

M. Sc. (Agri.) theses abstracts produced in the
Department of Agricultural Entomology

1. Bio-Ecology of Spiralling Whitefly *Aleurodicus Dispersus* (Russell) and its Management using Fungal Pathogens on Guava

AISWARIYA. K.K.

ABSTRACT

Studies on the bio-ecology of Spiralling whitefly *Aleurodicus dispersus* (Russell) on guava carried out at Agricultural College, Shimoga during 2004-05 revealed that the egg period ranged from 5.54-10.02 days. The four nymphal instars took 4.74-6.5, 3.56-6.22, 6.02-8.96 and 7.52-10.1 days respectively during different seasons. During the survey, 99 host plants belonging to 38 families were recorded from Shimoga taluka, of which 19 were new records from Karnataka, 11 of which were new host records. A study on natural enemies, revealed seven natural enemies, which included six predators and a parasitoid.

Studies on seasonal incidence indicated that the peak population of spiralling whitefly was associated with rise in temperature and the different stages of whitefly were considerably low during June and first fortnight of July. The total whitefly population showed positive correlation with maximum and minimum temperature, but a negative correlation with relative humidity, rainfall and wind velocity. Further, studies on efficacy of *Fusarium semitectum* Berk. and Ravenel and *Verticillium lecanii* (Zimm.) Viegas were carried out under laboratory conditions. Highest mortality was recorded at concentration of 4.2×10^9 spores/ml of *F. semitectum* and 3.6×10^9 spores/ml of *V. lecanii* with per cent mortality of 75.21, 89.97 (nymphs) and 64.40, 79.90 (adults), respectively. The earlier instars showed higher susceptibility to fungal infection than the later stages. Among 12 treatments evaluated under greenhouse conditions, *F. semitectum* 4.2×10^9 + *V. lecanii* 3.6×10^9 + 0.06% Triazophos registered highest mortality of 85.80, 86.81 and 83.30 per cent on eggs, nymphs and adults, respectively. Under field conditions, highest mortality was found in *F. semitectum* 6.2×10^{15} + *V. lecanii* 4.6×10^{14} + Triazophos 0.03%, with 84.44, 1.02 and 79.45 percent mortality in case of eggs, nymphs and adults, respectively. However, Triazophos 40 EC @ 0.06% was highly effective in controlling all the stages of spiralling whitefly.

2. Bio-Ecology and Management of Arecanut Inflorescence Caterpillar, *Batrachedra Arenosella* (Walker) using Entomopathogenic Fungus, *Nomuraea rileyi* (farlow) Samson.

NAVEEN KUMAR. V.

ABSTRACT

The investigations on the Bio-ecology and management of arecanut inflorescence caterpillar were carried out at Department of Agricultural Entomology, College Agriculture, Shimoga, Karnataka. Studies on the seasonal incidence of arecanut inflorescence caterpillar, *Batrachedra arenosella* from July 2003 to June 2004 revealed an incidence ranging from 0.00 to 21.75 larvae / rachis. The highest incidence of 21.75 larvae was observed during July first fortnight, while the lowest incidence of 0.42 mean number of larvae/rachis was observed during February. The simple correlation with the weather parameters and larval population showed weak positive correlation with temperature, where as with relative humidity and rainfall it showed strong positive correlation. The biology of *B. arenosella* was studied in the laboratory during August to October 2004. The total life cycle took an average of 29.0 ± 2.56 days, where in the egg, larval and pupal period lasted for 3.80 ± 0.40 , 18.2 ± 1.76 , 7.00 ± 0.40 , respectively during August – September, whereas during September – October the life cycle took an average of 32.8 ± 2.90 days, where in the egg, larval and pupal period lasted for 4.20 ± 0.74 , 20.2 ± 1.36 , 8.40 ± 0.80 , respectively. The pupa measured 3.81 ± 0.05 mm in length and 0.99 ± 0.08 mm in width. The adult is small with filiform antenna. The female has a total wingspan of 8.18 ± 0.04 mm and that of male is 7.86 ± 0.04 mm.

The incidence of different concentrations of *N. rileyi* on mortality of different instars of *B. arenosella* under laboratory conditions from three to five days after spraying indicated the maximum mortality at a concentration 3.2×10^9 spores /ml. The mortality on I, II, III, IV and V instar was 93.00, 85.00, 56.00, 49.00 and 44.00 per cent, respectively. The efficacy of the same fungus in combination with chemical and botanicals on *B. arenosella* under field conditions and observations recorded at 15 days after spraying indicated the maximum mortality of 76.56 per cent in 4.1×10^{15} spores / ml. + chlorpyrifos followed by 4.1×10^{15} spores / ml + malathion with 67.41 per cent, exclusive chlorpyrifos gave 60.83 per cent and least mortality of 3.98 per cent was observed in untreated check.

July, 2005

(Prof. B.L. Visweswaragowda)
Major Advisor

3. Evaluation of Fungal Pathogen, *Fusarium Semitectum* (Berk. and Ravenel) against Sugarcane Woolly Aphid, *Ceratovacuna Lanigera* Zehntner (Homoptera: Aphididae)

ASWINI, G. V.

ABSTRACT

Survey for the fungal pathogens on sugarcane woolly aphid in Bhadra command area revealed that woolly aphid was infected with *Fusarium* sp. and *Aspergillus wentii*. Both the fungi isolated proved to be pathogenic to woolly aphid *Ceratovacuna lanigera*, LC₅₀ value of the fungal isolates *Fusarium* sp. and *Aspergillus wentii* were at 2.21×10^7 spores/ml and 6.21×10^7 spores/ml, respectively, indicating more virulence nature of *Fusarium* sp. than *Aspergillus wentii*. Studies on the effect of temperature and relative humidity on growth of *Fusarium semitectum* revealed that maximum growth of (87.00 mm diameter) occurred at temperature of $35 \pm C$ and 90% relative humidity. Maximum sporulation (9.1×10^7 spores/ml) was seen with $35^\circ C$ temperature and 90% RH at 14 days after inoculation followed by temperatures at 30, 25 and $20^\circ C$. There was steep fall in growth and sporulation of *F. semitectum* at $40^\circ C$.

Studies on efficacy of *F. semitectum* under laboratory conditions. Highest mortality was recorded at 2.7×10^9 spores/ml of *F. semitectum* with mortality of 87.27 per cent nymphs, 59.32 per cent adults, respectively. The earlier instars were more susceptible to fungal infection than the later stages. Among the eight treatments evaluated under greenhouse conditions, the combination of *F. semitectum* 2.7×10^9 spores/ml and chlorpyrifos (0.02%) registered highest mortality of 84.12 per cent which was superior next to chlorpyrifos (0.04%). Under field conditions highest mortality was found in combination of *F. semitectum* 3.7×10^{14} spores/ml + chlorpyrifos (0.02%) with 75.32 per cent mortality, which was superior next to chlorpyrifos (0.04%).

November 2006

(M. Manjunatha)
Major Advisor

4. Studies on Utilization of *Micromus Igorotus* (Banks) (Neuroptera : Hemerobiidae) for Management of Sugarcane Woolly Aphid *Ceratovacuna lanigera* (Zehntner) (Homoptera : Aphididae)

PRAVEEN M.P.

ABSTRACT

Studies on seasonal incidence of *M. igorotus* revealed that incidence ranged from 0.00 (NovII-FebII) to 8.00(SepII) larvae/plant, 0.00 (NovI-FebI) to 7.25 (JuneII) larvae/plant and 0.00 (DecI-JanII) to 13.90 (AugII) larvae/plant at ARS, Honnavile, SRDI, Karehalli and ARS, Kattalagere respectively. The biology of *M. igorotus* was studied in the laboratory condition at ARS, Honnavile from August to September, 2006. The total life cycle ranged from 25 to 28 days in case of male and 33-35 days in case of female. The incubation, larva, pupa and adult periods ranged from 3.00 to 4.00, 5.00 to 7.50, 6.00 to 8.00 and 7.00 to 15.00 days respectively. Adult female laid 165-188 eggs. The total feeding potential of *M. igorotus* was 161.76 ± 13.09 aphids.

The studies on impact of *M. igorotus* on population dynamics of sugarcane woolly aphid indicated that higher sugarcane woolly aphid population was noticed in treatment with heavy infestation of SWA without *M. igorotus* with 106.85 aphids/ 2.5 cm² leaf area, whereas least population in treatment with initial infestation of SWA with out *M. igorotus* and subsequent release of *M. igorotus* with 3.42 aphids/ 2.5 cm² leaf area due to predation activity of *M. igorotus*. Studies on standardization of mass production techniques under laboratory conditions revealed that the multivoltine silken thread was superior to other substrates for oviposition. Corrugated paper strips were best suited as pupation substrate compare to other substrates and density of 65-70 first instar larvae in insect rearing box (22cm dia) are the best standardized methods for mass rearing. Above methods are adopted for mass rearing starting with 20 pairs of adults and it yields around 750 pupae in a period of one month.

August, 2007

(B. Shivayogishwara)
Major Advisor

5. Studies on Population Dynamics of Pest Complex of Field Bean (*Lablab Purpureus L.*) with Special Reference to Pod Borers

THEJASWI L.

ABSTRACT

Investigations on the status and management of pod borer complex in field bean were carried out under field conditions during 2005-06 at the College of Agriculture, Shimoga. During the investigation, as many as 22 species of insect pests have been recorded on the crop. The important sucking pests constituted *Riptortus pedestris*, and *Aphis crassivora*. The important pod borers included *Helicoverpa armigera*, *Adisura atkinsoni*, *Cydia ptychora* and *Sphenarches caffer*. The incidence of pod borers was noticed from May II fortnight to February I fortnight. Significant negative correlation was established between pod borers population and minimum temperature. However, the relationship was non-significant with maximum temperature, relative humidity and rainfall. Among the natural enemies of pod borers, the parasitoids *Campoletis chlorideae* and *Bracon* sp. nr. *greeni* (Ashmead) were more predominant. The predators included lady bird beetles and mirids.

The economic injury level for pod borers was determined as 0.44 larva per plant. An highest yield of 42.50 q per ha pod yield could be obtained from supervisory control (EIL based) plot followed by the treatments which received three sprays of indoxacarb (41.37 q/ha) at 45, 55 and 65 DAS and two sprays of indoxacarb (36.65 q/ha) at 45 and 65 DAS. Among the newer insecticide molecules, spinosad (36.44%) recorded very high larval reduction followed by thiodicarb (36.68%) and lamda cyhalothrin (27.82%) with a pod yield of 44.02 q per ha, 43.88 per ha and 41.08 q per ha, respectively. However, the spinosad application resulted in highest B:C ratio (2.13) followed by thiodicarb (1.98) and lamda cyhalotrin (1.86).

August, 2007

(Mohan I. Naik)
Major Advisor

6. Bio-Ecology and Management of Yellow Stem Borer, *Scirpophaga Incertulas* Walker (Lepidoptera : Pyraustidae) in Aerobic Rice

SHIDDALINGAPPA V. HIUGAR

ABSTRACT

Field experiments were conducted at College of Agriculture, Shimoga during 2005-06 on bio-ecology and management of yellow stem borer (YSB) in aerobic rice. Biology of *S. incertulas* studied revealed that the average incubation, larval, pupal, pre-oviposition, oviposition, post oviposition periods and fecundity were 6.8 ± 0.20 , 28.7 ± 1.10 , 11.1 ± 0.83 days, 25.6 ± 1.2 , 23.0 ± 1.0 , 20.3 ± 0.87 hours and 159.3 ± 37.74 eggs/female, respectively from the larva reared on transplanted paddy and 6.5 ± 0.50 , 28.4 ± 1.47 , 8.6 ± 0.49 days, 25.2 ± 0.83 , 22.0 ± 0.71 , 20.2 ± 0.52 hours and 152.2 ± 31.58 eggs/female, respectively from the larva reared on aerobic paddy. Per cent dead hearts or white ear heads had significant negative correlation with minimum temperature and afternoon relative humidity during *kharif* and with morning and afternoon relative humidity during *rabi* and significant positive correlation with sunshine hours per day during *kharif* and with minimum and maximum temperature during *rabi*.

During *kharif* effect of dates of sowing on infestation by YSB showed that the increase in the incidence of infestation was observed as the dates of transplanting and sowing was delayed. But aerobic paddy had lower infestation. During *rabi* season, in aerobic paddy 30th November sown crop yielded higher with 49.86 q/ha with lower infestation. Similar trend was followed on transplanted paddy but with higher incidence of YSB than on aerobic paddy. Efficacy of new insecticide molecules on YSB infestation in aerobic paddy revealed that among spray formulations beta-cyfluthrin 25 EC @ 12.5 g a.i/ha recorded lower incidence of YSB and gave higher grain yield of 38.67 q/ha and among granular formulations, fipronil 0.3G @ 7.5 g a.i/ha recorded lower incidence of per cent DH or WH and gave highest grain yield of 42.97 q/ha. The cost benefit ratio was maximum for beta cyfluthrin (1:20.39) and minimum for carbofuran (1:3.12).

January 2007

(Mohan I. Naik)
Major Advisor

7. Utilization of Bioagents in the Management of the Castor Semilooper, *Achaea janata* Linnaeus (Lepidoptera: Noctuidae)

AJITH KUMAR. M. A.

ABSTRACT

Investigations on the status of castor pests, natural enemies of semilooper and management of castor semilooper in castor were carried out under field conditions during 2007-08 at Shikaripur, Honnali and Channagiri taluks and at the College of Agriculture, Shimoga. During the investigation, as many as 16 species of insect pests have been recorded on the crop. The important pests recorded are *Achaea janata* Linn., *Spodoptera litura* F., *Helicoverpa armigera* Hub., *Ergolis merione* Cramer, *Euproctis fraterna* Moore, *Liriomyza trifolii* (Burgess), *Trialeurodes ricini* Misra, *Empoasca flavescens* F. and *Conognethes punctiferalis* (Guenn.). Among the natural enemies of *Achaea janata*, the egg parasitoid, *Trichogramma chilonis* Ishii and a larval parasitoid, *Microplitis maculipennis* Szepligate were more predominant. The incidence of *T. chilonis* was noticed throughout the crop period along with the pest activity. Parasitisation by *T. chilonis* showed significant positive correlation with minimum temperature and rainfall. While, larval population exhibited significant positive correlation with parasitisation (%) by *M. maculipennis*. Per cent parasitisation by *M. maculipennis* exhibited significant negative and positive correlation with maximum temperature and total rainfall, respectively.

Among different aged eggs, one day old eggs were highly (85.2%) preferred by *T. chilonis*. Among the different larval instars tested, maximum of 72.30 per cent parasitisation was noticed in second instar larvae of *A. janata* by *M. maculipennis*. The total life cycle of *T. chilonis* ranged from 8.62 to 9.04 days on the eggs of *A. janata*. The egg, larval, pupal and adult periods of *M. maculipennis* lasted for 1.70 ± 0.07 , 11.64 ± 0.27 , 2.22 ± 0.02 and 3.52 ± 0.37 days, respectively.

Among the various IPM modules tried, module-3 (*T. achaea* @ 1.5 lakh per ha @ 30DAS + fenvalerate 20EC @ 45 DAS + *T. achaea* @ 60 DAS) showed superiority in the suppression of the pest, safety to natural enemies, higher yield (15.6 q/ha) and benefit cost ratio (2.08) followed by module-5 (*T. achaea* @ 1.5 lakh per ha @ 30 DAS + profenophos (20EC) @ 45 DAS + Agroneem @ 60 DAS) compared to recommended module-9 (methyl parathion @ 30 DAS + methyl parathion @ 45 DAS + methyl parathion @ 60 DAS) with seed yield of 13.6 q per ha and B:C ratio of 1.70.

June, 2008

(Mohan I. Naik)
Major Advisor

8. Bio-Ecology of Aphid, *Aphis craccivora* Koch and Evaluation of Fungal Pathogen *Fusarium semitectum* Berk and Ravenel against Aphid on Cowpea

ROOPARANI, V.

ABSTRACT

Studies on seasonal incidence of cowpea aphid, *Aphis craccivora* Koch were carried out at Agriculture College Shimoga during 2007- 2008. The studies revealed an higher incidence of the aphid during June, October, November, December, February and March and a lower incidence from July to September, January and April. The correlation between the aphid population and weather parameters revealed that, the population of cowpea aphid increases with an increase in temperature. The natural enemies recorded on aphid were coccinellid predators, *Menochilus sexmaculatus* Fab. and *Coccinella transversalis* Fab.

The bio-ecology of cowpea aphid revealed that it had a complex life cycle where in both alate and apterous forms were reproduced by parthenogenetic viviparity without sexual reproduction. Total nymphal duration of the aphid occupied 4.86 ± 0.51 days in the laboratory. Pre-reproduction period was 1.01 ± 0.10 days, reproduction period was 10.31 ± 0.31 days and post-reproduction period was 0.70 ± 0.05 days. Adult longevity took an average of 11.82 ± 0.43 days. Aphids laid an average of 23.37 ± 7.67 nymphs and 16.75 ± 0.91 days to complete its life cycle.

Studies on the efficacy of *F. semitectum* under laboratory conditions indicated the highest mortality at 4.20×10^9 spores per ml with a mortality of 89.20 per cent nymphs, 64.66 per cent adults, respectively. The earlier instars were more susceptible to fungal infection than the later stages. Among ten treatments evaluated under green house conditions, the combination of *F. semitectum* 4.20×10^9 spores per ml and oxydemeton methyl (0.018%) registered the highest mortality of 85.70 per cent which was superior next to oxydemeton methyl (0.037%). Under field conditions the highest mortality was recorded in combination of *F. semitectum* 4.70×10^{14} spores per ml + oxydemeton methyl (0.018 %) with 79.01 per cent mortality, which was superior next to oxydemeton methyl (0.037%).

August 2008

(M. Manjunatha)
Major Advisor

9. Performance of Inter Specific Bt Cotton Hybrids against Major Insect Pests

MANJUNATHA, R

ABSTRACT

The investigations on interspecific Bt and non-Bt cotton hybrids were under taken at Agriculture Research Station, Honnaville, Shivamogga, during *Kharif* 2008. In the present study it was found that, there was no differential susceptibility between Bt and non-Bt cotton genotypes against sucking pests *viz.*, thrips, aphids, white flies and leaf hopper. Among all the genotypes MRC-7201 Bt and its non-Bt counterpart recorded significantly lower population of sucking pests. However, red cotton bugs and Dusky cotton bugs were comparatively more in Bt cotton than in non-Bt cotton.

The larval population of *Helicoverpa armigera* and *Earias vittella* was almost nil on all the Bt cotton hybrids as against non-Bt cotton hybrids which allowed the larvae to cross the ETL (more than one larvae /plant). Significantly lower per cent of fruiting body damage due to *H. armigera* (1.44-3.67 per cent), *E. vittella* (2.31-5.19 %), rosette flowers (0.01-1.57 per cent) due to pink bollworm was noticed in Bt cotton hybrids. Similarly significantly higher seed cotton yield (16.71-21.16 q/ha) were recorded in Bt cotton hybrids. The seasonal decline in expression of *Cry I Ac* differed among Bt cotton genotypes and the expression was variable among plant parts. The highest concentration of *Cry I Ac* expression was noticed in leaves (16.34) followed by squares (11.95) and bolls (11.57 µg/g) of JK CH-99 Bt hybrid. The expression in other hybrids (MRC-7201, MRC-6918, Rasi XL-708, NCBH-990 and SP-911) ranged between 5.15-7.30, 2.98-6.58 and 3.78-4.68 µg/g in leaves, squares and bolls respectively.

Economics of Bt cotton hybrids revealed that, although over all cost of cultivation of Bt cotton was more, it recorded higher net returns of Rs. 20920.65 per acre with maximum BC ratio of 3.31 as compared to non-Bt cotton. Adoption level of Bt cotton was highest (91.16 per cent) in Davangere, followed by Chitradurga (87.17 per cent) and Shivamogga (84.59 per cent) districts of Karnataka.

September, 2009

(Pradeep S)
Major Advisor

10. Seasonal Incidences of Cowpea Pests and their Management

NAVEEN.V.

ABSTRACT

Investigations on seasonal incidence of cowpea pests and their management in cowpea were carried out under field conditions during 2008-09 at the College of Agriculture, Shimoga. During the investigation, 20 species of insect pests have been recorded on the crop. The important constituted *Aphis crassivora* Koch among sucking pests and among borers *Maruca testulalis* Geyer and *Cydia ptychora* Meyrick. The incidence of *Aphis crassivora* was noticed throughout the year. The incidence of pod borers was noticed from May II fortnight to March I fortnight. Studies on the bioecology of *Maruca testulalis* revealed the total developmental period of 22.36 ± 1.45 days with a fecundity ranging from 90-201 eggs per female. Studies on the bioecology of cowpea aphid revealed that it had a complex life cycle, wherein both alate and apterous forms were reproduced by parthenogenetic viviparity. Aphids laid on an average of 24.02 ± 7.55 nymphs and took 16.99 ± 0.91 days to complete its life cycle.

An highest yield of 13.02 q per ha grain yield was obtained from supervisory control (EIL based) plot followed by the treatments which received three sprays of spinosad (12.10 q/ha) at 45, 55 and 65 DAS and two sprays of spinosad (9.88 q/ha) at 45 and 55 DAS. Among the newer insecticide molecule combinations, the combination sequence of clothianidin, NSKE and spinosad which were sprayed at different crop growth stages resulted in the high aphid population reduction (47.55%) and high larval population reduction (48.58%). The next to follow was the sequence of thiamethoxam, NSKE and spinosad which resulted in per cent aphid population reduction of 46.20 and per cent larval population reduction of 47.80. However, sequence of clothianidin, NSKE and spinosad resulted in highest B:C ratio of 1.65 followed by spray sequence of thiamethoxam, NSKE and spinosad with B:C ratio of 1.51.

September 2009

(Mohan I. Naik)
Major Advisor

11. Bio Ecology and Management of Sucking Pests in Bt Cotton

NAGARAJA, D. N

ABSTRACT

Studies on seasonal incidence of sucking pests of Bt cotton were carried out at Agriculture College Shimoga during 2008-09. The studies revealed higher incidence of aphids (48.11 per three leaves) during second fortnight of May and zero incidence in Second fortnight of July and first fortnight of August. The higher incidence of leafhopper (19.20) during May second fortnight and zero incidence in August. Higher incidence of whitefly (29.50) during second fortnight of April and zero in July, August and September months. Where as, the higher incidence of thrips population (26.81) was noticed during April second fortnight and zero incidence in July, August, September and October months. The incidence of all these sucking pests were correlated positively with maximum temperature. The peak population red cotton bug (0.80/ Plant) and ducky cotton bug (8.60/boll) was noticed during second fortnight of November (150 DAS) and second fortnight of December (190 DAS), respectively. The most commonly recorded natural enemies on sucking pests were coccinellids, spiders and chrysopa were positively correlated with increasing pest population.

The life cycle of cotton aphid revealed that the average total nymphal period was 5.24 ± 0.74 days. The aphid was found to reproduce parthenogenitically viviparous. The pre-reproductive, reproductive and post-reproductive periods were found to be 0.88 ± 0.24 , 10.33 ± 1.25 and 4.10 ± 0.51 days, respectively. The number of young ones produced by an adult aphid was 11.10 ± 3.47 .

The average incubation period and the total nymphal period of leafhopper was 6.53 ± 0.58 and 11.68 ± 3.74 days, respectively. The pre-oviposition, oviposition and post-oviposition periods were found to be 3.30 ± 0.35 , 9.53 ± 1.11 and 3.80 ± 0.63 days, respectively. The fecundity of leafhopper varied with a mean of 20.33 ± 2.65 eggs per female. The longevity of adult leafhopper was 16.38 ± 1.83 and 15.90 ± 1.58 for female and male respectively.

Among the treatments one day after spraying Fenprothrin showed superior efficacy in bringing down all the sucking pest population followed by Dimethoate, Imidacloprid and Acetamiprid. Dimethoate and Imidacloprid were most effective against aphid and Dimethoate alone was most effective on leafhopper, whitefly and thrips at three days after spraying. The similar trend was maintained even at seven days after treatment also.

July, 2009

(B. K., Shivanna)
Major Advisor

12. Effect of Organic Manures on Incidence of Pests of Pigeon Pea and their Natural Enemies

BOMMESH, B.

ABSTRACT

A field investigation on “Effect of organic manures on incidence of pests of pigeon pea and their natural enemies” was carried out at College of Agriculture, Shimoga during *khariif* 2009. In the present study the lowest population of leaf hopper (0.11 hopper/three trifoliolate/pl) and leaf roller (0.55 larvae/pl) were recorded in NC and PM+NC (Poultry manure+Neem cake) applied plots respectively. The lowest population of spotted pod borer, plume moth, gram pod borer were recorded (0.39, 0.99, 0.45 larvae/pl, respectively) in NC applied plots, while blue butter fly was low (0.19 larvae/pl) in standard check. Similarly, significantly lowest blister beetle (0.20 adults/pl) and pod fly (0.50 maggots/10 pods) were recorded in NC, while pod bugs (0.32 adults/pl) in PM applied plots. Significantly higher numbers of coccinellids (0.42 grubs and adults/pl) and spiders (0.52 spiders/pl) were recorded in untreated check.

The application of NC has resulted lower chlorophyll (1.8291, 1903 mg/g), reducing sugars (1.20, 1.71%) and total sugar (1.77, 2.35%) and highest phenol content (4.49, 5.21 mg/g) in leaves at 45 and 75 days after sowing. While, PM+NC (10.46, 11.27%) plot had lower protein. Whereas, in green pods application of NC had highest phenol (7.97 mg/g), lowest protein, reducing and total sugars of 21.60, 1.42, and 3.42 per cent, respectively. The correlation was positively significant between spotted pod borer ($r=0.60^*$), gram pod borer (0.63^*), blue butter fly (0.63^*) with protein and spotted pod borer (0.63^*) and gram pod borer (0.59^*) with reducing sugars and spotted pod borer ($r=-0.73^{**}$), blue butter fly (-0.67^*), gram pod borer (-0.77^{**}), plume moth (-0.68^*) tur pod fly (-0.68^*) had significantly negative relationship with phenol. Among organics FYM+VC (Farm yard manure+Vermicompost) had highest net returns (Rs.12448 per ha) with ICBR of 2.85, followed by VC (Rs.11302 per ha) with ICBR of 2.26.

July, 2010

(Mohan I.Naik)
Major Advisor

13. Biology and Management of Pulse Beetles, *Callosobruchus maculatus* (Fab.) and *C. analis* (Fab.)

RAMAMURTHY, B.N.

ABSTRACT

Investigations on the biology and management of pulse beetles, *Callosobruchus maculatus* (Fab.) and *C. analis* (Fab.) were carried out under laboratory conditions in the Department of Agricultural Entomology, Shimoga during 2009-2010. On cowpea, the incubation period, pupal period and total developmental period were 5 ± 0.24 , 9.90 ± 0.94 and 27 ± 2.79 days, respectively for *C. maculatus*. While the corresponding figures for *C. analis* were 6 ± 0.62 , 9.0 ± 1.02 and 30 ± 2.65 days. Similarly on green gram, the figures for *C. maculatus* were 4 ± 0.59 , 10.55 ± 0.76 and 29 ± 1.48 and for *C. analis* it was 5 ± 0.36 , 8.80 ± 1.42 and 30 ± 1.55 days. The size and life span of female is comparatively more than male in both the species of pulse beetle. Sizes of male and female *C. maculatus* were bigger than *C. analis*.

Among the tested pulses, field bean (GL-66) and red gram (BRG-1) were least preferred for both the species. Cowpea and green gram were most preferred hosts for *C. maculatus* and *C. analis*, respectively. Among the cowpea varieties, CP-17 and IT-38956 were least preferred for oviposition in both the species. Prolonged developmental period, least per cent adult survival and grain weight loss were observed in these varieties. On the contrary C-152 and local variety of cowpea were highly preferred for both the species.

Among the indigenous materials [sand layer (2" over the grains), neem seed powder (5 %) and asafeotida powder (0.2%)] and plant oils [neem oil (1%) and ground nut oil (1%)] gave better protection upto three months for both the species of pulse beetles on cowpea. Red earth coating (5%), rice hull ash (5%), wood ash (5%), sunflower oil (1 %) and neem leaf dust (5%) recorded the highest population build up, per cent grain damage and per cent weight loss. Neem oil showed cent per cent adult mortality at 2 DAT when compared to neem seed powder and asafeotida powder which caused cent per cent mortality at 4 DAT in the both the species.

July, 2010

(B. K. Shivanna)
Major Advisor

14. Bio-ecology and Management of *Calepitrimerus azadirachtae* ChannaBasavanna (Eriophyidae: Acari) on neem

NAVIK, O. S

ABSTRACT

Studies on seasonal incidence of *Calepitrimerus azadirachtae* ChannaBasavanna and their natural enemies carried out at college of Agriculture, Shimoga during 2010 – 2011. Studies revealed that the incidence of mite was associated with rise in temperature and they were considerably high in the month of April and May and lower incidence was recorded in the month of July, September, October and from December to first fortnight of January. The maximum and minimum temperature was significantly positive correlation with the population of mites, but a negative correlation with relative humidity was observed. However, rainfall showed non-significant positive correlation with mite population. Studies on bio- ecology of mite *Calepitrimerus azadirachtae* on neem carried out during and revealed that developmental period was 7.65 ± 0.65 and 8.03 ± 0.81 days in male and female of *C. azadirachtae*, respectively.

Further studies on efficacy of *Fusarium semitectum* Berk and Ravenel and *Hirsutella thompsonii* Fisher along with new acaricides were carried out in laboratory conditions. The highest adult mortality was recorded at a concentration of 4.6×10^8 spores/ml of *H. thompsonii* and 2.3×10^9 spores/ml of *F. semitectum* with per cent mortality of 89.90 and 83.33, respectively. The nine treatments of fungi along with acaricides evaluated in laboratory conditions showed the highest mortality in difenthrun followed by propergite with 95.33 and 93.33 per cent mortality. *F. semitectum* and *H. thompsonii* showed 82 and 86 per cent in reduction of mite population at 2.3×10^9 and 4.6×10^8 spores/ ml, respectively. Among the nine treatments evaluated against the *C. azadirachtae* under field conditions, the highest mortality of 91.96 was recorded in difenthrun. Propergite and fenazaquin were next best showing 84.50 and 87.31 per cent mortality of mites. The treatment *F. semitectum* at 2.6×10^{15} spores/ ml showed 46.09 per cent mortality being least effective. *F. semitectum* + dicofol (0.02%) and *H. thompsonii* at 4.1×10^{14} spores/ ml recorded 55.49 and 54.85 per cent mortality. Treatments dicofol and wettable sulphur registered mortality of 78.35 and 68.99 per cent, respectively.

Aug, 2011

(M. Manjunatha)
Major Advisor

15. Studies on Insect Pest Complex of Promising Traditional Paddy Cultivars and their Management using Organics

PRASHANTA KUMAR, G. K.

ABSTRACT

The investigation on occurrence of insect pests on promising traditional paddy cultivars and their natural enemies in organic farming situation and management of insect pests using organics were undertaken at Organic Farming Research Center and College of Agriculture, Navile, Shimoga during *kharif* 2010.

In the present study it was found that among the promising traditional paddy cultivars Ratnachudi recorded significantly lowest mean damage of sucking pests *viz.*, thrips, green leaf hopper and ear head bug with 0.47 damage score, 0.64 damage score and 1.94% respectively. Significantly less mean damage of dead heart and white ear head due to yellow stem borer was recorded in *Selum sanna* with 9.38% and 13.70% respectively. Minimum leaf damage due to leaf folder was recorded in *Selum sanna* (1.90%). There was no significant difference among promising traditional paddy cultivars with respect to case worm damage and were below the economic threshold level (35% leaf damage). However *Selum sanna* (0.65%) recorded significantly least mean damage. Among the promising traditional paddy cultivars significantly higher grain yield was recorded in *Selum sanna* (42.55 q/ha.)

The most common and dominant highest mean number of predators in the promising traditional paddy cultivars were spiders (1.37/hill), coccinellids (1.01/hill), damselflies (1.12/m² area) and dragonflies (0.87/ m² area) was noticed in Ratnachudi, *Selum sanna*, respectively. Among the different organic management practices against green leaf hopper and ear head bug population, significantly lowest in tobacco decoction (1%), neem seed kernel extract (5%), chilli garlic extract (3%), azadirachtin 10,000 ppm and cow urine (1:5 ratio) treatment. While the case worm and leaf folder population was lowest in spinosad (0.02%) spray. Spinosad (0.02%) was more effective in reducing the stem borer dead heart and white ear head infestation, while significantly highest grain yield (49.07 q/ha.) was noticed in spinosad (0.02%) treated plots.

August, 2011

(S. Pradeep)
Major Advisor

16. Survey on the Incidence and Management of Pink Bollworm, *Pectinophora Gossypiella* (Saunders) on Bt Cotton

SANTHOSH KUMAR, K.

ABSTRACT

Investigations on survey of pink bollworm (PBW) at Shimoga, Shikaripura and Honnali taluks and its incidence and management were carried out at Agriculture College Shimoga during 2010-11. In the survey work, minimum larval population and per cent green boll damage was recorded at Agaswalli (2.00 larvae/20 green bolls and 9.00%, respectively) as against maximum larval population and per cent green boll damage at Basavanandihalli (3.10 larvae/20 green bolls and 14.00%, respectively). Studies on population dynamics of PBW moths through pheromone traps indicated the activity throughout the study period with four peaks viz., 37th, 50th, 2nd and 8th standard week. Maximum temperature had negative and significant association with trap catches of PBW, while minimum temperature, morning and afternoon relative humidity were partially correlated with trap catches. Whereas, total rainfall had non-significant negative influence on PBW trap catches. *Goniozus* sp. (Hymenoptera: Bethyridae), a larval parasitoid of PBW was recorded in the month of October and November.

Insecticide treated plots performed significantly better than control for all the parameters against PBW. Three days after treatment, minimum number of larvae on bolls was recorded in novaluron, thiodicarb and spinosad as against the higher number of larvae registered in NSKE. Significantly the highest number of larvae/20 bolls was observed in control. Same trend was also followed even at seven days after treatment. Three days after treatment minimum green boll damage was recorded in thiodicarb, spinosad and lambda cyhalothrin as against highest green boll damage registered in control and NSKE. Seven days after treatment, the same trend was also followed. Significantly higher number of good opened bolls (GOBs) was recorded in spinosad, novaluron, indoxacarb, thiodicarb and lambda cyhalothrin than NSKE and control. Among the treatments minimum BOBs/plant were recorded in spinosad, novaluron and thiodicarb as against the higher number of BOBs/plant recorded in control and NSKE. Locule damage due to PBW was significantly less in spinosad, thiodicarb and indoxacarb treated plots. Maximum locule damage was registered in NSKE but significantly different over control. Significantly higher seed cotton yield was recorded in spinosad (1935.20 kg/ha), indoxacarb (1909.83 kg/ha), thiodicarb (1890.10 Kg/ha), novaluron (1866.73 kg/ha) and lambda cyhalothrin (1802.17 kg/ha). Whereas, control (968.60 kg/ha) and NSKE (1507.27 kg/ha) recorded lower seed cotton yield.

June, 2011

(B. K. Shivanna)
Major Advisor

17. Biology and Management of Bud worm, *Helicoverpa armigera* (Hubner) on Tobacco

GIRISH, M. R

ABSTRACT

Studies on the Biology and management of bud worm, *Helicoverpa armigera* on tobacco were carried out under laboratory and field condition at agricultural college, shimoga during 2010-11. Under laboratory condition the average incubation period, larval period and pupal period of bud worm were 4.02 ± 0.64 , 23.94 ± 1.21 and 10.70 ± 1.26 days, respectively. The total developmental periods of male and female were 47.40 ± 0.80 and 50.13 ± 1.23 days, respectively. The size and life span of female is comparatively more than male. Freshly laid eggs were spherical having flattened base, cream coloured which later turned dark. The insect possessed six larval instars. There was a remarkable variation in the colour pattern of the larvae which varied from greenish brown to brown with longitudinal stripes.

The fully grown sixth instar larvae measured a average length of 41.88 ± 2.11 mm. the average wing span of male and female adult moth was 34.61 ± 1.42 mm and 37.01 ± 1.64 mm, respectively. Investigation on population dynamics of bud worm using pheromone traps indicated the scattered activity of moth throughout the year. However, maximum number of moth activity was observed from 35th to 43rd standard week *i. e.* during September up to end of October. Rainfall and minimum temperature had positive and significant association with trap catches. Whereas, negative and non significant correlation was observed with maximum temperature and relative humidity.

Studies on the efficacy of new molecules and botanicals against tobacco bud worm showed that all the treatments significantly superior over control. Novaluran application yielded better result by controlling cent per cent larval population within seven days, followed by chlorpyrifos (90.0 %) and indaxocarb (87.59 %) application. The insecticides *viz.* azadirachtin (71.67 %), Nomurea (71.67%), HaNPV (80.0 %) and NSKE (83.0 %) were also effective in controlling the pest and are recorded significantly lower larval population over control.

June, 2011

(B. K. Shivanna)
Major Advisor

18. Management of POD Borers on Field Bean with Entomopathogenic Fungus *Nomuraea rileyi* (Farlow) Samson and Insecticides

LOLAKSHI, H. K.

ABSTRACT

Investigations on the status and management of pod borer complex in field bean were carried out under field conditions during 2009-10 at the College of Agriculture, Shimoga. During the investigation, as many as 21 species of insect pests have been recorded on the crop. The important sucking pests constituted *Riptortus pedestris* F. and *Nezara viridula* Linn. The important pod borers included *Helicoverpa armigera* Hübner and *Sphenarches caffer* Zeller.

The maximum damage due to pod borers throughout cropping period was 30.03 per cent. The maximum damage was done by *H. armigera* (20.27%) as its incidence was in higher level than other species. *S. caffer* contribution was next to *H. armigera* towards crop damage (9%) having medium level of incidence on crop. Among the natural enemies of pod borers, the parasitoids *Campoletis chloridae* Uchida and Tachinid parasite were more predominant on *H. armigera*. The predators include spiders and carabids.

In the bio efficacy study, the maximum mortality of 92.59 per cent was obtained in first instar larvae of *H. armigera* followed by 83.33 per cent in second instar at 3.20×10^9 spores per ml concentration of *Nomuraea rileyi* indicating that early instars were more susceptible to fungus than later instars at known period after spraying. Among the insecticides, indoxacarb (36.57%) recorded very high larval mortality followed by *N. rileyi* + fenvalerate (34.73%) and *N. rileyi* + neem (31.02%) with a pod yield of 42.36q per ha, 41.98 q per ha and 36.11q per ha, respectively. However, the *N. rileyi* + fenvalerate application resulted in highest B:C ratio (2.31) followed by indoxacarb (1.99) and *N. rileyi* + neem (1.80).

August, 2011

(M. Manjunatha)
Major Advisor

19. Effect of Organic Manures and Chemical Fertilizers on the Abundance and Diversity of Above and Below Ground Arthropods in Field Bean Ecosystem

MADHU, M.

ABSTRACT

Studies on effect of organic manures and chemical fertilizers on the abundance and diversity of above and below ground arthropods in field bean ecosystem were carried out at Organic Farming Research Centre (OFRC), Navile, Shimoga, Karnataka during 2010-11. The studies revealed that among the different intervals of observations, the plots treated with organic manure and chemical fertilizer + mulching recorded significantly higher abundance of soil arthropods compared to the rest of the treatments (29.33, 31.00, 28.67, 27.67, 26.67, 21.33 arthropods per 400 gm of soil) and diversity of soil arthropods was also higher in above mentioned treatment (0.91, 0.93, 0.90, 0.89, 0.80, 0.81). Abundance of collembolans, mesostigmata, and cryptostigmata was also higher in above mentioned treatment. With respect to above ground arthropods abundance (10.67, 34.67, 60.33, 65.00, 42.67, 38.67 insects per plant) and diversity (0.33, 0.40, 0.64, 0.87, 0.56, 0.49) was also higher in the plots treated with organic manure and chemical fertilizer + mulching.

The abundance of soil arthropods had a positive relationship with the soil moisture and a negative relationship to soil temperature. The plot which received recommended FYM and recommended fertilizers, FYM equivalent to N and FYM equivalent to N supplemented with P and K through inorganic fertilizers with and without mulching (T₁, T₂, T₃, T₇, T₈& T₉). Recorded significant positive relationship of soil arthropods abundance with available N, P, and K. The plot which did not receive any fertilizers with mulching (T₁₃) recorded a negative correlation with available P and K but had positive non significant relationship with available nitrogen. The plot which did not receive any fertilizers without mulching (T₁₄) showed a non significant positive relationship with available nitrogen and phosphorus but negative with available potassium. The abundance of soil arthropod showed significant positive correlation with the yield of field bean. The impact of abundance of soil arthropods on the yield of field bean was 86 per cent.

July, 2011

(S. Pradeep)
Major Advisor

20. Bio-Ecology and Management of Cut Worm, *Spodoptera litura*(Fabricius) on Chewing Tobacco

LATHA, M.

ABSTRACT

Studies on the Bio-ecology and management of cut worm, *Spodoptera litura* on chewing tobacco were carried out under laboratory and field conditions at Agriculture college, Shimoga during 2011-12. Under laboratory conditions, the average incubation period, larval period and pupal period of cut worm were 4.10 ± 0.32 , 19.90 ± 2.33 and 13.00 ± 0.82 days, respectively. The total developmental periods of male and female were 45.50 ± 1.58 and 48.20 ± 2.10 days, respectively. The size and life span of female is comparatively more than male.

Freshly laid eggs were hemispherical in shape with pale green in colour and turned yellow on second day. The insect possessed six larval instars. There was a remarkable variation in the colour pattern of the larvae at different instars which varied from translucent green to brown with longitudinal gray and yellow stripes. The fully grown sixth instar larvae measured an average length of 39.45 ± 1.14 mm. The average wing span of male and female adult moth was 35.80 ± 1.92 mm and 39.20 ± 1.92 mm, respectively. Investigation on population dynamics of *Spodoptera* using pheromone traps indicated the maximum activity of moths from 29th to 35th standard week. However, peak number of moths was noticed up to the 39th standard week (September). Rainfall, maximum and minimum temperature had positive and non significant correlation with trap catches. Whereas, negative and non significant correlation was observed with relative humidity.

Studies on the efficacy of new molecules and biopesticides against tobacco cut worm showed that all the treatments were significantly superior over control. Hundred per cent larval control was observed at seven and fifteen days after application of spinosad (112.5 g a.i./ha) and flubendiamide (98.36 g a.i./ha) respectively. Maximum per cent larval reduction was observed in novaluron-100 g a.i./ha (91.15%). Further chlorpyrifos-500 g a.i./ha (87.17%), Bt Dipel-35 g a.i./ha (85.00%), SINPV-250LE (84.96%), *Nomuraea rileyi*-350 g a.i./ha (82.63%) and NSKE 2% (66.6%) were also effective in controlling the pest and are significantly better than control.

July, 2012

(B.K.Shivanna)
Major Advisor

21. Comparative Development, Infestation Behavior and Management of Rice Weevil, *Sitophilus oryzae* (L.) (Curculionidae: Coleoptera) in Different Split Legumes

DEEPTHI N.

ABSTRACT

Experiment on comparative development, infestation behavior and management of rice weevil, *Sitophilus oryzae* (L) in different split legumes was undertaken at Department of Entomology, College of Agriculture, Shimoga during 2011-12. Study was conducted to understand the development of *Sitophilus oryzae* on different split legumes green gram, Bengal gram, field bean and sorghum.

In study the comparative development of *S.oryzae* factors such as fecundity, fertility, developmental period, adult longevity and the progeny production were compared. The highest fecundity of *S.oryzae* was in sorghum and lowest in green gram. The highest fertility was recorded in sorghum and low fertility in green gram. The developmental period of *S.oryzae* in green gram was highest and lowest in sorghum followed by field bean and Bengal gram. Adult longevity and progeny production was highest in sorghum followed by field bean and Bengal gram and lowest in green gram. Females weighed heavier than males. Based on results, it can be concluded that, there is a chance *S.oryzae* extending host range to split legumes. Infestation behavior of *S.oryzae* three moisture levels (10%, 12% & 14%) was evaluated. In sorghum and split legumes, the highest seed weight loss was recorded at 14 % moisture level and the lowest weight loss at 10 %. Eight plant products were tested against *S.oryzae*. Of them, sweet flag powder (1%) afforded maximum protection. Zanduparad (2%), ginger rhizome powder (2%) and neem leaf powder (5%) were next in the order of efficacy.

July, 2012

(Manjunath, M.)
Major Advisor

22. Survey and Management of Arecanut Rootgrub

SHABBIR K

ABSTRACT

Studies on the survey and management of arecanut root grubs in Shimoga district (Sagara, Hosanagara and Thirthahalli), during 2012-13 revealed that, Thirthahalli taluk showed higher grub count (3.38 grubs per palm) compared to Sagara, Hasaganara taluks. *Leucopholis lepidophora* was the predominant species in all the root grub infested areas of shimoga district. In all the three taluk as the grub population was highly significant and negatively correlated with rain fall. The activity of scolid wasp was more during April and May and was found to decline during other months. It was confirmed that *Colpacampsomeris nr.indica* (Saussura) is the species that has been observed as an ectoparasite of rootgrubs.

Among the indegenious practices mechanical digging and removal of grubs coupled with application of insecticides (Chlorpyriphos) was the best method in reducing the grub population. However, application of gravel (Garchu mannu) to the garden affects the rootgrub biology and thereby the adult will not lay the eggs and the larva will move away from garden. Among the different treatments tested against the rootgrubs rynaxypur @ 0.18 mL/L had given maximum mortality (74.95%) followed by rynaxypur @ 0.12 mL/L (73.33%). The bioagents *Metarrhizium anisopliae* performance was not satisfactory even after 60 days of application.

July, 2013

(B.K. Shivanna)
Major Advisor

23. Influence of Soil Amendments on the Incidence of Sucking Pests Infesting Bt Cotton

PRASANNA, S. O.

ABSTRACT

A field investigation on “Influence of soil amendments on the incidence of sucking pests infesting Bt cotton” was carried out at College of Agriculture, Shimoga during *kharif* 2008. In the present study it was found that the lowest mean population of aphids, whiteflies and thrips (1.69, 0.19 and 0.32/3 leaves/plant, respectively) were recorded in PM+NC (poultry manure + neem cake) treated plots. While, the leafhopper, red cotton bug and dusky cotton bug (1.77/3 leaves/plant, 0.40/plant and 4.93/boll, respectively) were least in FYM+PM (farm yard manure + poultry manure)treated plots, whereas, red spider mite was lower in NC (0.04 cm² leaf area/plant). Application of VC (vermicompost) recorded highest mean coccinellids and chrysopids (0.34 and 0.47/plant, respectively) however, higher mean population of spiders and anthocorids (0.44 and 0.29/plant, respectively) were noticed in NC+VC treatment.

Application of NC (0.713, 1.613 and 3.603 mg/g leaves) had significantly higher phenol content, FYM+VC (0.410, 0.640 and 2.217 mg/g) had higher chlorophyll content, FYM+NC(2.250), FYM+VC(4.917) and NC+VC(7.147) recorded highest total sugars at 30, 60 and 90 DAS, respectively. However, PM(0.910 and 3.267 mg/g at 30 and 60DAS, respectively) and VC (5.070 mg at 90 DAS) recorded highest protein content. Aphids had significant positive correlation with chlorophyll ($r=0.57^*$ and 0.70^*) at 30 and 60 DAS and protein ($r=0.58^*$) at 30 DAS, significant negative correlation ($r=-0.61^*$) with phenol at 90 DAS. Leafhoppers had significant positive correlation ($r=0.62^*$) with chlorophyll at 60 DAS and mites had significantly negative correlation ($r=-0.61^*$) with phenol at 90 DAS.

The organic carbon in soil was more in PM+NC treated plot, highest amount of N, P and K were recorded in RDF and standard check but on par between the treatments except untreated check. While, OC had significant negative correlation ($r=-0.65^*$) with mites at 90 DAS. N had significant positive with aphid ($r=0.62^*$) and leafhopper ($r=0.57^*$) at 30 DAS, aphid, whitefly and leafhopper($r=0.60^*$, 0.69^* and 0.64^* , respectively) at 60 DAS, while P had significant positive correlation ($r=0.66^*$) with aphid at 30 DAS. The K had significantly negative ($r=-0.64^*$) with aphids at 30 DAS while, S had significant positive correlation ($r=0.66^*$) with leafhoppers at 90 DAS and among organic amendments B:C ratio was high (1.78) in FYM+PM treated plot followed by FYM+NC (1.61).

24. Survey of Stem Borer Complex in Maize (*Zea mays* L.) and their Management

NAGARJUNA, B

ABSTRACT

The present study entitled “Survey of stem borer complex in maize (*Zea mays* L.) and their management” revealed that *Chilo partellus* (Swinhoe) and *Sesamia inferens* (Walker) were the common species debilitating the crop and their incidence ranging from 14.82 to 20.20, 17.30 to 19.33 and 20.78 to 23.75 per cent at Shimoga, Shikaripur and Honnali talukas respectively. The stem borer (*Sesamia inferens*) completed its life cycle in 35 to 57 days. The incubation period ranged from 5 to 6 days. The larval stage passed through six instars, ranged from 23 to 39 days. The adult male and female lived for 4.40 ± 0.75 and 6.10 ± 0.78 days, respectively with a fecundity of 96- 208 eggs. Whereas, the stem borer (*Chilo partellus*) completed its life cycle in 38 to 64 days.

The incubation period ranged from 5 to 7 days. The larval stage passed through six instars, ranged from 26 to 48 days. The adult male and female lived for 5.30 ± 1.35 and 45 ± 1.14 days, respectively with a fecundity of 198-348 eggs. Nine hybrids screened against maize stem borer revealed that the hybrids CP-828, NAH- 2049 and CP-818 were tolerant. While, the hybrids Bioseed-9544, Rajkumar and Allrounder were susceptible. Among the insecticides, Carbofuran 3G and phorate 10G whorl applications showed higher efficacy in suppressing the stem borer. The seed treatment with chlorpyrifos 3ml per kg had given good control upto 42 days. Hence, the ruling unrecommended farmer’s practice of chlorpyrifos seed treatment in and around Shimoga and Davangere districts can be fortified from the present findings.

June, 2009

(M. Manjunatha)
Major Advisor

25. Bioecology and Management of Sugarcane Woolly Aphid (Swa), *Ceratovacuna Lanigera* Zehntner (Aphididae: Homoptera)

NIRANJANA.B

ABSTRACT

Studies on seasonal incidence of SWA, *Ceratovacuna lanigera* Zehntner from June 2004 to May 2005 revealed an incidence ranging from 26.07 to 64.34, 21.33 to 66.33 and 0.00 to 57.47 aphids per 2.5 cm² leaf area at ARS Honnavile, Karehalli (representing Bhadra command area) and Gajanur (representing Thunga command area) of Shimoga district, respectively. The highest incidence of *C. lanigera* was observed during September in all the localities but the lowest incidence was observed during April at Honnavile; Karehalli and February–March at Gajanur. Further simple correlation between the aphid population and weather parameters revealed that, the woolly aphid incidence was negatively correlated with maximum temperature and minimum temperature but positively correlated with relative humidity and rainfall in all the localities.

The natural enemies recorded at ARS Honnavile, Karehalli and Gajanur include *Dipha aphidivora* (pyralid), *Micromus igorotus* (hemerobiid), *Eupeodes confrater* (syrphid) and *Cheilomenes sexmaculata*, *Coccinellatransversalis* (Coccinellids). In addition to this two more species of Coccinellids viz., *Synonycha grandis* and *Hormoniaoctomaculata* were recorded at Karehalli and one more species of Coccinellid, *Coelophora bipalgiata* was recorded at Gajanur. Among these predators, *D. aphidivora* was predominant followed by hemerobiid, syrphid and coccinellids. The bioecology of SWA studied both in laboratory and field condition revealed that it had an anoholocyclic life cycle, where in both alate and apterous forms were reproduced by parthenogenetic viviparity and no sexual reproduction was found. The woolly matter developed only on third and fourth instar nymphs in case of apterous form. Life cycle, fecundity and longevity of woolly aphid was maximum during January–February, while the minimum was observed during April–May under field condition.

All insecticides tested were quite effective in controlling SWA, except azadirachtin 5 % treatment. The reappearance of aphid was 77.77 and 5.76 aphids (per 2.5cm² leaf area) in azadirachtin and endosulfan treatments, respectively at seven days after application. However, as compared to other treatments tested, Thiamethoxam (6.27), imidacloprid (7.37), phosphomidon (9.87), acephate (12.13) and monocrotophos (13.06) recorded less number of aphid (reappearance) at 21 days after application. Thus indicating the possibility of their selective use in the management of sugarcane woolly aphid.

26. Biocenology and Management of Giant African Snail, *Achatina fulica* Bowdich (Achatinidae: Gastropoda) in Areca Ecosystem

RAVIKUMARA

ABSTRACT

The study on incidence of *Achatina fulica* Bowdich from June, 2004 to June, 2005 revealed that the population ranging from 1.00 to 91.25 snails per 10 m² area. The lowest and highest populations were observed during first fortnight of February, 2005 and second fortnight of September, 2004, respectively. Snail population had highly significant negative and positive correlation with the maximum temperature and relative humidity, respectively. Snails laid creamy white to yellowish bright eggs measuring 5.09 ° 0.79 mm in length and 4.18 ± 0.45 mm in width. The average fecundity was 90 ± 15.87 and 126 ± 61.5 during July-August, 2004 and June-July, 2005, respectively. Incubation period lasted for 13.85 ± 5.52 and 12.53 ± 5.31 days during July-August, 2004 and June-July, 2005, respectively. Hatching percentage was 93.40 ± 11.5 and 94.12 ± 4.43 during July-August, 2004 and June-July, 2005, respectively. The snails hibernated from October, 2004 to April, 2005 at a depth of 8.01 cm, 5.17 cm, 4.52 cm, 4.25 cm and 3.96 cm in red soil, red soil mixed with organic matter, sandy soil, red loamy soil and laterite soil, respectively.

In medium sized snails highest night time feeding rate was recorded in pepper (11.32 sq. cm.) followed by vanilla (5.68 sq. cm.), while day time feeding rate was highest in pepper (1.67 sq. cm.) followed by banana (1.25 sq. cm.). In big sized snail the highest night time feeding rate of 30.13 sq. cm. found in pepper followed by banana (12.78 sq. cm.) while highest day time feeding rate of 1.76 sq. cm. recorded in areca followed by betel vine (1.68 sq. cm.). Banana was the most preferred host for small sized snails while pepper was the most preferred host for medium and big sized snails. The highest number of snails was attracted in papaya stem waste followed by vegetable waste and fishmeal waste. Of the different chemicals and baits tested along with papaya stem waste, the highest mortality (87.67%) was observed at 6 kg metaldehyde bait per acre on second day which was on par with 2 and 4 kg metaldehyde bait per acre. Similar findings were observed even on fourth and the sixth day after application of metaldehyde. Hence 2 Kg metaldehyde bait per acre can be recommended to manage the snails.

June, 2006

(Mohan I. Naik)
Major Advisor

27. Studies on Bio-Ecology and Management of Paddy Earhead Bug, *Leptocorisa Oratorius* (Fabricius) (Hemiptera: Alydidae)

VENKATESH HOSAMANI

ABSTRACT

Study conducted on biology of *Leptocorisa oratorius* under green house and field conditions revealed that, The *Leptocorisa oratorius* took an average of 25.76 ± 2.73 and 26.00 ± 3.91 days to complete life cycle from egg to adult under green house and field conditions respectively. Fecundity was 98.30 ± 27.59 and 92.90 ± 19.99 in greenhouse and field conditions respectively, with an ovipositional period of 19.00 ± 5.89 days and 13.10 ± 3.67 days respectively. The longevity of adult male and female was 30.30 ± 5.21 and 71.00 ± 11.48 respectively under greenhouse condition and it was 47.70 ± 10.85 and 65.70 ± 12.96 days in field conditions respectively. The mean occurrence of bugs per hill ranged from 1.31-2.26 and 2.39-4.02 during *kharif* and 1.49-2.52 and 2.81-3.86 during summer in Shimoga and Bhadravathi taluks respectively. Whereas it was 0.21-1.62 bugs per hill during *kharif* in Shikaripura taluk. Light trap studies (6.00 pm to 6.00 am) indicated 96 per cent of attraction of bugs upto 2.00 am while it was 27.85 per cent between 11 and 12 pm being peak attraction.

During present investigation eight alternate hosts were identified, out of which *Echinochloa crusagalli* and *E. colona* were found to be the most preferred alternate hosts. In addition to these hosts, bugs were found to congregate on arecanut, banana, carambola, papaya, maize and cinnamon for shelter during sunny hours. The study conducted on percent damage due to earhead bug revealed that the average per cent damage to paddy due to earhead bug was 5.79 and 4.08 during *kharif* and 5.57 and 3.84 during summer in Bhadravathi and Shimoga respectively, which represents command areas and 1.96 per cent during *kharif* in Shikaripura taluk, which represents tank fed area. The average germination percentage of bug infested grains at 5th and 14th day was 70.07 and 74.02, 37.49 and 54.45 and 54.44 and 64.96 per cent in Shikaripura, Bhadravathi and Shimoga taluks respectively.

The study conducted on bio efficacy of dust and EC formulations against earhead bug revealed that, among the six treatments, the maximum of 90.49 per cent and 94.45 per cent reduction in bug population was noticed in malathion 5 per cent dust during *kharif* and summer respectively. Remaining insecticides showed either moderate or least effectiveness against earhead bug.

June, 2007

(S. Pradeep)

Major Advisor

28. Studies on Insect Pests of Maize (*Zea Mays* Linn.) with Special Reference to the Bio-Ecology and Management of Maize Stem Borer, *Chilo Partellus* (Swinhoe) (LEPIDOPTERA: PYRALIDAE)

SIDDALINGAPPA

ABSTRACT

The study conducted to know the insect pests of maize at College of Agriculture Shimoga, revealed that *Chilo partellus*, *Sesamia inferens*, *Helicoverpa armigera*, *Marasmia trapezalis*, *Mythimnaseparata*, *Rhopalosiphum maidis*, *Cicadulina bipunctella* and *Myllocerous* sp. were common. The study conducted on seasonal incidence of maize stem borer revealed an incidence ranging from 4.0 to 18 per cent, 10.0 to 22.0 per cent and 8.5 to 20.0 per cent at College of Agriculture Shimoga, Attibele village of Shikaripur taluk and Abbalgere village of Shimoga taluk respectively. The highest incidence was observed during I fortnight of September, 2007 in all the three localities while the lowest incidence was noticed during I fortnight of December, 2007 at College of Agriculture Shimoga. Similarly, in Attibele and Abbalgere village lowest incidence was noticed during I fortnight of June, 2007. Further the simple correlation between the percentage stem borer incidence and weather parameter revealed that, the per cent incidence of stem borer had the significant positive correlation with minimum temperature, relative humidity and rainfall.

The biology of maize stem borer was studied under laboratory conditions from June to August, 2007. The stem borer completes its life cycle in 30 to 69 days. The incubation period ranged from 3 to 6 days. The larval stage passed through six instars. The mean duration of I, II, III, IV, V and VI instar was 4.80 ± 0.78 , 4.40 ± 1.89 , 5.30 ± 1.88 , 5.90 ± 2.28 , 6.10 ± 2.37 and 8.30 ± 2.21 days respectively. The total larval period ranged from 20 to 51 days. The pre-mating and mating period occupied 9.15 ± 1.40 and 5.04 ± 0.70 hours respectively, oviposition period occupied 4.2 ± 0.63 days. The stem borer had the fecundity rate of 262-657 eggs. The adult male and female lived for 3 to 8 days and 3 to 7 days with a mean of 6.20 ± 1.75 and 5.00 ± 1.49 days, respectively. The study on efficacy of insecticides against maize stem borer showed that, all the insecticides tested were effective in suppressing the stem borer. Indoxacarb 0.0145, lambda cyhalothrin 0.005, cypermethrin 0.01 per cent spray showed higher efficacy in suppressing the stem borer. All other chemicals showed moderate to least effectiveness but they are significantly superior to untreated control.

June, 2008

(C. Thippeswamy)
Major Advisor

29. Bio-Ecology of Leaf Hopper, *Amrasca Biguttula Biguttula* Ishida and Aphid, *Aphis Gossypii* Glover and Evaluation of Fungal Pathogen, *Fusarium Semitectum* Berk and Ravenel on them in Okra.

JAYASIMHA G T

ABSTRACT

Studies on seasonal incidence of leaf hopper *Amrasca biguttula biguttula* Ishida and aphid *Aphis gossypii* Glover on okra were carried out at Agricultural College, Shimoga during 2007-08. The results revealed a higher incidence of leaf hopper (16.44 to 0.25 per leaf) during March I fortnight and a lower incidence in December II fortnight. Leaf hopper population was positively correlated with temperature. The incidence of aphid ranged from 24.23 to 0.29 per sq cm leaf its population was correlated positively with temperature.

A study on biology of leaf hopper and aphid revealed a total development period of 28.30 to 34.00 days and for leaf hopper 12.00 to 22.00 days for aphid.

The studies on the efficacy of *Fusarium semitectum* Berk and Ravenel and *Verticillium lecanii* Zimmerman were evaluated against leaf hopper and aphid under laboratory conditions, *F. semitectum* @ 3.60×10^9 spores/ml recorded a mortality of 83.34 per cent for nymphs and 75.21 per cent for adults of leaf hopper and for aphid *F. semitectum* @ 4.60×10^9 recorded mortality of 79.90 per cent for nymphs and 64.40 per cent for adults. While *V. lecanii* @ 2.50×10^9 spores/ml on leaf hopper recorded mortality of 87.27 per cent for nymphs and 78.20 per cent for adults and for aphid on *V. lecanii* @ 2.10×10^9 spores/ml recorded mortality of 87.27 per cent for nymphs and 92.31 per cent for adults.

Under the field conditions against leaf hopper dimethoate (0.06%), *V. lecanii* @ 4.90×10^{14} spore/ml + dimethoate (0.03%), *V. lecanii* @ 4.90×10^{14} spores/ml and *F. semitectum* 2.50×10^{15} + dimethoate (0.03%) recorded mortality of 82.12, 75.23, 60.26 and 57.08 per cent at 15 days after spray respectively. While for the aphid dimethoate (0.06%), *V. lecanii* 5.20×10^{14} spore/ml + dimethoate (0.03%), *V. lecanii* 5.20×10^{14} spores/ml alone and *F. semitectum* 3.60×10^{15} + dimethoate (0.03%) recorded mortality of 83.76, 72.59, 69.26 and 55.32 per cent respectively at 15 days after spray.

June, 2008

(M. Manjunatha)
Major Advisor

30. Effect of Organic Manures and Biopesticides on the Incidence of Insect Pests of Moth Bean and Their Natural Enemies

KUMARA SWAMY, M.C

ABSTRACT

A field investigation on “Effect of organic manures and biopesticides on incidence of insect pests of Moth bean and their natural enemies” was carried out at College of Agriculture, Shimoga during *kharif* 2011. In the present study the lowest population of aphid, *Aphis craccivora* (Koch) (1.77 aphids/ three trifoliolate leaves/plant) and leaf hopper *Exitianus indicus* (Distant) (0.12/ three trifoliolate leaves/plant) were recorded in neem cake (NC) applied plots.

The lowest population of beetle *Maladara* sp. was recorded in NC (0.09 adults/plant) while it was low (0.10 adults/plant) in recommended dose of fertilizers (RDF) + *F. semitectum*+*N. releyi*+NSKE. Similarly, the lowest bug, [*Riptortus pedestris* (Fabricius)] population (0.10 nymphs and adults/plant) and lowest population of leaf folder *Omiodes indicata* (Fab.) (0.09/plant) was recorded in NC. Similarly lowest pod borer damage [*Cydia ptychora* (Meyrick)] (11.3 damaged pods/plant) was recorded in NC, while pod borer damage of 13.0 pods/plant was recorded in RDF + *F. semitectum*+*N. releyi* + NSKE sprayed plots. Significantly higher numbers of coccinellid, *Coccinella transversalis* (Fab.) (0.38 grubs and adults/plant) were recorded in RDF.

The highest organic carbon content was recorded in farm yard manure (FYM) treated plots at 30, 45 and 60 days after sowing (DAS) (0.45%, 0.47% and 0.49%) respectively. Similarly, highest available nitrogen (162.67, 165.44 and 167.74 Kg/ha) phosphorous (56.58, 59.29 and 59.15 Kg/ha) and potassium (187, 184 and 185 Kg/ha) were recorded at 30, 45 and 60 DAS in RDF and poultry manure (PM) treatment plots respectively.

The lowest population of aphid (2.42/ three trifoliolate leaves/plant) and leaf hopper (0.11/ three trifoliolate leaves/plant) were recorded in GMO-01-09 and Shikaripura-2 respectively, while 0.18 beetle per plant were recorded in GMO-01-09. Similarly lowest number of bug (0.11 nymphs and adults/plant) were recorded in GMO-01-09, while a reasonable population of leaf folder (0.13 larvae/plant) and pod borer (11.4 damaged pod/plant) were recorded in Local-2 and GMO-01-09, respectively. Among organics, FYM had highest net returns (Rs.16960.00 per ha) with B:C ratio of 6.78 followed by vermi compost (VC) (Rs.14260.00 per ha) with B:C ratio of 5.94.

June, 2011

(M. Manjunatha)
Major Advisor

31. Seasonal Incidence and Management of Scarlet Mite *Raoiellaindica* Hirst (Tenuipalpidae: Acari) using *Fusarium Semitectum* Berk and Ravanel on Arecanut

RAGUNATHA

ABSTRACT

Studies on seasonal incidence of *Raoiellaindica* Hirst and its management using *Fusarium semitectum* Berk and Ravanel on arecanut was carried out at college of Agriculture, Shimoga during 2011-12. The higher incidence of the mite was noticed in April and May and lower incidence was recorded in the months of July to January. The incidence of mite was observed more on lower portion of the frond. The mite population was positively correlated with temperature and negatively with relative humidity, whereas with rainfall the relation was non-significant. Studies on host preference of *Raoiellaindicato* different areca cultivars revealed that cv. Thirthalli was severely affected and colonized by more mites compared to other cultivars. Whereas, cv. Sreemangala recorded lowest mite population. Further studies on efficacy of fungi *Fusarium semitectum* and *Hirsutella thompsonii* on different stages of *R. indica* was carried out under laboratory conditions. The highest adult mortality was recorded at a concentration of 4.6×10^8 spores/ml of *H. thompsonii* and 2.3×10^9 spores/ml of *F. semitectum* with per cent mortality 84 and 80 respectively. Eight treatments evaluated under laboratory conditions showed highest mortality in propergite followed by dicofol with 91.30 and 84.00 per cent mortality. Among eight treatments evaluated against the *R. indica* under field conditions, the highest mortality of 83.44 was recorded in propergite. Dicofol and azadiractin were next best showing 76.35 and 59.30 per cent mortality of mites. The treatment *F. semitectum* at 2.6×10^5 spores/ml showed 44.37 per cent mortality being least effective. *F. semitectum* + dicofol and *H. thompsonii* 4.1×10^4 spores/ml recorded 53.32 and 54.75 per cent mortality

June, 2012

(M. Manjunatha)
Major Advisor

32. Studies on the Effect Of Herbicides on the Soil Fauna in Soybean Ecosystem

PRADEP KUMAR C. S

ABSTRACT

A field experiment entitled “Effect of herbicides on the soil fauna in soybean ecosystem” was conducted during kharif 2011 at ZARS, Navile, Shimoga. The experiment was laid out in randomized complete block design with three replications.

The studies revealed that among the different intervals of observations, post emergent application of fluzifop butyl @ 50 g a.i./ha recorded significantly lower soil arthropod population at 80 DAS as compared to the rest of the treatments (20.00 arthropods per 400 gm of soil) an diversity of soil arthropods was also lower (0.62). Abundance of collembolans, mesostigmata and cryptostigmata was lower at 80 DAS (0.67, 0.33 and 0.67 per 400 g of soil, respectively). Fluzifop butyl at recommended dosage recorded higher conidial inhibition of *Metarrhiziumanisopliae* (34.43 per cent) and application of recommended dose of trifluralin recorded lower (15.06 per cent) inhibition. Application of chlorimuron ethyl recorded higher inhibition (34.42 per cent) at recommended dosage and lower inhibition (15.51 per cent) of conidial germination *Beauvaria bassiana* with a n application of recommended dose of clethodim.

Among the herbicidal treatments significantly higher soybean seed yield and haulm yield (26.00 q/ha and 3880 kg/ha respectively) was recorded with pre-emergent application of pendimithalin at 1 kg a.i./ha. Abundance of arthropods showed significant negative correlation with the yield if soybean. Soil arthropods population significantly influenced the yield of soybean.

June, 2013

(Pradeep S)
Major Advisor

33. Studies on Insect Pest Complex on Traditional Varieties of Brinjal (*Solanum Melongena* L.) Cultivars

SOWMYA, E

ABSTRACT

Thirty four traditional brinjal cultivars were screened against shoot and fruit borer *Leucinodes orbonalis* Guen, Hadda beetle *Henosepilacna vigintioctopunctata*, Leaf folder *Antoba olivacea* and leaf hopper *Amrasca biguttulla biguttulla*. Maximum shoot infestation was noticed in dodda badane (42.63 per cent) and minimum in holesalu badane (27.52 per cent). The maximum number of leaf hopper was noticed in hassiru udda badane (12.81) and minimum in Kanakapura badane (2.54). Screening of cultivars against hadda beetle revealed that the maximum number of hadda beetle reported in hasiru udda badane (24.25) and minimum in 40-A badane (0.50). The maximum leaf damage caused by leaf folder was noticed in Heddaragulla badane (25.47 per cent) and minimum 40-A badane (11.75). An attempt was made to study the relationship between shoot and fruit borer infestation with morphological and biochemical characters of both shoot and fruit.

The results were highly significant and gave a very strong significant negative correlation between shoot infestation with leaf trichomes (-0.391*) phenol content in shoot (-0.710**), fruit weight (-0.455**), mesocarp thickness (-0.389*), number of seeds (-0.740**), phenol content in fruit (-0.357*) and fruit yield (-0.825**). Among the different chemicals used to manage the shoot and fruit borer higher larval reduction of 56.01 per cent recorded with spinosad which was on par with flubendi amide (55.66 per cent) followed by indoxacarb (51.22 per cent). The lower larval reduction of 10.53 per cent recorded with *Metarhizium anisopliae* which differed significantly from the control. The higher benefit cost ratio was obtained in spinosad 45 EC (4.58) which was on par with flubendiamide 480 EC (4.44) followed by chlorantraniliprole 18.5 SC (3.71), indoxcarb 14.5 SC (3.61) and chlorpyrifos 20 EC (3.59). Lower B:C ratio was observed in treatment untreated check i.e., 1.56 which was on par with *Metarhizium anisopliae* 2g/L (1.57) followed by 2.1 for NSKE (4%).

June, 2014

(Pradeep, S)
Major Advisor

34. Bio-Ecology and Management of *Phyllocoptruta oleivora* (Ashmead) (Eriophyidae: Acari) on Italian Lemon Citrus limon (L.) Burm.f."

MANJUNATH D.K

ABSTRACT

Studies on seasonal incidence of *Phyllocoptruta oleivora* (Ashmead) and their natural enemies carried out at college of Agriculture, Shimoga during 2013 - 2014. Studies revealed that the incidence of mite was associated with rise in temperature and they were considerably high in the month of March and April and lower incidence was recorded in the month of July, August and from December to second fortnight of February. The maximum and minimum temperature had significantly positive correlation with the population of mites, but a negative correlation with relative humidity was observed. However, rainfall showed non-significant positive correlation with mite population.

Studies on bio- ecology of mite *P. oleivora* on lemon carried out during and revealed that in summer developmental period from egg to adult was $8.63 + 2.13$, 9.83 ± 1.79 days for male and female respectively on leaf, similarly $7.57 + 1.52$, $8.98 + 1.61$ days for male and female respectively on fruits. However, during winter, it was $17.67 + 1.85$, $19.03 + 2.11$ days for male and female respectively on leaf, similarly $14.43 + 1.94$ and $15.06 + 1.99$ days for male and female respectively on fruits.

Further studies on efficacy of *Fusarium semitectum* Berk and Ravenel and *Hirsutella thompsonii* Fisher along with new acaricides were carried out in laboratory conditions. The highest adult mortality was recorded at a concentration of 4.6×10^8 spores/ml of *H. thompsonii* and 2.3×10^9 spores/ml of *F. semitectum* with per cent mortality of 90.33 and 81.33, respectively. The nine treatments of fungi along with acaricides evaluated in laboratory conditions showed the highest mortality in fenazaquin followed by propergite with 96.30, 94.70 and 93.70, 94.30 per cent mortality on leaves and fruits respectively. *F. semitectum* and *H. thompsonii* showed 79.30, 78.70 and 82.30, 80.70 per cent in reduction of mite population at 2.3×10^9 and 4.6×10^8 spores/ ml on leaves and fruits, respectively. Among the nine treatments evaluated against the *P. oleivora* under field conditions, the highest mortality of 90.89, 90.79 was recorded in fenazaquin on leaves and fruits respectively. Propergite and diafenthiuron were next best showing 86.32, 90.39 and 87.79, 83.28 per cent mortality on leaves and fruits, respectively. The treatment *F. semitectum* at 2.6×10^{15} spores/ ml showed 49.84 and 42.36 per cent mortality on leaves and fruits respectively being least effective. *F. semitectum* + dicofol (0.02%) and *H. thompsonii* at 4.1×10^{14} spores/ ml recorded 54.04, 43.70 and 50.43, 49.21 per cent mortality on leaves and fruits respectively.

June, 2014

(M. Manjunath)
Major Advisor

35. Spatial Distribution, Adult Emergence Pattern and Field Evaluation of Insecticides Against Areca Nut White Grubs, *Leucopholis lepidophora* (Blanchard) (Coleoptera: Scarabaeidae)

ADARSHA, S.K.

ABSTRACT

Studies on spatial distribution, adult emergence pattern and field evaluation of insecticides against areca nut white grubs were conducted under the field conditions during 2013-2014. Spatial distributions of root grubs were examined in between the palms (BP) and around the palm (AP) in new and old traditional gardens at Kabbinamane and Bheemanakone, Sagara taluk and Kesere, Thirthahalli taluk (Shimoga District) revealed that the I and II instar root grubs were distributed in random to aggregated manner in new and old gardens at both the locations. The early instars were found to be distributed throughout the gardens during July to October in both the type of gardens. No later instar larval population was recorded in old traditional garden from November onwards. Vertical distribution of larval population was in top surface (0-15 cm) during rainy season and up to 60 cm in summer season. Flooding of entire garden for eight days brought the larvae from deeper layer to surface layer up to 15 cm depth. The pattern of adult emergence of *L. lepidophora* and *L. burmeistri* was observed during emergence periods. Peak emergence of adult beetles of both species was noticed at 7.00 to 7.30 PM. No beetles where rain occurred between 6.00 to 9.00 PM no emergence of adult beetles. The sex ratio of *L. lepidophora* was male biased in Harakere, Shimoga taluk and Gulukoppa, Hosanagara taluk (female:male; 1:1.46 and 1:2.46) respectively. Whereas, in female dominance was observed in *L. burmeistri* in Aladka, Udipi taluk (1:0.02). When freshly emerged females were placed in small nylon mesh trap, they attracted males. Adult beetles of both the species were feeding on different host plants belonging to family Anacardiaceae and Dipterocarpaceae after emergence under field condition. Among the different insecticides treated imidacloprid 17.8 SL 1 l/ha (75 %) gave good reduction over the untreated check in Gulukoppa. Whereas, in Harakere imidacloprid 17.8 SL 1 l/ha, fipronil 5 SC 2.5 l/ha and chlorantraniliprole 18.5% SC 658ml/ha gave 100 per cent reduction of larval population. Some insecticides viz., chloropyrifos 20 EC 10 l/ha, chlorantraniliprole 18.5% SC 658ml/ha, imidacloprid 17.8 SL 1 l/ha and Phorate 10G 25Kg/ha also had negative effect on soil arthropod and earth worms.

June, 2014

(C. M. Kalleshwara Swamy)
Major Advisor

36.Bio-Ecology And Management of Turmeric Shoot Borer, *Conogethespunctiferalis* Guenee (Lepidoptera: Pyralidae)

CHETHAN, K. S

ABSTRACT

The nine genotypes of turmeric were screened against insect pests viz., leaf eating caterpillar (*Spodoptera litura*), shoot borer (*C. punctiferalis*), leaf folder (*Udaspes folus*) and thrips (*Panchaetothrips indicus*) during 2013- 14 at College of Agriculture UAHS, Shimoga. Maximum leaf damage caused by leaf eating caterpillar was noticed in Prathiba (19.75 per cent) and minimum leaf damage was noticed in Belgam local (2.21 per cent). The genotypes Salem, Alleppy supreme, PTS-24 and Bidar-4 were moderately resistant whereas, Rajapuri and Kadapa were susceptible to shoot borer. The maximum leaf damage caused by leaf folder was noticed in Alleppy supreme (14.03 per cent) and minimum leaf damage was noticed in PTS-24 (7.89 per cent). Screening of genotypes against thrips revealed that, the Rajapuri, PTS-24, Salem, Alleppy supreme and Belgam local were highly resistant to thrips while, the genotypes CLI-325, Kadapa, Prathiba and Bidar-4 were resistant to thrips. An attempt was made to study the relationship between weather parameters with incidence of shoot borer revealed that per cent dead heart has significant positive correlation with maximum temperature (0.791'). Whereas, significant negative correlation with rainfall (-0.815') and afternoon relative humidity (-0.798). Biology of *C. punctiferalis* studied in laboratory conditions revealed that, the incubation period of egg was 5.15 ± 0.36 days and total larval period was 17.80 ± 3.42 days. The pupal period was 9.50 ± 0.51 days in male, whereas in female, 9.90 ± 0.55 days. The total life cycle from egg to the death of adult in male was 36.45 ± 5.38 days, whereas in female 39.05 ± 5.24 days. Among the different insecticide tested against shoot borer, highest mean per cent larval mortality over check was recorded in the treatment lamda cyhalothrin 2.5% EC (59.30 per cent) followed by carbofuron 3G (56.63 per cent) and chlorpyrifos 20% EC (53.19 per cent). However, the B:C ratio was higher in lamda cyhalothrin 2.5% EC treated plots (2.38) followed by plots treated with chlorpyrifos 20 EC (2.07) and carbofuron 3G (2.04).

June, 2014

(Hanumantha Swamy B C)
Major Advisor

37. Faunistic Studies on Termites (Isoptera) of Shivamogga District and Evaluation of New Insecticides

G.S. SATHISHA

ABSTRACT

A total of 25 termite species belonging to 11 genera, 6 subfamilies under two families viz., Rhinotermitidae and Termitidae were recorded in Shivamogga district. Rhinotermitinae was represented by two subfamilies viz., Coptotermetinae and Heterotermetinae. *Coptotermes ceylonicus* was the only one species under Coptotermetinae whereas, *Heterotermes indicola* and *H. malabaricus* two species under Heterotermetinae. Termitidae was the dominant family with 22 species which were belonging to nine genera and four subfamilies viz., Amitermitinae, Macrotermitinae, Nasutitermitinae and Termitinae. Amitermitinae had four species, namely, *Eurytermes budda*, *Microcerotermes fletcheri*, *M. pakistanicus* and *Speculitermes sinhalensis*. Macrotermitinae had the highest number of species belonging (12) two genera, namely *Microtermes* and *Odontotermes*. *Microtermes* genus was with only one species i.e., *Microtermes obesi*.

The genus *Odontotermes* was represented by the highest number of species (11), namely, *O. adampurensis*, *O. anamallensis*, *O. assmuthi*, *O. bellahunisensis*, *O. bhagwathi*, *O. boveni*, *O. feae*, *O. horni*, *O. microdentatus*, *O. obesus* and *O. redemanni*. Nasutitermitinae was represented by four species, namely *Nasutitermes anamalaiensis*, *N. krishna*, *N. indicola* and *Trinervitermes biformis*. Termitinae subfamily was represented by two species, namely *Labiocapritermes distortus* and *Pericapritermes* sp.

Illustrated key was prepared for all the collected families, genera and species for easy and accurate identification based on the morphology of head and thorax of soldiers caste. The present study also revealed that the differences in the species composition and richness among three different habitats (Western Ghats (11 species and Shannon's index (H) - 1.56), semi-malnad (11 species and H - 1.37) maidan (4 species and H - 0.89). Among the different insecticides tested, lowest termite density was recorded in bifenthrin @ 2ml per litre upto 21 days after insecticide application in soil. The next best effective insecticides were imidacloprid @ 0.5ml and fipronil @ 2ml per litre.

June, 2015

(Kalleshwra Swamy, C. M)
Major Advisor

38. Evaluation of Different Intercrops, Organic Manures and Biopesticides against Stem Borers in Maize (*Zea Mays L.*)

KAVITAHEGDE

ABSTRACT

The present investigation was carried out against important maize stem borers, *Chilopartellus* (Swinhoe) and *Sesamia inferens* (Walker) at College of Agriculture, Shivamogga during *kharif*, 2014-15. The different intercropping systems *viz.*, maize + cowpea, maize + field bean, maize + coriander, maize sole crop and different organic manures *viz.*, FYM, neem cake, poultry manure and rice hull ash were evaluated against these stem borers in maize.

Among the different intercropping systems maize + cowpea (1:1) recorded lowest percentage of plants showing pinholes (12.80%), lowest number of pinholes per plant (19.60), lowest per cent dead hearts (5.65%) and cob damage (4.33%) with highest grain (48.53 q ha⁻¹) and fodder yield (93.97 q ha⁻¹). Among the different organic manures neem cake @ 0.2 t ha⁻¹ resulted in lowest percentage of plants showing pinholes (16.74%), lowest number of pinholes per plant (21.19), lowest per cent dead hearts (6.32%) and cob damage (4.70%) with highest grain (46.31 q ha⁻¹) and fodder yield (85.45 q ha⁻¹). Interaction effect between different combinations of intercropping systems and organic manures showed that maize intercropped with cowpea along with application of neem cake found superior among the treatments by recording lowest percentage of plants showing pinholes (6.71%), lowest number of pinholes per plant (12.91), lowest per cent dead hearts (3.34%) and cob damage (2.98%) with highest grain (53.40 q ha⁻¹) and fodder yield (97.86 q ha⁻¹).

Among the different bio pesticides and insecticides evaluated, seed treatment (2ml/kg of seed) and foliar application of chlorpyrifos (2ml/l) at 40 DAS recorded lowest damage in terms of percentage of plants showing pinholes (21.15%), per cent dead hearts (8.78%) and number of larvae per plant (2.57) with highest grain (30.47 q ha⁻¹) and fodder yield (42.06 q ha⁻¹).

June 2015

(M. Manjunatha)
Major Advisor

39. Aphid (APHIDIDAE: HOMOPTERA) Vectors of Potato Viruses and their Management

KUMARA, B. B.

ABSTRACT

Population dynamics of potato aphids was conducted during *Kharif* and *Rabi* of 2014-15 in potato fields of chikkamagaluru district. Five locations were selected during the study period at both the seasons. Among five locations Beekannahalli (location 3) has recorded highest aphid population on crop followed by Mugalavalli (location 5) during *Kharif*. In *Rabi*, highest aphid population was recorded on crop in Lakshmipura II (location 3). Six species of aphids were trapped on sticky trap and four species on water traps during *kharif*. In *Rabi*, five species of aphids were trapped on sticky trap and four species on water traps. Aphids had positive correlation with minimum temperature and maximum temperature in almost all locations. The per cent PVY incidence was more in *Kharif* compared to *Rabi* in all the locations. The transmission efficiency of potato viruses by three aphid vectors (*M. persicae*, *A. gossypii* and *A. craccivora*) was studied. Efficiency was measured by single aphid inoculation following a single acquisition access period (AAP) and the number of plants showing symptoms to which the aphids could successfully transmit the virus. Single aphid inoculation studies for PVY indicated that *M. persicae* (66.66%) was significantly more efficient in transmitting PVY than *A. gossypii* (26.66%) and *A. craccivora* (16.66%). Settling behaviour of aphids was studied on healthy potato plant and PVY infected plants. On healthy plants, all the three species took more time to initiate the probe compared to PVY infected plants. *Myzus persicae* initiated probing earlier than other two species. Insecticides were evaluated against potato aphids and also virus incidence in two locations. In one location, thiomethoxam followed by imidacloprid and acephate were effective in controlling aphid population. PVY incidence was low in thiomethoxam treated plots compared to other insecticides. However, none of the insecticides were effective in reducing PLRV incidence. In another location, imidacloprid, thiomethoxam and acetamiprid are found effective.

December, 2015

(Kalleshwaraswamy, C. M)
Major Advisor

40. Studies on the Population Density, Spatial Distribution and Management of Coconut Black Headed Caterpillar, *Opisina arenosella* (Walker) (Oecophoridae: Lepidoptera)

SHARANABASAPPA, M. KAMADAL

ABSTRACT

Studies on the population density, spatial distribution and management of coconut black headed caterpillar, *Opisina arenosella* (Walker) (Oecophoridae: Lepidoptera) were carried out in the two agro-climatic zones of Karnataka (Central dry zone, Chikkamagaluru district and Southern transition zone, Shivamogga district) during 2014-15. The study clearly showed that, at least in some months, there was a complete deviation from the discrete generation, particularly in the month of June and September 2014. With respect to spatial distribution of different life stages of *O. arenosella* indicated that, eggs were found to have aggregated distribution in a large infested patch. In most of the sampling periods, early, medium, later instar larval and pupal stages showed the aggregated distribution. Pre-oviposition period of field collected *G. nephantidis* was significantly lower (4.15 ± 0.75 days) than lab reared *G. nephantidis* (4.80 ± 0.77 days). Oviposition period of field collected *G. nephantidis* was significantly higher (15.2 ± 1.36 days) than the lab reared *G. nephantidis* (14.35 ± 0.99 days) at 25 to 30°C. Progeny production was higher in field collected *G. nephantidis* (123.4 ± 10.30 eggs) than the lab reared *G. nephantidis* (80.45 ± 4.5 eggs). The sex ratio (female to male) in lab reared population was ($1:0.12 \pm 0.02$) and it was lesser as compare to field collected population of *G. nephantidis* ($1:0.22 \pm 0.02$). The field and laboratory evaluation of selected insecticides against *O. arenosella*, indicated that the highest per cent mortality was recorded in case of monocrotophos 36% SL (54.33%) and neemazal 10/o (29.26%) as compare with other insecticides inferred by the observation made after three days of root feeding. The insecticides monocrotophos 36% SL, bifenthrin 10o/o EC, imidacloprid 17.8% SL, neemazal 7%, and emamectin benzoate 50g SG gave significant reduction in larval population of *O. arenosella* after seven days, 14 and 21 days of root feeding as compared to only 10.9% reduction in untreated control.

December, 2015

(B. C. Hanumanthaswamy)
Major Advisor

41. Studies on Mango Fruit Fly Species Composition, Evaluation of Traps and Screening of Varieties for Resistance

LAVANYA, M. N

ABSTRACT

Studies on monitoring of mango fruit fly species, evaluation of different traps and screening of varieties for resistance was conducted at College of Agriculture, Shivamogga, farmer field Devabala, Shivamogga and Doddabbigere, Davanagere during 2014 to 2015. The population of *Bactrocera dorsalis* had two peaks from 23rd to 29th and 10th to 22nd SW and from 23rd to 33rd and 10 to 22nd SW at College of Agriculture, Shivamogga and Devabala, respectively. *Bactrocera correcta* had two peaks at both the locations *i.e.* 23rd to 33rd and 10 to 22nd SW. *Bactrocera zonata* also had two peaks from 23rd to 33rd and 10th to 22nd SW and 23rd to 32nd and 10th to 22nd SW at College of Agriculture, Shivamogga and Devabala, respectively. *Bactrocera versicolor* recorded during 23rd to 41st and 11th to 22nd SW and 23rd to 43rd and 12th to 22nd SW at College of Agriculture, Shivamogga and Devabala, respectively. *Bactrocera curcurbitae*, *Bactrocera tau* and *Bactrocera paraverebascofoliae* observed at College of Agriculture, Shivamogga and Devabala, Shivamogga where as *Bactrocera affinis* recorded only at Devabala, Shivamogga. At College of Agriculture, Shivamogga and Devabala, *Bactrocera dorsalis*, *Bactrocera correcta* and *Bactrocera zonata* had significant positive correlation with maximum, minimum temperature and wind speed whereas, *Bactrocera versicolor* showed significant positive correlation with rainfall and wind speed. In Saindura and Raspuri, *B. dorsalis* emerged to an extent of 100 per cent and 99.43 per cent from Alphanso. *B. correcta* was noticed to an extent of 0.58 per cent only in Alphanso. In all the three varieties *B. dorsalis* was male dominant with a sex ratio of 1: 0.63 to 1: 0.66 whereas, females were dominant in *B. correcta* with sex ratio of 1: 2.9. PCI trap recorded significantly higher number of fruit flies and followed by IIHR trap at College of Agriculture, Shivamogga and Devabala, Shivamogga. Wooden block lure trap proved to be ineffective by attracting significantly less number of fruit flies. Neelam variety resulted as resistant by recording least percentage of incidence. Highest percentage of incidence was recorded in Alphanso, Raspuri and Totapuri.

December, 2015

(Sharanabasappa)
Major Advisor

42. Bioassay and Evaluation of Newer Insecticides against Insect Pests of Okra

THARA, K.T.

ABSTRACT

As many as 10 species of insect pests and one natural enemy has been recorded in all stages of the okra at ZAHRS, University of Agricultural and Horticultural Sciences(UAHS), Shivamogga. Among them, grey weevil, *Mylokerus undecim pustulatus* (Fab.); flea beetle, *Nisotra cardoni*(Bryant) as defoliators; aphid, *Aphis gossypii* (Koch.); leafhopper, *Amrasca biguttula biguttula* (Ishida); mites, *Tetranychus urticae* (Koch.) and red cotton bug, *Dysdercus koenigii* (Fab.) were serious sucking pests. The fruit borers include *Helicoverpa armigera*(Hub.) and *Earias vittella*(Fab.) The population of all insect pests were abundant during August to November, 2016. The activity of fruit borers commenced 6-8 weeks after sowing (WAS) and peak incidence was observed during 13th WAS. All fruit borers have showed significant negative correlation with maximum and minimum temperature and positively correlated with relative humidity.

The per cent mortality of *H. armigera* at different regions varied, the per cent mortality was highest in population of Davanagere area recorded lesser LC₅₀ values to chlorantraniliprole and flubendiamide obtained for the F₁ generations of the laboratory populations. Similarly, the per cent mortality was less in Raichur population of *H. armigera* and recorded higher LC₅₀ values and Higher resistance ratio (3.12) followed by Bangalore (2.60) and Shivamogga (2.04). Evaluation of different insecticides against sucking pests revealed that the least number of sucking pests were observed in case of imidacloprid 17.8 SL (4.17 aphids/3 leaves) (5.8 leafhoppers/3 leaves) and buprofezin 25 SC (4.89 aphids/3 leaves) (6.7 leafhoppers/3 leaves) and found effective. With respect to management of borers (*H. armigera* and *E. vittella*) the lowest larval population was noticed in chlorantraniliprole 18.5 SC (0.34 larva/plant) and flubendiamide 480 SC (0.38 larva/plant) followed by emamectin benzoate 5SG (0.60 larva/plant). Chlorantraniliprole 18.5SC proved highly effective in the management of fruit borer and recorded highest yield (86.87q/ha) with a B: C ratio of 3.56.

October, 2016

(Sharanabasappa)
Major Advisor

43. Population Dynamics and Management of Rice Leaf Folder, *Cnaphalocrocis Medinalis* Guenee (LEPIDOPTERA: PYRALIDAE)

MURALI, R.

ABSTRACT

Studies on population dynamics and management of rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) were carried out at the College of Agriculture, UAHS, Shivamogga during 2014-15. Population dynamics of leaf folder and its natural enemies during summer and *kharif* of 2015 revealed that, the maximum number of eggs, larvae and pupae were observed during the 12th standard week (*i.e.*, 4th week of March), 13th standard week (*i.e.*, 1st week of April) and 14th standard week (*i.e.*, 2nd week of April), respectively during Summer season. The maximum per cent leaf damage during summer was observed in April. During *kharif* season, maximum number of eggs, larvae and pupae were observed during the 38th standard week (*i.e.*, last week of September), 39th standard week (*i.e.*, last week of September) and 42nd standard week (*i.e.*, 3rd week of October), respectively. The maximum per cent leaf damage during *kharif* was observed in September and October. Natural enemies *viz.*, spiders, ground beetles and parasitoids were noticed in both the season and these were correlated with leaf folder population.

Field screening of 25 rice germplasms was carried out against rice leaf folder during summer, 2015. Out of 25 germplasm, only one germplasm (Doddiga) had highly resistant to leaf folder. Thirteen germplasms were resistant and remaining eleven germplasms were moderately resistant to leaf folder. Among the plant morphological traits (number of trichomes, number of tillers and leaf width) studied, only number of trichomes and leaf width (cm) showed significant negative and positive correlation, respectively with leaf folder infestation. Field experiment was conducted to evaluate newer insecticide molecules against rice leaf folder during summer 2015. Chlorantraniliprole 18.5% SC @ 0.30 ml/l registered its superiority over rest of the treatments by recording least per cent leaf damage and higher grain yield. Highest B: C ratio was recorded to be 3.62 in both flubendiamide 39.35% SC and thiamethoxam 25% WG treated plots.

April, 2016

(B. K. Shivanna)
Major Advisor

44. Seasonal Fluctuation, Crop Loss Estimation and Management of Yellow Stem Borer, *Scirpophagaincertulas* (Walker) (LEPIDOPTERA: PYRALIDAE) on Paddy

PALLAVI, D.

ABSTRACT

In order to understand seasonal fluctuation, crop loss estimation and management of yellow stem borer, *Scirpophagaincertulas* (Walker) on paddy, studies were conducted during summer and *Kharif* 2015 at ZAHRS, College of Agriculture, Shivamogga. During summer, the highest incidence of dead heart (DH) (46.40%) and white ear (WE) (22.00%) was noticed during third week of April and third week of May, respectively. In *Kharif*, 2015 the incidence was high during second week of September (31.20% DH) and first week of October (24% WE). In both the seasons, maximum temperature showed significant positive correlation with infestation. With regard to pheromone trap catches, in summer, peak moth catches of 44.40 moths /trap was recorded during fourth week of April and there was a positive correlation with maximum temperature, sunshine hours and minimum temperature, While morning relative humidity had negative correlation and during *Kharif*, peak catches of 35.20 moths / trap was recorded during third week of September. Maximum temperature, sunshine hours exerted significant positive correlation with trap catches. While total rainfall, morning relative humidity and afternoon relative humidity had negative relationship. The yellow stem borer was the most predominant species and pink stem borer was the second most predominant species observed during second week of October. The plots which were sprayed thrice at 15 days interval after sowing in nursery followed by 15 and 30 days after transplanting was considered as best treatment and if there were no spray, stem borer can do yield loss of up to 87.66 per cent. Among the different insecticides, Chlorantraniliprole 0.4 GR proved very effective in recording lowest per cent of 7.20% DH and 6.67% WE infestation and recorded significantly highest yield (65.75q/ha).

June, 2016

(Sharanabasappa)
Major Advisor

45. Faunistic Studies on Hairy Caterpillars (LEPIDOPTERA: NOCTUOIDEA) in different Cropping Ecosystems

MALLIKARJUN WARAD

ABSTRACT

Investigations were made on faunistic studies on hairy caterpillars (Noctuoidea: Lepidoptera) in different cropping ecosystem. Among lymantrid hairy caterpillars reared, *Euproctis* was documented to feed on banana and paddy, *Lymantria* on castor and *Perina* on fig and one wingless species from *Mimosa pudica* which was not identified to species level. Among arctiids *Cretonotus* was documented from cocoa, *Utetheisa* from sunhemp, *Spilarctia* from castor and *Pericalia* from pigeonpea. *Estigmena*, *Argina*, *Amerila*, *Asura*, *Amata* were collected from light traps. Seven unidentified species were also recorded on different hosts. Biology of the Bihar hairy caterpillar, *Spilarctia obliqua* reared on field bean leaves revealed that the eggs were creamy white became pale yellow in colour.

The number of eggs per mass varied from 148 to 232 in batches. Egg period, larval and pupal period varied from 5 to 6, 20 to 21 and 8 to 9 days, respectively. The average egg laid by a female moth was 148 - 232. The length of male and female moth varied from 51 to 55 mm and 55 to 59 mm, respectively. The total life span of male and female ranged from 37 to 42 days and 39 to 44 days, respectively. Variations in morphological and genital characters of adults were studied in all the collected species of hairy caterpillars. Based on these variations, an illustrated key was prepared for families of super-family Noctuoidea, sub-families of Erebidae and to the genera of twelve species of hairy caterpillars. The developed illustrated identification key may be useful for identification of important adults of hairy caterpillars occurring in this region.

June, 2016

(Kalleshwaraswamy, C. M)
Major Advisor

46. Development of Trap Nests and Hives for Stingless Bee, *Tetragonula iridipennis* (Smith)

IMRANALI

ABSTRACT

Present study on development of trap nests and hives for stingless bee, *Tetragonula iridipennis* (Smith) was carried out during 2015-16 in apiary at College of Forestry, Ponnampet, UAHS, Shivamogga. Cavities or wooden logs and wall cavities were found to be the most important nesting sites of *T. iridipennis*. The external tunnel of nest was made of resin. Natural nest characteristics revealed the length and breadth of entrance tube ranged between 4-12 mm and 3-6 mm respectively, height of entrance from the ground ranged from 23 cm to 188 cm. The food storage zone was divided into pollen and honey zone. The honey and pollen were stored in separate pots, but these pots were often intermixed. Different trapping materials were used for attracting swarms of stingless bee like cardboard nest, plastic bottles or plastic containers, bamboo slits, earthen pots, coconut shells and cement pipes smeared with honey and cerumen but no colonies were trapped in any of above traps except one in the bamboo slit of two liter volume.

Among the different kind of hives rectangular box with two halves was found more favorable for the growth of the colonies, followed by UTOB hive with two storey space, but there was no honey pot segregation in both of them. UTOB hive and rectangular box with two compartments showed honey pot segregation among these UTOB hive showed highest brood growth. Black ants, earwigs, red ants, termites and spiders are the five different species of organisms found associated with stingless bee colonies. A total of 43 species were recorded as bee forage plants among which 12 species were exclusively stingless bee forage plants and remaining 31 species were served as bee forage plants for stingless bees and other honey bees. Among 43 species 19 species served as pollen source 5 species served as nectar source and 19 species served as both pollen and nectar source. The mean temperature of brood of stingless bees was found to be 20.33 °C.

August, 2016

(R. N. Kencharaddi)
Major Advisor

47. Bio-ecology and Management of Aphid Complex in Radish (*Raphanussativus*L.)

MEGALADEVI, P.

ABSTRACT

Studies on population dynamics of the radish aphids, effect of nitrogen on the incidence of aphids and management of radish aphids using newer insecticides and bio-pesticides were conducted during 2014-15 at College of Agriculture, UAHS, Shivamogga. Radish crop was raised in 16x12 m size plot at monthly interval with hot water treated seeds for aphid monitoring. The aphid (*Myzuspersicae* and *Brevicorynebrassicae*) population was high during first week of December to last week of April and third week of October to last week of November with peak population during first week of December (24.1 and 40.8 aphids/plant, respectively). At the same time, predatory coccinellid population was low varying from 0.0 to 1.3/plant with maximum population during first week of December (1.3/plant).

The aphids had positive significant correlation with maximum temperature and bright sunshine hours. Significant negative correlation was observed with rainfall, minimum temperature, morning humidity and afternoon humidity. The effect of Nitrogen on aphid, *Brevicorynebrassicae* was clearly evident. Highest population (478.13 aphids/plant) was observed on plants receiving more Nitrogen (450.00 mg N/plant) and minimum population (33.51/plant) on plants receiving no Nitrogen (0.00 mg N/plant). Effect of nitrogen on plant height was significant.

The response was higher when N application increased from 168.75 to 225.00 mg/plant later there was decrease in plant height with increase in N application. Root yield was positively related to the rate of Nitrogen application. Thiometoxam (0.5g/l), imidacloprid (0.3ml/l) and dimethoate (1.7ml/l) were best and effective chemicals in reducing the population of aphids (*Myzuspersicae* and *Brevicorynebrassicae*) (3.83, 3.98 and 17.67 aphids/plant, respectively), whereas the two microbial pesticides (*Fusariumsemitectum* and *Verticilliumlecanii*) were less effective.]

June, 2016

(M. Manjunath)
Major Advisor

48. Monitoring of Major Pests on Capsicum with special reference to Management of *Spodoptera Litura* (Fab.) (Lepidoptera: Noctuidae) under Naturally Ventilated Polyhouse Condition

MARUTHI, M. S.

ABSTRACT

The investigations were carried out on monitoring of major pests of capsicum, management of *Spodoptera litura* through safer insecticides and bio-pesticides under naturally ventilated polyhouse during *kharif* 2015 at Zonal Agricultural and Horticultural Research Station, University of Agricultural and Horticultural Sciences, Navile, Shivamogga. A total of five insect and mite pests belonging to five orders and five families were observed on capsicum. They were mite, *Polyphagotarsonemus latus* (Banks) (Acarina: Tarsonemidae), thrips, *Scirtothrips dorsalis* (Hood) (Thysanoptera: Thripidae), aphid, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae), leaf miner, *Liriomyza trifolii* and fruit borer, *S. litura* (Fabricius) (Lepidoptera: Noctuidae). The peak incidence of mite, *P. latus* was noticed during 1st and 2nd week of October and that of thrips, *S. dorsalis* was noticed during 4th week of August and 1st, 2nd, 3rd week of September.

The maximum incidence of aphid was observed during 1st, 2nd and 3rd week of September. The peak infestation of leaf miner was observed during 4th week of July. Further, more number of egg mass of *S. litura* was recorded during 3rd and 4th week of August and that of larval population and fruit damage due to *S. litura* was noticed during 1st and 2nd week of September. Management of *S. litura* on capsicum by safer insecticides revealed that, the treatment chlorantraniliprole 18.5 SC was effective by recording lesser larval population (0.19 larva/ plant) with lowest fruit damage of 11.01 per cent with fruit yield of 29800 kg/ha and the next best treatment was cyantraniliprole 10.26 OD (0.30 larva/ plant with 12.25% fruit damage and fruit yield of 28600 kg/ha).

Assessment of different bio-pesticides for management of *S. litura* on capsicum showed that the treatment SI-NPV was proved very effective in recording the lowest larval population (0.74 larva/ plant) with least mean fruit damage of 13.99 per cent with fruit yield of 19250 kg/ha followed by *Bacillus thuringiensis* var. *kurstaki* (0.91 larva/ plant with 15.85 % and fruit yield of 18820 kg/ha).

October, 2016

(B. C. Hanumanthaswamy)
Major Advisor

49. Biology and Management of *Tetranychus urticae* Koch (Acarina: Tetranychidae) on Carnation under Polyhouse Condition

SANDEEPA, A.R.

ABSTRACT

An investigation on the biology and management of *Tetranychusurticae*Koch (Acarina: Tetranychidae) on carnation was undertaken at College of Agriculture, University of Agricultural and Horticultural Sciences (UAHS), Navile, Shivamogga during 2015-16. Studies on biology of *T. urticae*revealed that both the sexes (male and female) passed through five stages viz., Egg, larva, protonymph, deutonymph and adult with a short resting period known as quiescent. Morphology of all the stages, immature stagesperiods, longevity of adults and reproductive potential of *T. urticae* were also studied.The incubation period was 3.36 ± 0.56 days.The larval period was 1.79 ± 0.64 days and 2.79 ± 0.57 days of male and female, respectively. Total nymphal period of male was 6.67 ± 0.91 days and female was 8.10 ± 1.16 days.The adult male period was 10.00 ± 1.41 days and adult female was 12.60 ± 1.43 days. The mean fecundity was 76.80 ± 16.38 eggs/female. The total life period of *T. urticae*of male and female was 21.65 ± 1.63 daysand 26.85 ± 1.15 days, respectively.

Further studies on varietal screening of carnation against *T. urticae* revealed that Trinidad (25.41 mites/plant) proved less susceptible variety with low mite population incidence. The highest population was found on variety Pingu with 72.44 mites/plant.The acaricides tested against *T. urticae* under polyhouse conditions revealed that the treatment of propargite 57 EC recording significantly highest mite reduction (65.35 per cent) andthe next best treatment was diafenthiuron 50 WP (59.91 per cent).The least effective treatments against *T. urticae*weregarlic extract 5% (29.84 per cent) and onion extract 5% (23.57 per cent).

September, 2016

(S. Pradeep)
Major Advisor

50. Monitoring and Management of Melon Fruit Fly, *Bactrocera cucurbitae* (Coq.) (Tephritidae: Diptera) in Ridge Gourd

**ABHILASH J.
ABSTRACT**

The present investigation on monitoring, evaluation of traps and management melon fruit fly (*Bactrocera cucurbitae*) using different botanicals was conducted at farmers field at Bommanakatte, Basavanagangur and Abbalagere villages of Shivamogga district during Rabi 2016-17. Monitoring of melon fruit fly revealed that initial incidence of melon fruit fly population begins from the flowering stage of ridge gourd and peak incidence coincides with the peak fruiting period of the crop. The incidence of melon fruit fly from three locations showed significant positive correlation with maximum and minimum temperature. Whereas, afternoon relative humidity and rainfall had significant negative correlation with melon fruit fly incidence from all three locations. The incidence of melon fruit fly were influenced to an extent of 83.60, 67.50 and 85.90 percent in respective locations by all the weather parameters together. Among the five different types of traps evaluated, PCI trap recorded significantly higher number of fruit flies and followed by Barrix trap in both the locations. Among the various botanicals, Azadiractin 1 percent EC recorded significantly lowest fruit damage (26.53%) which was followed by NSKE 5 percent (29.06%). Highest fruit fly damage was noticed from untreated check *i.e.* 69.65 percent. Azadiractin 1 percent EC recorded maximum marketable yield (45.99 q/ha) followed by NSKE 5 percent (42.48 q/ha). Azadiractin 1 percent EC treated fruits recorded higher oviposition deterrence with 74.26 over control followed by NSKE 5 percent with 68.26 percent ovipositional deterrence over control. Highest percent reduction of larval survivability over control was observed in Azadiractin 1 percent EC (79.88 %) followed by NSKE 5 per cent (72.08%).

August, 2017

(S. U. Patil)
Major Advisor

51. Survey and Eco-friendly Management of Radish Flea Beetle (*Phyllo tretchotanica* Duv.)

G S UMA ABSTRACT

Studies on survey and eco-friendly management of radish flea beetle were conducted during 2016-17 at College of Agriculture, UAHS, Shivamogga. Roving survey was conducted in farmers' field in 17 villages around Shivamogga at fortnightly interval from August first fortnight of 2016 to first fortnight of January 2017. The beetle population was high during first fortnight of December (9.10 adults/plant) and was least during first fortnight of November (1.20 adults/plant). However the mean population of flea beetle was lower on cabbage and cauliflower crops when compared to radish crop. Radish was intercropped in 3:1 ratio with six selected crops. In both *kharif* and *rabiseasons*, radish intercropped with coriander proved to be superior when compared to all other treatments by recording least number of beetles per plant (3.17). Radish + green amaranthus was less effective by harbouring significantly higher number of beetles (7.42). Radish grown as sole crop recorded maximum number of beetles per plant (8.70) and proved inferior to rest of the treatments. Maximum root yield (118.00 q ha⁻¹) registered in radish grown with coriander which was proved to be the best treatment compared to all other treatments. Different botanical insecticides were evaluated against radish flea beetle. The mean population of flea beetle was least in malathion 50 EC (3.30) and NSKE (5%) (4.17) treated plots. Untreated check harboured highest number of beetles (8.93/plant) and number of holes per leaf and per cent leaf damage also followed same trend. The highest root yield of 160.78 q ha⁻¹ was recorded with treatment Malathion 50EC which was on par with NSKE 5% (157.33 q ha⁻¹). The untreated check recorded lowest root yield of 143.00 q ha⁻¹.

June, 2017

(M. Manjunath)
Major Advisor

52. Studies on Species Composition, Population Dynamics and Management of Mango Leafhoppers

GIRISH B. R.

ABSTRACT

Investigation on **species composition, population dynamics, screening of different genotypes and the effect of different bio pesticides against mango leafhoppers** were carried out during 2016-17 in farmer's orchard at Doddabbigere, Channagiri, College orchard, Shivamogga. A total of five species of mango leafhoppers were recorded across the four different Agro climatic zones of South Karnataka those were *Idioscopus nitidulus*, *I. nagpurensis*, *I. clypealis*, *Amritodus atkinsoni* and *Amrascasplendens*. Leafhopper population at College of Agriculture Shivamogga during second fortnight of February 2017 was highest (33.54 leafhoppers/ inflorescence) and lowest leafhoppers was found during first fortnight of September 2016 (1.15 leafhoppers/ 5 sweeps in each direction). At Doddabbigere, peak incidence of leafhoppers was found during first fortnight of February 2017 (35.47 leafhoppers / inflorescence) and lowest leafhopper was found during second fortnight of August 2016 (1.60 leafhoppers / 5 sweeps in each direction). Mango leafhoppers incidence in both the locations showed a positive and significant correlation with maximum, minimum temperature. Totapuri and Mallika harboured lowest mean number of leafhoppers (8.00 and 9.53) followed by Baneshan (10.69). Whereas, highest mean number of leafhoppers was documented in Alphonso (17.99) followed by Sindhura (14.14), Mulgoa (13.90) and Neelum (13.56). Lower crude proteins, reducing sugars, amino acids and higher phenol content were noticed in Mallika and Totapuri followed by Baneshan whereas, significantly higher in varieties like Alphonso, Sindhura, Mulgoa and Neelum. Phenol content was inversely related to the incidence of leafhoppers. Among the bio pesticides Azadirachtin 5 EC recorded significantly lower number of leafhoppers (12.71 leafhoppers) followed by Azadirachtin 1 EC (14.41 leafhoppers).

July, 2017

(Sharanabasappa)
Major Advisor

53. Biology and Management of Bud borer, *Elasmopalpus jasminophagus* (Hampson) (Lepidoptera: Pyralidae) in Jasmine

KIRAN C. M

ABSTRACT

Investigation on **Biology and management of bud borer, *Elasmopalpus jasminophagus* (Hampson) (Lepidoptera: Pyralidae) in Jasmine** was carried out at College of Agriculture, Navile, UAHS, Shivamogga during 2016-17. During the study, thirteen species of insect and mite pests were found damaging the jasmine crop. Among them, bud borers, *Elasmopalpus jasminophagus* (Hampson) and *Hendecasis duplifascialis* (Hampson), leaf web worm, *Nausinoe geometrialis* (Guenee) was found to feed on leaves. Red spider mite, *Tetanychus* sp. and thrips were found to suck the sap from jasmine leaves. Out of these insect and mite pests, banana flower thrips, *Thrips florum* is the first report infesting jasmine from India. Bud borer, *E. jasminophagus* was predominant pest with a maximum incidence of 38.85 per cent affected buds during first fortnight of January. Incidence of bud borer, *E. jasminophagus* was significant and negatively correlated with minimum temperature, while maximum temperature was non-significant and positively correlated. Biological studies of *E. jasminophagus* on *Jasminum multiflorum* revealed that female moth laid eggs singly or in groups on calyx of buds, near the base of green bud stalk and also on white buds. Freshly laid eggs were creamish white coloured and round in shape, incubation period of which ranged from 3.00 to 5.00 days with a mean of 3.30 ± 1.41 days. There were five larval instars, duration of which ranged from 16.00 to 21.60 days with a mean duration of 18.11 ± 1.94 days. Total life cycle of pest lasted for 38.26 ± 3.36 to 40.06 ± 3.24 days in laboratory. Chlorantraniliprole 18 SC @ 0.1 ml/lt was found significantly superior (mean per cent affected buds of 6.80) over all other insecticides in managing bud borer, *E. jasminophagus*. Chlorantraniliprole recorded highest B: C ratio of 1: 3.47 by recording highest flower yield (1975.11 kg/ha).

July, 2017

(Jayalaxmi Narayan Hegde)
Major Advisor

54. Seasonal Incidence and Management of Pod Borers in Cowpea, *Vigna unguiculata* L.

NAVEEN A. S.

ABSTRACT

An investigation on “**Seasonal incidence and management of pod borers in cowpea, *Vigna unguiculata* L.**” was carried out at the College of Agriculture, Navile, UAHS, Shivamogga during *kharif* and *rabi* of 2016-17. During the study, four species of pod borers viz., spotted pod borer, *Maruca vitrata* Geyer, gram pod borer, *Helicoverpa armigera* Hubner, African pea moth, *Cydia ptychora* Meyrick and Lycaenid Blue butterfly, *Lampides boeticus* Linnaeus were found damaging the crop. Among them, spotted pod borer, *M. vitrata* was predominant pest with peak incidence during third week of October (2.3 larvae/ten plants), *H.armigera* reached its peak during the second week of October (1.30 larvae/ten plants), *C. ptychora* and *L. boeticus* reached its peak during the third week of October with mean larval population of 0.6 and 0.5 larvae per ten plants. Incidence of spotted pod borer, *M. vitrata* was non significant and positively correlated with maximum temperature, minimum temperature and morning relative humidity, while evening relative humidity and rainfall showed significant and negative correlation. Studies on screening of six genotypes of cowpea against pod borer complex revealed that the genotypes C-152, KBC-2 and IT 38596 were found highly resistant to cowpea pod borer complex with mean per cent pod damage of 14.80, 17.38 and 18.77, respectively. While, DC-47-1, South pearl and North border were found moderately resistant to pod borer complex with mean per cent pod damage of 20.32, 21.97 and 24.25, respectively. Flubendiamide 480 SC (0.2 ml/lt) proved the best of all the insecticides to control the pod borer complex in cowpea with highest pod yield of 22.15 q/ha and B:C ratio of 1:3.22, followed by chlorantraniliprole 18.5 SC (0.1 ml/lt) with pod yield of 20.05 q/ha and B:C ratio of 1:2.49 and organic molecule, NSKE 5% recorded the pod yield of 11.95 q/ha and B:C ratio of 1:1.97.

August, 2017

(Jayalaxmi Narayan Hegde)
Major Advisor

55. Sucking Pest Complex of *Bt* Cotton and their Management

NAVEENA J. B.

ABSTRACT

Investigation on **Survey, population dynamics, screening of different *Bt* and non *Bt* cotton hybrids and effect of different insecticides against sucking pests of cotton** were carried out during 2016-17 in a farmer field at Kommanalu Village, Shivamogga and Agricultural and Horticultural Research Station (AHRS), Honnavile farm, Shivamogga. During survey, highest population of sucking pests was noticed in Shivamogga district followed by Davanagere and Chitradurga. The peak incidence of thrips (*Thrips tabaci* Lind) was noticed during first fortnight of September (43.70/ 3 leaves). While, the leafhopper (*Amrasca biguttula biguttula* Ishida) population reached peak during September second fortnight (19.80/ 3 leaves). The aphid (*Aphis gossypii* Glover) population reached peak during December second fortnight (25.22/ 3 leaves). The Whiteflies (*Bemisia tabaci* Gennadius) population reached peak during November first fortnight (0.75/ 3 leaves). The peak incidence of mirid bug (*Poppiocapsidea biseratense* Distant) was noticed in second fortnight of September (19.25/ 25squares). While, the red cotton bug (*Dysdercus similis* Freeman) population peaked during October first fortnight (0.35/ plant). Sucking pest incidence showed positive and significant correlation with maximum temperature and negative significant correlation with rainfall. The most commonly recorded natural enemies on sucking pest were coccinellids, spider and Chrysopa. Among the different *Bt* and non *Bt* cotton hybrids screened against sucking pests are MRC-7351, double *Bt*, chamundi BG-II and Ankur HB-2110 shown moderate resistant against sucking pests while, DCH-32 highly resistant against sucking pest. Among different insecticides evaluated, thiamethoxam 25 WG found very effective in bringing down all the sucking pests. The highest per cent (71.81) reduction in population and highest cotton yield (17.20q/ ha) was recorded in thiamethoxam treated plot.

July, 2017

(Sharanabasappa)
Major Advisor

56. Seasonal Incidence and Management of Major Lepidopteran Pests of Cabbage

RAKESH NAYAKA S

ABSTRACT

Seasonal incidence of major lepidopteran pests of cabbage was carried out in the College of Agriculture, Shivamogga during 2016-17. Lepidopteran pests like diamondback moth (*Plutella xylostella* (Linnaeus)), tobacco caterpillar (*Spodoptera litura* (Fabricius)), cabbage leaf webber (*Crocidolomia pavonana* (Fabricius)), cabbage head borer (*Hellula undalis* (Fabricius)) and semilooper *Thysanoplusia orichalcea* (Fabricius) was recorded during *Kharif* and *Rabi*. The biology of *P. xylostella* on cabbage under laboratory conditions revealed that, female moth laid eggs either in single or in small groups of two to six along the midribs and veins of leaves. The mean incubation, larval, pre-pupal, pupal and male and female adult period was 2.70 ± 0.70 , 12.50 ± 1.09 , 1.05 ± 0.15 , 3.92 ± 0.47 and 8.20 ± 0.60 and 10.15 ± 0.70 days, respectively. The biology of *P. xylostella* on Indian mustard revealed no significant difference in morphometrics of different stages of *P. xylostella* on Indian mustard compared to cabbage. Evaluation of insecticide molecules indicated that chlorantraniliprole, emamectin benzoate and flubendiamide were significantly effective against diamondback moth and cabbage leaf webber whereas, NSKE was least effective compared to other treatments. *Spodoptera litura* population was effectively reduced by chlorantraniliprole, flubendiamide and emamectin benzoate. NSKE was least effective in reducing larval population compared to other treatments. Chlorantraniliprole recorded highest C:B ratio of 3.98 compared to rest of the treatments. Untreated check recorded the lowest C:B ratio of 1.10. All treatments recorded higher C:B ratio and superior over untreated check.

July, 2017

(Pradeep, S)
Major Advisor

57. Screening of Genotypes and Evaluation of Selected Insecticides and Acaricides against Chilli Murda Complex

SUMA, G. S.

ABSTRACT

Performance of fourteen different chilli genotypes against sucking pests *viz.*, thrips, *Scirtothrips dorsalis* (Hood), mite, *Polyphagotarsonemus latus* (Banks), aphids, *Aphis gossypii* (Glover) and whitefly, *Bemisia tabaci* (Gennadius), comparative toxicity of insecticides on chilli whitefly and field evaluation of insecticides and acaricides against chilli sucking pests were carried out during *Kharif* 2016-17. Arka Lohit found to be superior over the other genotypes by recording lowest number of thrips and mites. Arka Suphal and Arka Harita were next in the line. Highest number of thrips and mite population noticed from Byadagi Kaddi and Byadagi Dabbi. Arka Lohit, Arka Suphal and Arka Harita had least aphids infestation and the highest number of aphids recorded on Sarpan Hybrid Chilli-153 and Byadagi Dabbi. Least number of whiteflies were recorded on Arka Harita. However, Sarpan Hybrid Chilli-153 had significantly highest whitefly population. Arka Lohit had least leaf curl index compared to other genotypes and registered as moderately resistant genotype. The genotypes Byadagi Dabbi and Byadagi Kaddi had highest leaf curl index and were graded as susceptible genotypes. Comparative toxicity of insecticides and oils on whitefly, *Bemisia tabaci* under laboratory condition showed that thiamethoxam and imidacloprid were registered with least LC₅₀ values when compared to triazophos. Among oils, neem oil recorded with least LC₅₀ value. Acephate was the best chemical against chilli thrips followed by chlorfenapyr and thiamethoxam. However, for mites propargite stood best followed by chlorfenapyr. Thiamethoxam and imidacloprid were the best chemicals in controlling both aphids and whitefly population and also had least leaf curl index. Thiamethoxam recorded the highest yield of 95.55 q/ha when compared to the rest of the treatments. It was followed by imidacloprid (89.63 q/ha) and the lowest yield was registered from fenazaquin (65.92 q/ha).

July, 2017

(B. K Shivanna)
Major Advisor

58. Taxonomy of Thrips Associated with Horticultural Crops with Special Reference to Ecology and Management of Pepper Leaf Gall Thrips, *Liothrips Karnyi* (Bagnall) (Thysanoptera: Phlaeothripidae)

TANUJA NAIK

ABSTRACT

Thrips are economically important pests on several horticultural crops and the damage caused by them has aggravated in recent past owing to their virus transmission abilities. Their diversity has been poorly described and their accurate identification is a challenging task. Studies were conducted to assess the diversity of thrips in and around Shivamogga from different horticultural crops. A total of 13 thrips species were recorded from 10 genera and three subfamilies under two families viz., Thripidae and Phlaeothripidae. Among the total collections, Thripidae was the most dominant family (84.61%) with 11 species in eight genera under two subfamilies viz., Thripinae (81.81%) and Panchaetothripinae (18.18%) followed by Phlaeothripidae (15.38%) with two genera under one subfamily Phlaeothripinae. Illustrated identification keys were prepared systematically based on the morphological variations of collected thrips. Pepper leaf gall thrips, *Liothripskarnyicauses* damage to black pepper having export potential. Population dynamics of *L. karnyion* black pepper was studied at Ikkeri, Sagar from April 2016 to March 2017. The population fluctuated under the influence of presence of young leaves on the vines, which was further influenced by rainfall. Selected insecticides were evaluated against *L.karnyi* at Mugaralli, Mudigere taluk from December 2016 to February 2017. All the nine insecticides tested were superior in suppressing the population of *L.karnyiat* 15, 30 and 45 days after spray. One spray of systemic insecticide was sufficient in reducing the population and maintaining it at a lower level. It appears from the mean population that, biorational insecticides viz., NSKE, azadirachtin and fish oil rosin soap (FORS) were equally effective in suppressing thrips population as those of chemical insecticides. So, such of the treatments may be recommended to avoid residue problem in black pepper.

July, 2017

(Kalleshwaraswamy, C. M)
Major Advisor

59. Studies on Pest Complex of Pigeonpea and Their Management with Special Reference to Pod Borer, *Marucavitrata*(Geyer)

JAHANTAJ, K. A.

ABSTRACT

Survey on insect pests of pigeonpea was carried out in Shivamogga and Chitradurga districts of Karnataka during 2017-18. The highest population of *Helicoverpa armigera* (Hubner), *Clavigralla gibbosa* (Spinola), *Aphis craccivora* (Koch), *Empoasca* sp., *Megalurothrips* sp. and *Mylocerus* sp. were found in Shivamogga followed by Chitradurga district. However, the peak incidence of *Marucavitrata*(Geyer), *Melanagromyza obtusa* (Malloch), *Exelastis atomosa*(Walsingham), *Riptortus pedestris*(Fabricius), and *Otinotus* sp. were found in Chitradurga district followed by Shivamogga district. The biology of *M. vitrata* on pigeonpea under laboratory conditions revealed that, female moth laid minute eggs singly or in batches of 2 to 6 on the under surface of leaves, terminal shoots and flower buds. The mean incubation period, larval, pre-pupal, pupal, male and female adult period was 3.3 ± 0.70 , 13.45 ± 0.95 , 2.35 ± 0.41 , 9.85 ± 0.67 , 8.1 ± 1.19 and 9.7 ± 1.16 days, respectively. Evaluation of insecticide molecules against pod borer complex of pigeonpea indicated that chlorantraniliprole, emamectin benzoate, and flubendiamide were significantly effective against pod borer *H. armigera*. *E. atomosa* population was effectively reduced by chlorantraniliprole followed by spinosad, emamectin benzoate, flubendiamide and Chlorantraniliprole proved very effective in recording the lowest pod fly maggot population of pigeonpea whereas, NSKE 5 per cent was least effective in reducing larval population compared to other treatments. The highest and least percent pod damage was observed in NSKE 5 per cent (27.97) and chlorantraniliprole 18.5 SC, respectively. Chlorantraniliprole recorded highest B:C ratio of 2.63 compared to rest of the treatments. Untreated control recorded the lowest B:C ratio of 1.09. All treatments recorded higher B:C ratio and superior over untreated control.

August, 2018

(B. C. Hanumanthaswamy)
Major Advisor

60. Species Composition, Ecology and Management of Leafhoppers (CICADELLIDAE: HEMIPTERA) Infesting Potato

MEGHANA, N.

ABSTRACT

Investigations on **Species composition, ecology and management of leafhoppers (Cicadellidae: Hemiptera) infesting potato** was carried out in major potato growing regions of Karnataka during 2017-18. During the study, nineteen species of leafhoppers were recorded. Molecular technique using 650-base pair region of the mitochondrial cytochrome oxidase I (COI) gene was employed to identify different *Empoasca* spp. A total of nine sequences were submitted to NCBI-Gene Bank and accession numbers were obtained. The population of potato leafhoppers attained peak during harvesting stage in both seasons *i.e.*, *Kharif* and *Rabi* 2017-18. Incidence of potato leafhoppers had significant negative correlation with wind speed, non-significant positive correlation with minimum temperature, relative humidity and sunshine hours. A non-significant negative correlation was observed with maximum temperature and total rainfall during *Kharif* 2017. Leafhoppers incidence in *Rabi* 2017-18, showed a non-significant positive correlation with maximum temperature, minimum temperature, total rainfall and wind speed and non-significant negative correlation with relative humidity and sunshine hours. Highest number of trichomes were found in Kufri Jyothi (218.00) followed by FL-5 (79.00) and lowest in S-6 (39.30) followed by FC-3 (72.50). Lower TSS, higher phenol and higher potassium content was noticed in Kufri Jyothi and FL-5 followed by FC-3 and S-6. Among the selected insecticides Imidacloprid 17.8 SL @ 0.3 ml/lit recorded significantly lower number of leafhoppers. The economic analysis of different insecticides indicated imidacloprid 17.8 SL @ 0.3 ml/lit was most effective by recording highest C:B ratio of (1:3.90).

August, 2018

(Kalleshwaraswamy, C.M.)
Major Advisor

61. Species Complex of Aphids in Legumes with Special Reference to Bio-Ecology and Organic Management of Field Bean Aphid, *Aphis craccivora* (KOCH)

NAMITHA N. V.

ABSTRACT

Investigations on **Species complex of aphids in legumes with special reference to bio-ecology and organic management of field bean aphid, *Aphis craccivora* (Koch)** was carried out at College of Agriculture, Navile, UAHS, Shivamogga during 2017-18. During the study, two species of aphids viz., *Aphis craccivora* and *Aphis gossypii* Glover were found infesting different legumes in different regions of Shivamogga during 2017-18. The population of bean aphids attained peak during third week of October (15.3 aphids per five centimeter twig) during *Kharif*. During *Rabi* season, the aphid population was maximum during first week of January (224.7 aphids per five centimeter twig). Incidence of bean aphid, *Aphis craccivora* had non-significant negative correlation with total rainfall, non-significant positive correlation with maximum temperature, significant negative correlation with minimum temperature and non-significant positive correlation with relative humidity during *Kharif* 2017, while during *Rabi* 2017-18, aphid showed non-significant negative correlation with total rainfall, maximum temperature, minimum temperature and positive correlation with relative humidity. Biological studies of *Aphis craccivora* on *Lablab purpureus* revealed that the total life cycle of the bean aphid under laboratory condition ranged from 14.20 to 20.80 days with a mean of 17.50 ± 1.91 days. Total nymphal period ranged from 4.20 to 7.70 days with a mean of 5.43 ± 1.05 days and fecundity was 29 ± 4.34 nymphs per female in laboratory. Among the organic molecules, *Verticillium lecanii* 2×10^8 cfu/g (1.5ml/l) was found more effective in the management of bean aphid. It was significantly superior (with 79.63 mean per cent reduction of aphids) over untreated control. Among all organic molecules, tested *V. lecanii* 2×10^8 cfu/g (1.5ml/l) recorded highest C: B ratio of 1: 3.11 by recording highest green pod yield (24.14 q / ha).

July, 2018

(R.N.Kencharaddi)
Major Advisor

62. Bio Ecology and Management of Lablab Leaf Webber, *Omiodes indicata* (Fabricius) (Lepidoptera: Crambidae) on Field Bean

NIRANJANAKUMAR, K. V.

ABSTRACT

An investigation on “Bio ecology and management of lablab leaf webber, *Omiodes indicata* F. On field bean” was carried out at the College of Agriculture, Navile, UAHS, Shivamogga during *Kharif* and *Rabi* of 2017-18. Lablab leaf webber, *O. indicata* Fab. (Lepidoptera:Crambidae) is an emerging pest on leguminous plants, commonly known as bean leaf webworm moth. Studies on biology of *O. indicata* on field bean under laboratory conditions revealed that five larval instars and four moults took place through the shedding of larval skin and casting of head capsule. The mean larval, pre-pupal, pupal, male and female adult period was 13.45 ± 0.95 , 2.35 ± 0.411 , 9.85 ± 0.67 , 8.20 ± 1.39 and 9.7 ± 1.16 days, respectively. The full grown larvae pupated in the rolled leaves. The total developmental period was 25.52 ± 2.71 days. The incidence of *O. indicata* was recorded in two seasons i.e., *Kharif* and *Rabi*. During *Kharif* 2017 pest reaches peak population during 2nd week of September 2.35 larvae per plant and during *Rabi* 2017 fourth week of January 3.10 larvae per plant and it becomes low at the end of both the seasons. Minimum temperature shows positive significant correlation against pest population during *Kharif* 2017. Maximum temperature and morning relative humidity shows positive significant correlation against pest population, whereas total rainfall, bright sunshine hours shows significant negative correlation against pest population. Evaluation of selected insecticides indicated that flubendiamide 39.35 SC (0.1 ml/lit) proved best of all the insecticides to control the lablab leaf webber in field bean with highest green pod yield of 31.23 q/ha and B:C ratio of 1:1.355 and untreated control recorded the pod yield of 16.15 q/ha and B:C ratio of 1:1.9.

September, 2018

(Onkarappa, S.)
Major Advisor

63. Diversity of Predatory Coccinellids in Different Ecosystems and Safety Evaluation of Selected Insecticides against *Cheilomenes sexmaculata* (Fab.)

POOJA KARANE

ABSTRACT

Investigation on **Diversity of predatory coccinellids in different ecosystems and safety evaluation of selected insecticides against *Cheilomenes sexmaculata* (Fab.)** was carried out at University of Agricultural and Horticultural Sciences (UAHS), Shivamogga during 2017-18. A survey on diversity of coccinellids in different ecosystems of Shivamogga indicated the presence of 11 different coccinellid species belonging to 4 different sub families. *Cheilomenes sexmaculatus* (Fab.) was found to be predominant species. Majority of the species belonged to sub family Coccinellinae representing 78.15 per cent of the total species collected, followed by Chilocorinae (11.45%) and Scymninae (8.76%). The population of cowpea aphid and coccinellid prevailed throughout the cropping period of cowpea. The peak incidence of aphids was noticed in 2nd week of November (125.35 aphids/2.5cm pod length). The coccinellid population followed the trend of cowpea aphid. The population of aphids and coccinellids showed positive correlation with maximum temperature and negative correlation with remaining weather parameters such as minimum temperature, morning, evening relative humidity and rainfall. Under laboratory condition azadirachtin 1 EC @ 2 ml/lit was found to be relatively safer, whereas dimethoate 30 EC @ 1.7 ml/lit was found to be highly toxic insecticide against adults of *Cheilomenes sexmaculata*. Under field condition imidacloprid 17.8 SL @ 0.3 ml/lit was found to be effective in managing aphid population, whereas azadirachtin 1 EC 2 ml/lit was found to be safest in maintaining the coccinellid population. Among the insecticides, dinotefuron 20 SG 0.3 ml/lit was found to be relatively safer to coccinellids as well as effective in managing the aphid *Aphis craccivora* Koch.

July, 2018

(Sharanabasappa)
Major Advisor

64. Pest complex of rose with special reference to sucking pests and their management

PRIYANKA

ABSTRACT

Investigations on sucking pests of rose was carried out at Centre of Excellence for Floriculture, Shivamogga during 2017-18. During the study, two species of thrips viz., *Rhipiphorothrips cruentatus* Hood and *Selenothrips rubrocinctus* (Giard), aphid (*Macrosiphum euphorbiae* Thomas) and mite (*Tetranychus urticae* Koch) were found to feed on rose. During the survey, maximum thrips population (13.93/flower) and maximum aphid population (49.65/ 5 cm twig) was recorded in Shivamogga district during first fortnight of April and second fortnight of August respectively and lowest population of aphids (4.01/5 cm twig) was found in Davanagere district. The peak population of mites (10.90 mites/leaf) was noticed during first fortnight of December in Shivamogga district. Correlation studies with weather parameters on thrips showed negative correlation with relative humidity and rainfall, whereas, it had positive correlation with temperature. Population of aphids had negative correlation with temperature. Mite population was having negative correlation with temperature, relative humidity and rainfall. Imidacloprid 30.5 SC @ 0.50 ml/l, thiamethoxam 25 WG @ 0.20 g/l and dinotefuran 20 SG @ 0.20 g/l were found to be effective in an experiment with insecticides for the management of aphids and thrips. Diafenthiuron 50 WP @ 1.20 g/l and chlorfenapyr 10 EC @ 1.60 ml/l were found to be effective against mites.

July, 2018

(S. U. Patil)
Major Advisor

65. Seasonal Incidence of Pests of Soybean with Special Reference to Biology and Management of Red Spider Mite, *Tetranychus macfarlanei* Baker and Pritchard

SATISH S BATAGI

ABSTRACT

Studies on “Seasonal Incidence of pests of soybean with special reference to biology and management of red spider mite, *Tetranychus macfarlanei* Baker and Pritchard” was carried out at Agricultural and Horticultural Research Station (AHRS), Bavikere, Tarikere Taluk, Chikmagalur District during *Kharif* and *Rabi* of 2017-18. During the study, a total of three lepidopteran defoliators viz., soybean leaf webber (*O. indicata*), tobacco caterpillar (*S. litura*) and green semilooper (*T. orichalcea*) and two sucking pests viz., soybean aphid (*A. glycines*) and red spider mite, (*T. macfarlanei*) were found damaging the crop. Peak incidence of *O. indicata* was noticed during second week of August (3.61 larvae/m²), tobacco caterpillar reached its peak population during third week of August (4.60 larvae/m²) and highest population of *T. orichalcea* was recorded during third week of August (2.69 larvae/m²). Aphid population was highest during fourth week of November (26.69 aphids/3 leaves) and red spider mite reached its peak population during first week of December (5.18 mites/ 2.5 cm² leaf area). Studies on biology of red spider mite, *T. macfarlanei* revealed that males had less developmental period (10.62 ± 0.69 days) than females (11.92 ± 0.89 days). The adult longevity was also less in males (11.37 ± 0.69 days) compared to females (24.61 ± 0.57 days). Mated females laid more number of eggs (54.93 ± 8.08) than unmated females (31.87 ± 2.61). Overall males lived for 21.99 ± 1.86 days whereas, females took 36.53 ± 2.14 days to complete their life cycle. Propargite 57 EC @ 427.50 a.i./ha proved to be highly effective in reducing the mite population with highest yield of 21.74 q/ha and also had highest C: B ratio of 1: 3.91 followed by spiromecifen 22.9 SC @ 91.60 a.i./ha which registered yield of 18.66 q/ha and C: B ratio of 1: 3.28.

July, 2018

(S. Pradeep)
Major Advisor

66. Sucking Pest Complex of Chrysanthemum, *Dendranthemagrandidiflora* BORKHAND their Management

SMITHA O.R.

ABSTRACT

Investigation on sucking pest complex of chrysanthemum, *Dendranthemagrandidiflora* Borkh and their management was carried out at Karnataka State Department of Horticulture (KSDH), Shivamogga, Karnataka during 2017-2018. During the study, two thrips species viz., *Haplothripsgowdeyi* Franklin and *Microcephalothripsabdomanalis* Crawford, two aphid species viz., *Macrosiphoniellasanbornii* Gillette and *Aphis gossypii* Glover and a whitefly species *Bemesiatabaci* Gennadius were found to infest chrysanthemum. During survey, maximum aphid population was recorded in Shivamogga district (9.57/3 leaves) during the first fortnight of January. The maximum mean number of whiteflies (5.25/3 leaves) was recorded during the first fortnight of September in Chitradurga district. The peak population of thrips was noticed during first fortnight of February in Chitradurga district (8.95 thrips/flower). Studies on the population dynamics of sucking pests revealed that the peak infestation of aphid was observed during second fortnight of January (42.59/3 leaves). Both maximum and minimum temperature, relative humidity and rainfall were found to exert a significant negative influence on the aphid population. The peak thrips incidence (6.15 thrips/flower) was observed during first fortnight of February. The thrips incidence was positively correlated with both maximum temperature and minimum temperature but has negative correlation with maximum and minimum relative humidity and rainfall. The insecticidal treatments imidacloprid 17.8 SL, acetamiprid 20 SP and flonicamid 50 WDG were found to be effective in managing the sucking pests. However, all the insecticidal treatments under evaluation were significantly superior in recording lower population of sucking pests compared to untreated check.

July, 2018

(M. Manjunatha)
Major Advisor

67. Population dynamics, crop loss estimation and management of lepidopteran pests of sunflower

SWATHI G. HEGDE

ABSTRACT

Investigations on lepidopteran pests of sunflower were carried out at College of Agriculture, University of Agricultural and Horticultural Sciences, Navale, Shivamogga during 2017. Correlation studies with weather parameters on *Spodoptera litura* (Fabricius), *Thysanoplusia orichalcea* (Fabricius) and *Hyposidra* sp. showed negative correlation with maximum temperature and sunshine hours. The population of *Spilarctia obliqua* (Walker) had negative correlation with minimum temperature and sunshine hours whereas, it had positive correlation with remaining weather parameters. *Helicoverpa armigera* (Hubner) had positive correlation with maximum temperature, morning relative humidity, sunshine hours and negative correlation with rainfall, minimum temperature and evening relative humidity. Crop loss estimation studies revealed maximum yield loss in untreated control by recording 60.43 per cent followed by mechanical method (31.54%), chemical method (16.11%) and chemical + mechanical method (12.11%) compared to caging method. Chlorantraniliprole 18.5 SC and flubendiamide 480 SC were found to be highly effective in managing the lepidopteran pests of sunflower by recording highest yield of 24.66 q/ha and 24.16 q/ha with a C:B ratio of 1:3.09 and 1:3.01, respectively. These were followed by spinosad 45 SC and indoxacarb 14.5 SC in reducing the larval population.

July, 2018

(B. K. Shivanna)
Major Advisor

68. Studies on Insect Pest Complex of Cocoa with Special Reference to Biology and Management of Cocoa Mealy Bug, *Planococcus lilacinus* (Cockerell)

VENUGOPAL H.M.

ABSTRACT

Investigations on insect pest complex of Cocoa with special reference to biology and management of Cocoa mealy bug, *Planococcus lilacinus* (Cockerell) was carried out at College of Agriculture, Navile, UAHS, Shivamogga during 2016-17. During the study period, fifteen species of insect pests were found damaging the Cocoa crop. Among them, the major ones were Cocoa mealy bug, *Planococcus lilacinus* (Cockerell); Tea mosquito bug, *Helopeltis bradyi* (Waterhouse); Cocoa pod borer, *Conogethes punctiferalis* (Guenee); Aphids, *Aphis gossypii* (Glover); Scarab beetle, *Maladera* sp. and three species of hairy caterpillars viz., *Cretonotus gangis* (Linnaeus), *Olene mendosa* (Hubner) and *Euproctis freterna* (Moore). Cocoa mealy bug, *P. lilacinus* was found throughout the year and attacked twigs, pods and leaves. Among the three parts, the mean mealy bug count was highest on pods (9.23), followed by twigs (4.72), while the least count of mealy bug was noticed on leaves (0.85). The population of mealy bugs showed two peaks, one peak from March to May and the other from October to November. Incidence of mealy bug was significant and positively correlated with maximum temperature, while rainfall was significant and negatively correlated. Studies on the biology of Cocoa mealy bug, *P. lilacinus* revealed that the fecundity of mealy bugs ranged from 130 to 288 eggs per female. Female mealy bugs had only three instars, while the males had four instars. Total nymphal duration ranged from 16 to 24 days. The total life cycle of the female mealy bug, *P. lilacinus* ranged from 27 to 41 days and that of males ranged from 20 to 32 days. Out of the insecticides evaluated, Thiamethoxam 25 WG @ 0.25 g/lit was found most effective in managing the mealy bug population and it recorded the highest yield (8.22 q/ha) with a cost-benefit ratio of 1: 1.85.

July, 2018

(Jayalaxmi Narayan Hegde)
Major Advisor