

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

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1. Studies on Insect and Mite Pests of Chilli and Their Management under Hill Zone of Karnataka

ASMA, A.

ABSTRACT

The investigations were carried out on survey of insect, mite pests and natural enemies of chilli at selected talukas of Chikmagalur district (Mudigere, Chikmagalur and Kadur), population dynamics of insect, mite pests and natural enemies and evaluation of organic and inorganic pesticides for the management of pests of chilli (var. Rudra) was conducted during summer 2013 at Sabbenahalli, Mudigere taluka of Chikmagalur district, Karnataka, India. Eight insect pests belonging to five orders and one non insect pest were found to be infesting chilli. The pests included six sucking pests of which four species were Hemiptera: *Aphis gossypii* Glover; *Nezara viridula* Linneus; *Bemisia tabaci* Gennadius; *Empoasca* sp.; one species of Thysanoptera, *Scirtothrips dorsalis* Hood, one species of Acari, *Polyphagotarsonem latus* Banks, one species of Diptera, *Asphondylia* sp. and two species of lepidopteran, *Helicoverpa armigera* Hubner and *Spodoptera litura* Fabricius. Further, the natural enemies recorded were *Cheilomenes sexmaculata* Fabricius, *Coccinella septumpunctata* Linnaeus, *Coccinella transversalis* Fabricius, *Brumoides suturalis* Fabricius, Chrysoperla sp. and spiders.

The peak incidence of *S. dorsalis* and *P. latus* was noticed during the last week of April and last week of May, respectively in population dynamics studies. Whereas, the peak LCI due to thrips and mites were noticed during the second week of April and third week of May, respectively. The peak incidence of *H. armigera* and *S. litura* were noticed during the second week of April and third week of May, respectively. Further, the peak incidences of aphids, plant bug, whitefly and leaf hopper were recorded in last week of February, May, April and May, respectively. During survey, the maximum population of sucking insect and mite pests, fruit borers and natural enemies were recorded at Kadur during the month of May. Management of insect and mite pests of chilli by organic and inorganic pesticides revealed that, among the different insecticides, two sprays of Imidachloprid 36 SL @ 0.3ml/1 at 2 & 5 WAT, two sprays of Flubendiamide 480 SC @ 0.2 ml/ 1 at 7 & 11 WAT, one spray of Fenazaquin 10 EC @ 1ml/1 of at 9 WAT recorded lowest population of insect and mite pests with highest net return and cost benefit (C: B) ratio.

July, 2014

(L. Hanumantharaya)  
Major Advisor

## 2. Insect and Mite Pests of Capsicum and Their Management through Organic and Inorganic Approaches under Hill Zone of Karnataka

**KUNDATY DEEPIKA**

### **ABSTRACT**

The investigations were carried out on population dynamics of insect, mite pests and natural enemies of capsicum, the management of insect and mite pests of capsicum through organic manures and inorganic fertilizers as well as with the superimposition of safer molecules during summer 2013 at Sabbenahalli, Mudigere, Chikkamagaluru, Karnataka, India.

Sixteen insect and mite pests along with natural enemies belonging to 7 orders and 10 families occurred on capsicum. They included thrips *Scirtothrips dorsails* (Hood), aphids *Aphis gosypii* (Glover), mite *Polyphagotarsonemus latus* (Banks), fruit borer *Helicoverpa armigera* (Hubner), defoliator *Spodoptera litura* (Fabricius), gall midge *Asphondylia capsici* (Barnes), plant bugs *Nezara viridula* (Linnaeus), white flies *Bemesia tabaci* (Gennadius), leaf hoppers *Empoasca* sp., coccinellids included *Cheilomenus sexmaculata* (Fabricius), *Coccinella septumpunctata* (Linnaeus), *Coccinella transversalis* (Fabricius), *Brumoides suturalis* (Fabricius), *Hormonia octomaculata* (Fabricius), Chrysopid, *Chrysoperla* sp. and unidentified spiders. In population dynamics, the peak incidence of thrips, *S. dor sails* and LCI due to thrips, mites. *P. latus* and LCI due to mites was noticed during the third week of April and third week of May, respectively. The peak incidence of *H. armigera* and *S. litura* were noticed during the first week of June. Further, the peak incidence of aphids and plant bug, whitefly and leaf hopper were recorded during third week of April and June, last week of April and June, respectively.

Management of insect and mite pests of capsicum by organic manures revealed that NPK100% + RPP proved to be better management tactic. Whereas, among the organics amended treatments, 50% N + 100% PK + 2500 kg/ha VC and 50% N + 100% PK + 500 kg/ha NC were found to be effective as it registered significantly lower population of insect and mite pests and leaf curl index with highest net returns and C: B ratio. Among the superimposed treatments with one spray of each nimbecidine 1500 ppm @ 3 ml/l at 3 WAT, spinosad 45 SC @ 0.25 ml/l at 8 WAT, NSKE @ 5% at 11 WAT and abamectin 1.9 EC @ 0.5 ml/l on 13 WAT, 50% N + 100% PK + 2500 kg/ha VC and 50% N + 100% PK + 500 kg/ha NC were found to be better in management of insect and mite pest and on par with NPK 100% + RPP with highest net returns and C: B ratio.

### 3. Studies on Toxicity of Selected insecticides against Whitefly, *Trialeurode vaporariorum* (Westwood) (Hemiptera: Aleyrodidae) on Tomato

**SACHIN U. S.**

#### **ABSTRACT**

All the farmers surveyed in 10 major vegetable growing villages of Chikkamagaluru taluk were literates having education up to college or technical education. However, education level of farmers did not influence decision making with respect to farm operations including use of pesticides. The farmers used 25 insecticides and three acaricides on vegetable crops to combat insect and mite pests. Among selected insecticides, thiamethoxam 25% WG was effective against adult whitefly population at one, five, seven and ten DAS followed by cyantraniliprole 10% OD at one and five DAS and triazophos 40% EC at seven and ten DAS during first spray on tomato under field conditions. While after the second spray, cyantraniliprole 10% OD emerged as the best insecticide over all other treatments at one, five and ten DAS followed by imidacloprid 17.8% SL at five, seven and ten DAS and triazophos 40% EC at one, seven and ten DAS. Further, per cent leaf curl was least in cyantraniliprole treated plots. The residual toxicity of imidachloprid, triazophos, thiamethoxam, cyantraniliprole, azadirhactin, fipronil and buprofezin was high up to sixth day after treatment against adult whitefly under laboratory condition which decreased from eighth DAT. While the residual toxicity of acephate and emamectin benzoate decreased from sixth and that of spinosad decreased from fourth day itself. The relative toxicity of selected insecticides under laboratory conditions revealed that imidachloprid, thiamethoxam and cyantraniliprole caused 100 per cent mortality four days after treatment. While fipronil 80% WG, recorded 100 per cent mortality five days after treatment and was followed by emamectin benzoate 5% SG at sixth, acephate 75% SP at seventh, azadirhactin 10000 ppm at eighth and triazophos 40% EC, spinosad 480% SC and buprofezin 25% SC at eleventh day after treatment.

June, 2015

(Suchithra Kumari M. H.)  
Major Advisor

#### 4. Cerambycidae Fauna in Plantation and Fruit Crop Ecosystems of Western Ghats in Karnataka

**SANGAMESH, R. HIREMATH**

##### **ABSTRACT**

Studies conducted on Cerambycidae fauna in plantation and fruit crop ecosystems of Western Ghats in Karnataka revealed a total of 76 species in 59 genera. Three families of the Cerambycoid complex viz. Cerambycidae, Disteniidae and Vesperidae were represented in Western Ghats of Karnataka. The family Cerambycidae was represented by four subfamilies viz. Prioninae (8 genera and 10 species), Lepturinae (1 species), Cerambycinae (19 genera and 27 species) and Lamiinae (29 genera and 36 species). The subfamily Lamiinae was the most speciose group found in the present study. The family Disteniidae with an unconfirmed species and Vesperidae with a species of an uncertain generic placement (*Philus globulicollis* Thomson) represented the Cerambycoid families in Western Ghats of Karnataka. Of the 76 species collected, 3 were new records to India (*Nepiodes terminalis* (Gahan), *Neoplocaederus consocius* (Pascoe) and *Paraleprodera* p. nr *javanica*) 11 were new records to south India and 22 were new records to Karnataka. A total of 13 new host plant records for the long-horned beetles collected in the present study were documented. Among the Cerambycidae fauna collected, members belonging to the subfamily Cerambycinae and Lamiinae are considered as pestiferous in their larval stage. *Chelidonium cinctum* (Guérin-Méneville), *Neoplocaederus ferrugineus* (Linnaeus), *Xylotrechus quadripes* Chevrolat, *Batoceraru fomaculata* (Degeer) and *Stheni asgrisator* (Fabricius) included in the present study are well known persistent pests on fruits and plantation crops. A checklist of the species documented in the present study along with the diagnostic characters and illustrated key for their identification were provided.

June, 2015

(Revanna Revannavar)  
Major Advisor

## 5. Assessment of Yield Loss and Management of Yellow Mite, *Polyphagotarsonemus latus* Banks on Bell pepper (*Capsicum annum* L.) under Protected Cultivation

### ABSTRACT

An investigation was carried out on insect and mite pest complex, yield loss due to yellow mite, *Polyphagotarsonemus latus* (Banks) and management of yellow mite using newer molecules of acaricides. The experiments were carried out under naturally ventilated polyhouse condition during 2015-16 at Department of Entomology, College of Horticulture, Hiriya, Chithradurga district, Karnataka, India. Seven insect and mite pests along with natural enemies belonging to six orders and six families were recorded on capsicum. They included yellow mite, *P. latus* (banks), thrips, *Scirtothrips dorsalis* (Hood), fruit borer, *Spodoptera litura* (Fabricius), mealy bug, *Phenacoccus peruvianus* (Granara), a grasshopper and the natural enemies like predatory mite, spiders and chrysopids, *Chrysoperla* sp. The crop loss due to yellow mite, *P. latus* in capsicum under protected cultivation was 29.78 per cent. The fruit yield recorded from treated and untreated plots was 5.34 kg/ 5m×3m plot and 3.75 kg/5m×3m plot, respectively. Among the selected acaricides, fenpyroximate 5 SC was effective against egg population at 3, 7 and 10 days after the first spray, second and third spray against egg population on capsicum under protected condition. Against active stages (nymph and adult), fenpyroximate 5 SC was effective at 3, 7 and 10 days after spray at first and third spray. The least effective acaricide was dicofol 18.5 EC. The order of efficacy of these acaricides against mite population was fenpyroximate 5 SC > diafenthiuron 50 WP > chlorofenapyr 10 EC > spiromesifen 22.9 SC > propargite 57 EC > fenazaquin 10 EC > dicofol 18.5 EC.

October, 2016

(Rajashekarappa. K.)

Major Advisor

## 6. Population Dynamics and Management of Brinjal Shoot and Fruit Borer, *Leucinodesorbonalis* Guenee (Lepidoptera: Crambidae) under Hill Zone of Karnataka

**RASHMI, S**

### **ABSTRACT**

A study on population dynamics, tolerant varieties and integrated management approaches against brinjal shoot and fruit borer (BSFB) was conducted during 2016 at College of Horticulture, Mudigere, Chikkamagaluru, Karnataka. The data on population dynamics of brinjal shoot and fruit borer indicated that highest shoot damage was noticed during the fourth week of March. The highest damage by BSFB on fruit was recorded during the third week of April and so also the peak larval activity was noticed during the third week of April. Climatic variables like temperature and relative humidity had a significant influence on larval activity and shoot and fruit infestation. Natural enemies viz. coccinellids, spiders, syrphid flies and green lace wings were significantly dependent upon population of shoot and fruit borer. The brinjal genotypes, Arka Nidhi and Arka Neelkant were fairly resistant to brinjal shoot and fruit borer. The lowest per cent shoot and fruit infestation was in IC281112 and IC332508 genotypes. Among the modules in integrated pest management practices, module I (maize as barrier crop; installation of pheromone traps at crop canopy; removal and prompt destruction of infested shoots and fruits from 30 DAT and scheduled spray of insecticides viz. profenophos, azadirachtin, chlorantraniliprole, *Bacillus thuringiensis*, spinosad from 40 DAT) reduced the infestation of shoot and fruit. The yield, net returns and C: B ratio was higher in module I than module II and module III.

June, 2016

(Suchithra Kumari, M. H)  
Major Advisor

## 7. Population Dynamics and Age Structure of Coffee Berry Borer, *Hypothenemus hampei* (Ferrari) (Coleoptera: Curculionidae: Scolytinae) in Robusta Coffee

**KAVYA, M. A.**

### **ABSTRACT**

The research was carried out in three robusta coffee plantations of Mudigere and laboratory of Department of Entomology, College of Horticulture, Mudigere during 2013-14. The size of coffee berry increased from 7.14 to 11.80, 3.88 to 12.07 and 6.70 to 12.00 mm in estates of Bilagula, Phalguni and ZAHRS (Mudigere), respectively. The infestation of *Hypothenemus hampei* increased from July to December. The difference in size of infested and uninfested berries was significant in June, July and August; whereas the difference was narrow after October. *H. hampei* prefers bigger berries during initial phase of berry bearing period, later berries will mature to uniform in size. The density of adult *H. hampei* increased from June to harvesting of the coffee. Every infested berry was accommodated with only one female adult beetle from June to August or September. Immature stages of *H. hampei* were first noticed in September or October. All stages of *H. hampei* were observed from October onwards. The highest number of immature and adult *H. hampei* was observed in November and December. The distribution of *H. hampei* within infested coffee plants varied significantly across blocks of the estates. The spatial distribution pattern of *H. hampei* was aggregate or random at early phase of berry bearing season, later the distribution was uniform as berries mature. The adult male beetle was not noticed in berry sample collected for age structure study. As male adult beetle was not noticed till harvest (December) of robusta coffee, extra sample collected in December was stored to observe emergence of adults. Male adult beetle was first observed in this trial and male to female ratio was 1:13 per berry.

July, 2016

(Revanna Revannavar)  
Major Advisor

## 8. Studies on the Seasonal Incidence and Management of Onion Thrips, *Thrips tabaci* (Lind.) (Thysanoptera: Thripidae)

**Vinuthan, K. D.**

### **ABSTRACT**

Studies on the seasonal incidence of onion thrips, *Thrips tabaci* (Lind.) on onion during 2014-15 revealed that, thrips incidence was maximum per onion plant (10.13 thrips) in farmer's field of Dharmapura village followed by Nandihalli village (7.29 thrips). Thrips incidence was the least in Hosadurga village (4.28 thrips). Thrips incidence was high in ZAHRS, Babbur farm during *rabi-summer* with an average of 31.81 thrips per plant and population was peak (61.04 thrips/plant) on 8<sup>th</sup> march 2015. Thrips incidence was the least during *kharif-rabi* with an average 8.59 thrips/plant and the incidence was peak (27.16 thrips/plant) on 29<sup>th</sup> September 2014. Thrips population had a significant positive correlation with maximum temperature and significant negative correlation with rainfall and relative humidity in both the seasons. Among the twenty onion cultivars screened against thrips, Arka Pragati was moderately resistant to thrips attack with the lowest thrips population (29.34 thrips/plant) followed by Arka Kalyan (32.12 thrips/plant) and Arka Niketan (34.10 thrips/plant). Whereas, Satara Garva was highly susceptible to thrips attack with the highest thrips population (79.38 thrips/plant) followed by Bellary Red (75.96 thrips/plant). Two times spray of acetamiprid caused maximum reduction in thrips population (96.33%) and higher bulb yield (21.37 t/ha) followed by imidacloprid (92.81 % and 19.47 t/ha, respectively) and fipronil (93.63 % and 18.92 t/ha, respectively). The thrips incidence was the highest in untreated control with onion yield 6.72 t/ha. The Cost: Benefit ratio was maximum in acetamiprid (2.01) treatment followed by imidacloprid (1.73) and fipronil (1.54). Thrips caused 68.55 per cent yield loss in untreated plot.

September, 2015

(K. Rajashekarappa)  
Major Advisor

## 9. *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae) in Arabica Coffee Plantations

PARASHURAM UDDAPPA MADIHALLI

### ABSTRACT

The research was carried out at Mudremane coffee estate of Mudigere (Chikkamagaluru District) during 2013-14. Among 1 to 6 year old arabica coffee plants, the highest infestation (6.68% among blocks 13) of *Xylotrechus quadripes* was in 4 year old plants. The cumulative infestation increased from 0.63 to 34.22 per cent during the past (2008 to 2013) and the spatial distribution pattern of *X. quadripes* was aggregated. The probability of *X. quadripes* new infestation was higher around uprooted or infested coffee plant than around uninfested coffee plant. In the current year (2013-14), the highest infestation was 32.31 per cent, spatial distribution pattern of *X. quadripes* was random to aggregate and probability of the new infestation was higher around the infested plants than uninfested coffee plants. The highest number of shade plants irrespective of species (269) was recorded in A<sub>6</sub> block with infestation 16.64 per cent, whereas the lowest number of shade plants (139) in A<sub>14</sub> block with infestation 31.41 per cent and these blocks represented 18 species of shade plants. The highest diversity of shade plants (24 species & Shannon-Wenner index 4.16) was noticed in block A<sub>3</sub> with 29.67 per cent infestation, whereas diversity of shade trees was the lowest (11 species & Shannon-Wenner index 2.02) in block A<sub>16</sub> with 34.96 per cent infestation. The infestation of *X. quadripes* in always shaded and always open area (not shaded) was 9.44 and 74.37 per cent, respectively.

July, 2016

(Revanna Revannavar)  
Major advisor

## 10. Studies on Varietal Evaluation and Integrated Management of Insect and Mite pests of Chilli under Hill Zone of Karnataka

**LATHA, S.**

### **ABSTRACT**

The investigations were carried out on varietal evaluation of chilli and integrated management of major insect and mite pest of chilli during 2015 at Karkipete, Chikmagalur district, Karnataka. Among the genotypes screened against chilli thrips and mites, genotypes *viz.*, DCC-3, 185, 109 and 89 recorded lowest populations of chilli thrips, mites and LCI. Further, high trichome density, high chlorophyll and total phenol content with higher fruit yield was also recorded in the above genotypes. However, DCC-177, 103, 39, 15, 184, 239, 44, 48, 167, 230 and 43 were categorized as susceptible genotypes which showed highest populations of thrips and mites. DCC-66 and Byadgi Kaddi were categorized as highly susceptible to thrips and mites with less fruit yield. Among the treatments evaluated for the management of major insect and mite pests, chilli crop, bordered by double layered shade net with single sprays of imidacloprid 17.8 SL @ 0.3 ml/l, cloranthraniliprole 18.5 SC @ 0.25 ml/l, flubendiamide 48 SC @ 0.2 ml/l, spiromesifen 30 SC @ 2ml/l and spinosad 45 SC @ 0.25 ml/l at 2, 5, 7, 9 and 11 weeks after transplanting respectively were found to be better in the management of insect and mite pest and found to be on par with seed treatment with imidachloprid 70 WS @ 7g/kg, neem cake @ 250 kg/ha. seedling dip with imidacloprid 17.8 SL @ 0.3 ml/l at the time of transplanting, one spray of azadirachtin 10000 ppm @ 2ml/l, cyantraniliprole 10% OD @ 1.2 ml/l, *Lecanicillium leacanii* @ 2g/l + spinosad 45 SC @ 0.25 ml/l, *M. anisoplea* @ 2g/l + spiromesifen 2 ml/l and flubendiamide 48 SC @ 0.2 ml/l, at 2, 5, 7, 9 and 11 WAT, respectively recorded significantly higher chilli fruit yield with highest gross return, net returns and C:B ratio.

May, 2017

(L. Hunumantharaya)  
Major Advisor

## 11. Population Dynamics and Molecular Characterization of Shot-hole Borer, *Xylosandrus compactus* (Eichhoff) (Coleoptera: Curculionidae: Scolytinae) in Robust Coffee

**KIRAN, V. S.**

### **ABSTRACT**

Studies on population dynamics and molecular characterization of shot-hole borer, *Xylosandrus compactus* (Eichhoff) (Coleoptera: Curculionidae: Scolytinae) in robust coffee was carried out at Department of Entomology, College of Horticulture, Mudigere and Division of Biotechnology, ICAR- IHR, Bengaluru during 2016-17. Average shot-holes per robusta twig was 1.32 from April, 2016 to 14<sup>th</sup> March, 2017 and the range was 1.0 to 2.54. Number of eggs, grubs, pupae and adults of *X. compactus* per twig across months of the year was 1.0, 1.7, 0.8 and 1.3, respectively. *Xylosandrus compactus* incidence was present throughout the year in robusta coffee. The ratio of adult to immature across the year was 1: 2.79 per twig and range was 1: 0.38 to 1: 4.74. Male adult beetle was smaller in size than female beetle and flightless. The sex ratio of *X. compactus* across months of the year was 1:8.62 that ranged from 1:06 to 1: 12. The infestation of shot-hole borer, *X. compactus* was 56.25, 35.38 and 49.25 per cent and the density of *X. compactus* infested twigs per plant was 3.54, 0.89 and 1.71, respectively across robusta coffee plantations located at 960, 1025 and 1125m MSL. The infestation was significantly more under shade than under without shade. The infestation was positively correlated with temperature and negative with relative humidity and rainfall. The infestation of *X. compactus* was more in younger plantations than old plantation. The molecular studies confirmed that there is no species complex within *X. compactus*.

July, 2017

(Revanna Revannavar)  
Major Advisor

## 12. Species Complex of Aphids on Horticultural Crops in selected Taluks of Chikkamagaluru District

**ROHINI, B. S.**

### **ABSTRACT**

A study on species complex of aphids on horticultural crops in selected taluks of Chikkamagaluru district was conducted during 2016-17 and aphid collections were made in Mudigere, Chikkamagaluru, Kadur, and Tarikeretaluks of the district. A total of 26 aphid species across 14 genera, five tribes and four subfamilies of the superfamily Aphidoidea were recorded. Most of the aphid species studied belonged to the subfamily Aphidinae followed by subfamily Greenideinae, Hormaphidinae and Lachninae. However, Hormaphidinae and Lachninae represented least number of aphid species. The subfamily Aphidinae was represented by two tribes, Aphidini and Macrosiphini constituting three (*Aphis*, *Hysteroneura* and *Rhopalosiphum*) and eight genera (*Macrosiphoniella*, *Macrosiphum*, *Myzus*, *Hyperomyzus*, *Pentalonia*, *Sitobion*, *Uroleucon* and *Lipaphis*), respectively. Only one tribe and one genus each were reported under the subfamily Greenideinae (*Greenidini* and *Greenidea*, respectively), Hormaphidinae (*Cerataphidini* and *Cerataphis*, respectively) and Lachninae (*Cinarini* and *Cinara*, respectively). One species of the tribe Macrosiphini, *Uroleucon (Uromelan) pseudambrosiae* (Olive) was reported for the first time in Asian continent on the host plant *Sonchus arvensis* (L.) (Asteraceae). The severity of aphid infestation was also assessed. The per cent infestation by *Aphis craccivora*, *Macrosiphoniella sanborni*, *Myzus persicae* and *A. gossypii* was higher and per cent infestation by *A. (Toxoptera) citricida*, *Macrosiphum rosae*, *Greenidea (Trichosiphum) heeri*, *G. ficicola*, *Rhopalosiphum padi* and *U. (Uromelan) compositae* was lesser. Out of the 26 aphid species, ten aphid species belonging to the subfamily Aphidinae were associated with 12 species of natural enemies especially predators and 12 species of aphids on 21 species of host plants were attended by seven species of ants. The most common ant genera attending the aphid colonies were *Componotus* and *Monomorium*.

September, 2017

(Suchithra Kumari, M. H.)  
Major Advisor

### 13. Studies on Varietal Evaluation and Management of Whitefly, *Bemisia tabaci* Genn. and leaf miner, *Liriomyza trifolii* Burgess on Gerbera under Protected Condition

**SHALINI, B.**

#### **ABSTRACT**

An investigation was carried out on gerbera varietal evaluation and management of whitefly, (*Bemisia tabaci* Genn.) and serpentine leaf miner (*Liriomyza trifolii* Burgess) by using newer molecules of insecticides and botanicals. The experiment was carried out under naturally ventilated polyhouse condition during 2016-2017 at College of Horticulture, Mudigere, Chikamagaluru. Fourteen varieties of gerbera (Teela, kyllion, Susan, Rionigro, Vilassar, Elite, Amelie, Nigella, Havana, Marinilla, Teresa, Julia, Nathasha and Nathan) were evaluated against whitefly and leaf miner. Among the varieties, none of the varieties were found to be resistant to whitefly and leaf miner. However, out of the fourteen varieties only four varieties were observed as moderately resistant to whitefly with lower number of adults per leaf were recorded in Nigella, Julia, Rionegro and Marinilla (28.69, 32.84, 34.75 and 35.44 adults/leaf, respectively). Further, higher trichome density, lower total soluble sugar and higher flower yield was also recorded in these varieties. However, Nathan, Elite, Vilassar and Havana were categorized as highly susceptible varieties, which showed higher whitefly population of 60.70, 62.10, 63.28 and 68.01 adults/leaf, respectively. Whereas, only three varieties, Nigella, Teela and Susan were observed as moderately resistant to leaf miner with lower number of mines per leaf (5.65, 5.95 and 6.20 mines /leaf, respectively) and other four varieties, Kyllion, Rionegro, Nathasha and Nathan (10.73, 11.25, 12.07 and 12.38 mines/leaf, respectively) were recorded as highly susceptible to leafminer. Among the insecticides and botanicals, diafenthiuron 50 SC @ 0.75ml/l, fipronil 5 SC @ 1ml/l, thiamethoxam 25 WG @ 0.25g/l, recorded significantly lower whitefly population per leaf. Further, thiamethoxam 25 WG @ 0.25g/l, diafenthiuron 50 SC @ 0.75ml/l and fipronil 5 SC @ 1ml/l also recorded significantly lower number of mines per leaf and these treatments recorded higher marketable flower yield, gross returns, net returns and C:B ratio.

July, 2017

(L. Hanumantharaya)  
Major Advisor

## 14. Diversity and Abundance of Hemipterans Attracted to Light Trap in Coffee and Cardamom Ecosystem

**SHWETA B. BELAGAVI**

### **ABSTRACT**

A study conducted on diversity and abundance of hemipterans attracted to light trap in coffee and cardamom ecosystem, revealed that a total of 1,424 individuals were trapped from both the ecosystems, of which, 685 individuals were from coffee that yielded 76 species and 739 from cardamom that contributed to 65 species. In total, 94 hemipteran species were trapped from both the ecosystems, of which, 47 species were common to both the ecosystems, 29 species unique to coffee and 18 species unique to cardamom. The diversity of hemipteran species was high in coffee compared to cardamom as the values of diversity indices; Shannon-Weiner index and Simpson reciprocal's index was high (1.063 and 2.79, respectively) which indicated that coffee supported for greater species compared to cardamom. In coffee, maximum (r = -0.432) and minimum temperature (r = -0.04) were negatively correlated with abundance. While, in cardamom, only maximum temperature (r = -0.056) was negatively correlated which indicated that temperature suppressed the abundance of hemipterans in both the ecosystems. Similarly, species richness exhibited a non-significant positive relationship with all the climatic variables except for maximum temperature (r = -0.041) in coffee. While, in cardamom, species richness was positively and significantly correlated with minimum relative humidity (r = 0.262) and negatively correlated with rainfall (r = -0.020) and maximum temperature (r = -0.028) which indicated that increasing rainfall and temperatures had a negative impact. Of the 1424 individuals recovered through light traps, 1330 were phytophagous and 94 were non-phytophagous hemipterans. Further, out of 1330 phytophagous individuals trapped, 648 were from coffee and 682 from cardamom. Similarly, of the 94 non-phytophagous individuals trapped, 37 were from coffee and 57 from cardamom, which indicated that cardamom supported higher number of phytophagous and non-phytophagous hemipteran individuals than coffee.

September, 2017

(Suchithra Kumari, M. H.)  
Major Advisor

## 15. Studies on Symptoms of Damage, Efficacy of Insecticides and Pheromone Traps against Coffee White Stem Borer, *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae) in Arabica Coffee

**TEJASWI, G. GOWDA**

### **ABSTRACT**

Studies on symptoms of damage, efficacy of insecticides and pheromone traps against coffee white stem borer, *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae) in arabica coffee was carried out at Department of Entomology, College of Horticulture, Mudigere and Division of Biotechnology, ICAR- IHR, Bengaluru during 2016-17. The morphological and molecular characterization confirmed that yellow banded beetles are *X. quadripes*. Number of rings per stem was significantly more at bottom (2.6) portion of the main stem. Yellowing of leaves gradually increased from August to March, number of berries per branch was significantly higher in uninfested plants (42.33) than infested plant (9.68). The adult emergence holes were significantly more on bottom portion of main stem (3.17). Profenofos (50% EC @ 2.0 ml/l) and combination product (Chlorpyrifos 50%+cypermethrin 5% EC @ 1.20 ml/l) caused 100 per cent egg mortality. Five insecticides caused 100 per cent neonate grub mortality under laboratory condition. Though *Bt* strain BT\_IHR\_AND (Cry1I) caused the highest neonate grub mortality (92.86%), BT\_IHR\_AU (Cry au) and BT\_IHR\_JK (Cry3a) were also on par. The first adult beetle emergence was first noticed in the third week of October in live plant under field condition and emergence was from 17<sup>th</sup> October to 4<sup>th</sup> December 2016. Adult emergence from uprooted coffee stumps in mesh house was from 11<sup>th</sup> October to 19<sup>th</sup> November 2016. Six male and eight female beetles were trapped on 25 pheromone traps installed in 66.21 per cent infested arabica coffee plantation. The adult beetle trap catches in trap with and without lure in field did not differ significantly. The pheromone trap did not attract adult beetles in a mesh house under field conditions. The pre-exposed glue panels of pheromone trap were sticky to trap 100 per cent up to 3 months and later per cent adult beetles trap gradually decreased.

July, 2017

(Revanna Revannavar)  
Major Advisor

## **16. Ecology of shot-hole borer, *Xylosandrus compactus* (Eichhoff) in relation with attractant and nutrient status of robusta coffee**

**AVINASH**

### **ABSTRACT**

The research on ecology of shot-hole borer, *Xylosandrus compactus* (Eichhoff) in relation with attractant and nutrient status of robusta coffee was conducted in Mudigere, Karnataka during 2017-18. Ethyl alcohol at 95 per cent was superior for monitoring the flight activity of *X. compactus*. Irrespective of concentrations used, the ethanol-baited traps were seen attracting only scolytid beetles. Three major nutrients viz. nitrogen, phosphorous and potassium were found significantly at the higher rate in the twigs sampled from fertigated plantation than in the twigs sampled from non-fertigated plantation. More nitrogen, phosphorous and potassium was quantified from infested twigs than uninfested twigs. The per cent infestation within the fertigated and non-fertigated plantation was found to be 72.14 and 61.42 respectively. The infested twigs per infested plant in the fertigated and non-fertigated plantation were 4.11 and 2.35 respectively without any significant difference. The number of bored holes in infested twigs of the fertigated plantation (2.58 bored holes/twig) was comparatively more with non-fertigated plantation (1.72 bored holes/twig). The variation was not much for nutrient content in twigs based on thickness. The number of bored holes in the thicker twigs (1.67 bored holes/twig) was superior over medium-size (1.55 bored holes/twig) and thinner twigs (1.12 bored holes/twig). The number of infested plants for the selected quadrants was more in the fertigated (30.75 plants/100 plants) plantation than non-fertigated plantation (26.2 plants/100 plants). The number of infested twigs per infested plant was significantly higher in the fertigated plantation (4.42 twigs/infested plant) over non-fertigated plantation (2.31 twigs/infested plant) amongst the selected quadrants. Irrespective of the plantation, the highest infestation among selected quadrants was noticed in February. The infestation spread was random, scattered and didn't confirm any specific pattern in both the plantation.

August, 2018

(Revanna Revannavar)  
Major Advisor

## 17. Studies on Tritrophic Interaction in Okra, *Helicoverpa armigera* (Hubner) and Chrysopids

**J. J. APOORVA**

### **ABSTRACT**

The investigational preference studies among the sixteen okra genotypes indicate that the mean number of egg laying by *Chrysoperla zastrowi sillemi* (Esben - Petersen) in absence and presence of *Helicoverpa armigera* (Hubner) was significantly highest on EC 169406 and EC 169424. Whereas, *H. armigera* laid significantly higher number of eggs on EC 169406 and EC 169424 and least on EC 169415 and Utkal Gaurav. Among the different growth stages of okra genotypes, *C. zastrowi sillemi* laid more number of eggs in the presence of *H. armigera* in comparison with the absence of *H. armigera*. Both in the presence and absence of *H. armigera*, *C. zastrowi sillemi* laid more number of eggs at flowering stage followed by fruiting stages of okra genotypes. Further, *H. armigera* followed the same trend in egg laying in flowering and fruiting stages of okra. The feeding potential of chrysopid species on *H. armigera* eggs on different okra genotypes were significantly higher on EC 169415, Utkal Gaurav followed by EC 169419 and significantly least feeding potential on EC 169406. Among the species of chrysopids, feeding potential of *C. zastrowi sillemi* was more followed by *Mallada boninensis* (Okomoto) and *Mallada astur* (Banks). Irrespective of the okra genotypes, trichome density was positively correlated with the oviposition of *C. zastrowi sillemi* and *H. armigera*. Whereas, negatively correlated with the feeding potential of chrysopids. Gas chromatography of okra leaf extract indicated the presence of tetradecane, pentadecane, tricosene and eicosene volatile compounds responsible for attracting chrysopids. Among the different treatments involving *C. zastrowi sillemi* as a major component in management of fruit borers in okra, seed treatment with imidacloprid 70 WS @ 10 g/ kg + application of NSKE (5%) + release of *C. zastrowi sillemi* (60,000 grubs/ ha) was superior in recording lower incidence of fruit borers in the okra variety, Arka Anamika and this treatment is as effective as RPP and recorded less fruit damage by borers, significantly higher pod yield, higher gross return, net return and B:C ratio (1:1.95) next to RPP.

July, 2018

(L. Hanumantharaya)  
Major Advisor

## 18. Diversity of Spider Mites in Vegetable Crops with Special Reference to Two Spotted Spider Mite, *Tetranychus urticae* Koch (ACARI: TETRANYCHIDAE) on Tomato

**MEGHANA, J.**

### **ABSTRACT**

An investigation was carried out on diversity of spider mites with special reference to *Tetranychus urticae* Koch, its seasonal incidence and management using acaricides. The experiment was carried out in open field condition during 2017-18 at Department of Entomology, College of Horticulture, Hiriya, Chitradurga District, Karnataka, India. Three species of Tetranychid mites viz., *Tetranychus urticae*, *T. macfarlanei* and *T. ludeni* were identified from ten different host plants. Among these, *T. urticae* was reported on tomato, *T. macfarlanei* was reported on tomato, brinjal, bhendi, cucumber, watermelon, bitter gourd, bottle gourd, soyabean, french bean and kakachi whereas *T. ludeni* was recorded on brinjal. During *kharif* 2017, the population of spider mite on tomato was first noticed during the second fortnight of August 2017 and continued up to last week of October 2017. The peak abundance was noticed during the second fortnight of September 2017 with 4.52 mites per leaf. During *rabi* 2017, the population of *T. urticae* was first noticed during the second fortnight of December of 2017 with the peak abundance of 38.76 mites per leaf was noticed during first fortnight of March 2018. Among the selected acaricides, fenpyroximate 5 SC was effective at 3, 7 and 10 days after first and second spray against total population of spider mite on tomato under field condition. The least effective acaricide was dicofol 18.5 EC. The order of efficacy of these acaricides against mite population was fenpyroximate 5 SC (1.0 ml/l) > diafenthiuron 50 WP (1.0 g/l) > chlorfenapyr 10 EC (1.0 ml/l) > spiromesifen 22.9 SC (0.8 ml/l) > propargite 57 EC (2 ml/l) > fenazaquin 10 EC (2.5 ml/l) > dicofol 18.5 EC (2.5 ml/l). Finally, the highest yield (69.40 t/ha) and B:C ratio (1: 2.80) was obtained in the treatment fenpyroximate 5 SC.

August, 2018

(Rajashekharappa, K)  
Major Advisor

## 19. Studies on Seasonal Development and Multiplication of Stingless Bee, *Tetragonula iridipennis* (Smith) Colonies

**MYTHRI, P.G.**

### **ABSTRACT**

Studies on seasonal development and multiplication of stingless bee, *Tetragonula iridipennis* (Smith) colonies were carried out during 2017-18 at College of Forestry, Ponnampet. The observations on seasonal development of the colony showed that the initial mean brood volume of 70.06 cm<sup>3</sup> during the month of April 2017 increased to the maximum of 162.28 cm<sup>3</sup> by the month of March 2018. The volume of food pots increased from the initial level of 30.39 cm<sup>3</sup> to the highest of 156.70 cm<sup>3</sup> and the colony weight from the lowest of 234.96 g to 373.68 g during the months of April 2017 and March 2018, respectively. The foraging activity of the bees and number of bees involving in various activity remained same across the seasons and also a same trend of lesser number of bees involving in different activity in the morning hours; gradually increasing towards noon and then onward declining and reaching to the lowest by evening was observed in all the seasons. Perusal of the beekeepers practices in dividing the stingless bees showed three different methods, with varying rate of success ranging from 50 to 80 per cent. Among the different methods of colony division, high success was obtained in the divided nucleus colonies with the presence of gynes and / or queen cells in parallel method of division; and without them the success rate was zero per cent. The artificially prepared queen cell cups made up of bee wax and brood cell material when placed into the colony, they were not accepted by the bees. Even the enlarged cell prepared by joining two adjacent cells with single larvae in them was also not accepted by the colony. In *invitro* rearing, larval stages showed good success than the egg stages in emerging as adults.

August, 2018

(R.N. Kencharaddi)  
Major Advisor

## 20. Studies on Pest Complex and Management of Fruit Fly, *Bactrocera cucurbitae* (Coquillett) in Cucumber

**SRINIVAS, M. P.**

### **ABSTRACT**

The present investigation on the pest complex and management of fruit fly, *Bactrocera cucurbitae* (Coquillett) in cucumber was conducted at Amble village, Chikkamagaluru, Karnataka during *kharif* 2017 and summer 2018. In the present study, 21 species of insect pests belonging to Lepidoptera (2 species), Coleoptera (5 species), Diptera (7 species), Hemiptera (6 species), Thysanoptera (1 species) and one non-insect pest belonging to class Acarina (1 species) were noticed. The cucumber was found to be attacked by eight species of sucking pests, eight species of defoliators and six species of fruit flies. A total of 11 species of predators belonging to Coleoptera (5 species), Neuroptera (1 species) and Hemiptera (2 species) and one non-insect class, Araneae (3 species) were encountered in the cucumber cropping system. Eight insecticides were evaluated against melon fruit fly, among which, significantly lowest number of ovipositional punctures (0.72 and 0.98 /fruit), number of maggots (8.0 and 8.93 /fruit) and per cent fruit infestation (14.92 and 17.90 %) as well as highest marketable fruit yield (15.63 and 16.49 t /ha.) and more cost-benefit ratio (1: 2.30 and 1: 2.43) was recorded in the treatment spinosad 45 SC (0.15 ml/l) during both *kharif* and summer season, respectively and it was on par with the treatment dichlorvos 76 EC (1.0 ml/l). Highest number of ovipositional punctures (2.72 and 3.01 /fruit), number of maggots (19.13 and 19.80 /fruit) and per cent fruit infestation (46.91 and 56.79 %) as well as lowest marketable fruit yield (10.75 and 9.01 t /ha.) was obtained in jaggery alone treatment (10 g/l) followed by control in both *kharif* and summer season, respectively. During *kharif* season the lowest cost-benefit ratio (1: 1.62) was obtained in jaggery alone treatment while in summer season cyantraniliprole 10.26 OD recorded the lowest cost-benefit ratio (1: 1.34).

July, 2018

(Suchithra Kumari, M. H.)  
Major Advisor

## 21. Seasonal Incidence and Management of Black Pepper Root Mealy Bug, *Formicoccus polysperes* Williams (Pseudococcidae: Hemiptera)

**SWATHI, N.**

### **ABSTRACT**

Investigations were carried out on the survey, seasonal incidence and management of black pepper root mealybug during 2017-18. A preliminary survey was conducted in Chikkamagaluru, Hassan and Kodagu districts of Karnataka to document the root mealy bug species infesting black pepper. Two species of mealy bugs, namely, *Formicoccus polysperes* Williams and *Pseudococcus* sp. were found to be infesting the underground parts of black pepper in Kodagu and Chikkamagaluru districts. The normal symptom observed by the root mealy bug infestation was yellow discoloration of the leaves. The root mealy bug colonizes on roots upto a depth of 25cm vertically with a maximum number of colonies 23.20/15cm root length. The alternative hosts recorded were viz., ginger, elephant foot yam and weeds like *Phyllanthus niruri* Lour, *Ageratum conyzoides* L., *Physalis minima* L., *Synedrella nodiflora* L. and a pepper standard, *Erythrina* sp. Seasonal incidence of root mealy bugs showed the presence of mealy bugs throughout the year with highest population was in post rainy month October (18.5) and lowest population in the month of March (1.20). A significant positive correlation was observed between mealy bug population with rainfall and relative humidity, while negative correlation was observed with temperature. Infested plants are associated with four ant species viz., *Paratrechina longicornis* Latreille, *Plagiolepis* sp.1, *Plagiolepis* sp.2 and *Aphaenogaster* sp. by which mealy bug infestation could be easily recognized. The *Formicoccus polysperes* is known to cause damage to black pepper in the hill zone of Karnataka. In an attempt to control this pest, six insecticides viz., chlorpyrifos, carbosulfan, imidachloprid, phorate, carbofuron, chlorantriliprole and neem cake were evaluated under field conditions. Chlorpyrifos 20EC @ 5ml/l, imidachloprid 17.8SL @ 1.5ml/l and chlorantriliprole 0.4G @ 20g/vine showed the highest efficacy recording 100, 98 and 97 percent reduction, respectively.

July, 2018

(R. Girish)  
Major Advisor

## 22. Studies on Seasonal Incidence and Management of Cardamom Thrips (*Sciothrips cardamomi* Ramakrishna) Under Hill Zone of Karnataka

**VENUKUMAR, S.**

### **ABSTRACT**

Studies on seasonal incidence and management of cardamom thrips (*Sciothrips cardamomi* Ramk.) was carried out at Mudigere, Karnataka during 2017-2018. The highest population of cardamom thrips was on leaf sheath of M2 and M3 cardamom varieties during February to May, whereas during September the population was the highest on panicle. There was significant positive correlation between the thrips population on leaf sheath and temperature in M2 and M3 cardamom varieties. Among the fourteen cardamom genotypes, the lowest thrips population per leaf sheath and panicle was recorded in PL No. 14, SKP 104, CR 6, IC 349651 and MCC 346 genotypes followed by SKP 164, IC 547167, Local Malabar, ICRI 3 and CL 726 genotypes. The highest thrips population was recorded in the genotype Green Gold followed by IC 349545, CL 691 and IC 547185.

The number of thrips per leaf sheath and panicle was the least in treatments *viz.* 1 ml fipronil 5 SC, 0.2 g acetamiprid 20 SP and 0.25 g thiamethoxam 25 WG per litre of water. The thrips population per leaf sheath and panicle was higher in biorational treatments (azadiractin 1 EC and spinosad 45 SC), however the population was lower than untreated control. The per cent capsule damage by thrips was significantly lower in the treatments *viz.* fipronil 5 SC, thiamethoxam 25 WG and acetamiprid 20 SP and the significantly higher marketable cardamom capsule yield was 724.2, 722.3 and 704.4 kg/ha in treatments *viz.* fipronil 5 SC, acetamiprid 20 SP and thiamethoxam 25 WG, respectively. The treatments *viz.* acetamiprid 20 SP, fipronil 5 SC and thiamethoxam 25 WG were superior with respect to benefit cost ratio (7.07, 6.93 and 6.76, respectively).

August, 2018

(L. Hanumantharaya)  
Major Advisor

## 23. Role of flower visitors in pollination and fruit set of guava (*Psidium guajava* L.)

**KRUTHI, M.K.**

### **ABSTRACT**

An investigation on role of flower visitors in pollination and fruit set of guava (*Psidium guajava* L.) was conducted during August 2013 to December 2014 at R.H.R.E.C., U.H.S.campus, G.K.V.K., Bengaluru. Among the two blooming seasons of guava during the study period, second fortnight of November 2013 and second fortnight of August 2014 were the peak flowering fortnights with 75.0 and 78.3 flowers per plant, respectively. Anthesis and anther dehiscence were maximum during 06.00hrs.to 07.00hrs. Maximum stigma receptivity was found two hours after anthesis, whereas, pollen viability was highest at the time of anthesis. Among eight hymenopteran flower visitors recorded on guava, *Apis dorsata*, *A. cerana* and *A. florea* were dominant species in the order. The most dominant species, *A. dorsata* in a single trip during early morning visited, 2.80 flowers to forage, spending the highest time of 96.73 sec. per flower. Whereas, it visited highest, 7.20 flowers to forage, spending the least time of 15.58sec. per flower during afternoon. Most of *A. dorsata* (82.50%) landed on anthers and the remaining (17.50%) landed on petals of the flower. They foraged both for nectar and pollen during early morning, but as the day progressed, most of them shifted to collect only pollen. Open pollinated flowers recorded highest fruit set (92.30%), fruit retention after fruit set (94.79%), fruit retention at harvest (87.49%), number of days taken from flowering to harvest (120.08 days), fruit weight (153.235g), fruit volume (149.75cc), number of seeds per fruit (490), seed weight per fruit (4.899g), pulp weight per fruit (148.336g) and fruit weight per plant (14.983kg). Whereas, flowers covered with nylon net and muslin cloth to avoid flower visitors showed least of these traits proving the importance of honey bee pollination for higher yield in guava.

September, 2018

(V. V. Belavadi)  
Major Advisor