots. The corresponding over all percent reduction over NPK was 85.78 and 83.41 (Table 2). This is in line with the findings of Saminathan and Jayaraj (2001) who reported that neem oil and pungam oil at 3 % effectively controlled the Mealy bug *Ferrisia virgata* Cockrell on cotton. Varghese and Tandon (1990) proved that Indian beech oil reduced the percent survival of grape vine mealy bug *Maconellicoccus hirsutus* (Green) from 90.44% to 56.87%. Further, Gahukar and Balbande (1997) also confirmed the efficacy of neem oil based formulation containing 300 ppm azadiractin against sucking pest viz., aphid *A. gossypii*; Jassid, *Empoasca spp* and whitefly *B. tabaci*. Venkateshan *et al*., (1987) also reported the efficacy of neem oil and neem leaf extract against brinjal aphid, *Aphis gossypii*.

The data on fresh root yield revealed a significant increase of fresh root yield as 1095.16 kg/ha in T_3 (1095.16) followed by T_4 (1055.24 kg/ha), T_{10} (960.10 kg/ha), T_7 (940.12 kg/ha), T_8 (926.08 kg/ha), T_9 (880 kg/ha), T_1 (874.56 kg/ha), T_2 (850.32 kg/ha), T_5 (788.20 kg/ha), T_6 (746 kg/ha), T_{11} (642 kg/ha) and T_{12} (625.04 kg/ha). These results are in line with the findings of Kavitha (2004). They reported that application of FYM along with neem cake and bio fertilizers recorded higher yield in brinjal.

REFERENCES

Atal, C.K., Gupta, O.P., Ragunathan, K., and Dhar, K.L. 1975. *Pharmacognosy and Phytochemistry of Withania somnifera (Dunal)*. Central Council for Research in Indian Medicine and Homeopathy Publication, New Delhi. **P**.6.

Bhagat, K.C. 2004. Mango mealy bug, *Drosicha mangiferae* (Green) (Margarodidae: Hemiptera) on Ashwagandha - a medicinal plant**.** *Insect Environment.,* **10**(1): 14.

Dhandapani, N., Rajmohan, N.S., and Abdul Kareem, A. 1985 Plant products as antifeedants to control insects. *Pesticides.,* **19**(11): 53-60.

Gahukar, R.T., and Balpande, P.B. 1997. Field evaluation of a new neem based formulation against major insect pests of brinjal. *Pestology.,* **21**(11): 14-18.

Jayarajan, S., and Sundarababu, P.C. 1990. Efficacy of certain azadirachtin rich neem seed fractions on brinjal Epilachna beetle, *Henosepilachna vigintiocto punctata* (Coleoptera: Coccinellidae). *South Indian Hort*., **38**(1): 46-48.

Jhansi Rani, B. 2001. Pest management in ornamental, medicinal and Aromatic crops. In: *Integrated pest management in Horticultural Ecosystems*. (Eds.) Parvatha Reddy, P. Abraham verghese and N.K. Krishna Kumar. Capital publishing company, New Delhi. **PP**.64 -77.

Kavitha, Z. 2004. *Studies on Induced resistance in brinjal to major insect pests*. Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore. **P**.156.

Mathur, A.C., and Srivastava, J.B. 1964. *Epilachna vigintioctopunctata* (F.) (Coleoptera: Coccinellidae), as a defoliator of some solanaceous medicinal plants. *Indian Journal of Entomology.,* **26**: 246.

Mishra, B.K., Mishra, P.R., and Pataki, M.C. 1990. Effect of neem oil on the growth and development of Epilachna beetle, *Henosepilachna vigintiocto punctata* F. *Orissa Journal of Agriculture Research.,* **2**(3-4): 169-172.

Parjhar, S.B.S., Kishore, R., and Ahmed, I. 1997. Development of *Henosepilachna vigintioctopunctata* (Fabr.) (Coleoptera: Coccinellidae) on some solanaceous plants. *Insect Environment.,* **3**(3): 83.

Patra, D.D., Kambod Singh, Misra, H.O., Gupta, A.K., Janardan Singh, Singh, S.C. and Khanuja, S.P.S. 2004 Agro technologies of Ashwagandha (*Withania somnifera*). *Journal of Medicinal and Aromatic Plant Sciences.,* **26**: 332 – 335.

Rao, S.J., Chitra, K.C., Rao, P.K., and Reddy, K.S. 1992. Antifeedant and insecticidal properties of certain plant extracts against spotted leaf beetle, *Henosepilachna vigintioctopunctata* (Fab.). *Journal of Insect Science.,* **5**(2): 163-164.

Reddy Venkataraimi, P., Chitra, K.C. and Rao, P.K. 1993. Efficacy of the plant extracts in the control of brinjal spotted leaf beetle, *Henosepilachna vigintiocto punctata* F. In: *Botanical Pesticides in Integrated Pest Management. Indian Soc. of Tobacco Sciences.,* 18-22 September, **PP.** 225-227.

Saminathan, V.R., and Jayaraj, S. 2001. Evaluation of botanical pesticides against the Mealy bug, *Ferrsiia virgata* Cockrell (Homoptera: Pseudococcidae) on cotton. *Madras Agricultural Jouranal.,* **88**(7-9)**:** 535-537.

Singh, R.H., Nath, S.K., and Behere, P.B. 1990. Depressive illness a therapeutic evaluation with herbal drugs. *Journal of Research in Ayurvedha and Siddha*., **11:** 1-6.

Varghese, A., and Tandon, P.L. 1990. Efficiency of certain oils on the first instar nymphs of grape vine mealy bug, *Maconellicoccus hirsutus* (Green). In**:** Proceedings of National Symposium on Problems and Prospects of Botanical Pesticides in Integrated Pest Management, Jan 2 1-22, 1990, CRTI, Rajamundry, Andhra Pradesh, India. **PP.** 38 – 40.

Venkateshan, S., Balasubramanian, G., Jayaraj, S. and Gopalan, M. 1987. Studies on the efficacy of neem products against the aphid, *Aphis gossypii* on cotton. *Madras Agriculture Journal.,* **74**(4-5): 255-257.

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