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POPULATION DYNAMICS OF MEALYBUG PHENACOCCUS SOLENOPSIS AND ITS NATURAL ENEMIES

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ABSTRACT

Studies revealed that brinjal (var. shyamala) planted on 31st July 2007 inhabited maximum (33.8 adults) population of mealybug *Phenacoccus solenopsis* Tinsley, in March 2008 and the least (0.93 adults) in November 2007. There existed a positive correlation with temperature. However, when planted 14th July 2008 remained free from the mealybugs except scanty population noticed during January 2009. The other variety of brinjal (var. Vikram) planted on14th July 2008 was found negatively correlated with rainfall (-0.21). The parasitoid, *Aenasius bambawalei* Hayat, was found negatively correlated with *P. solenopsis* (-0.21) and *Promuscidea unfasciativentris* Girault (-0.12). Highest (53.73 adults) population of *P. solenopsis* was observed during November followed by October (21.13 adults) and lowest observed in December (1.3 adults) on sorrel planted in 2007. Highest (91.7 adults) population of *P. solenopsis* was observed during July followed by June (54.5 adults) and lowest was seen in December (1.3 adults) on sorrel planted in 2008. Mealybug found positively correlated with temperature in sorrel planted 10.07.2007 and 15.04.2008 Highest number of *P. unfasciativentris* were recorded in October 2008 (116 adults) on sorrel and observed negatively correlated (-0.2) with mealybugs. Okra planted 26.06.2008, recorded highest (11.08 adults) population of *P. solenopsis* during October as compared to lowest (3.4 adults) in November. It was positively correlated with temperature. Highest population of *A. bambawalei* was observed during October (23 adults) and found positively correlated with temperature (0.68) and *P. unfasciativentris* (0.11) which was highest in highest in November (26 adults). China rose recorded highest (51.82 adults) population of *P. solenopsis* in July 2008, while lowest (0.06 adults) in October 2008. Mealybug was positively correlated with temperature (0.53), relative humidity (0.67) and rainfall (0.61). Mealybug, was again found positively correlated with parasitoid, *A. bambawalei* (0.70), hyper-parasitoid, *P. unfasciativentris* (0.97) and hyper-parasitoid, *Aprostocetus purpureus* Girault (0.73).

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RP-HPLC METHODS AND QUECHERS FOR DETECTION OF INSECTICIDES IN RICE GRAINS

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ABSTRACT

In this study, methods for detection and determination of monocrotophos, deltamethrin, phosphamidon and dichlorvos had been standardized by combination of reverse phase-high performance liquid chromatography (HPLC) with modified QuEChERS method. UV-VIS detection system and the Brownlee Analytical C18 column were used for the quantification of monocrotophos and deltamethrin with an isocratic flow of 1.70 mL min^{-1} of mobile phase of acetonitrile and water (90:10, v/v). Phosphamidon and dichlorvos were separated with an isocratic flow of acetonitrile and water (70:30, v/v). The peaks of monocrotophos and deltamethrin were depicted at retention times of 0.77 min and 3.01 min and the peaks of phosphamidon and dichlorvos were found at 1.11 and 1.39 min. The recoveries found in the method were above 80% with the evaluated insecticides, when samples were fortified at 0.05, 0.10, 0.25, 0.50 and 1.00 mg kg^{-1} levels.

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YIELD-INFESTATION RELATIONSHIP OF APHIDS INFESTING WHEAT AND THEIR ECONOMIC INJURY LEVELS

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ABSTRACT

The effect of aphid complex on wheat yield was studied through field experiments during *rabi* 2016-17 and 2017-18. Yield-infestation relationship was investigated on two widely cultivated wheat varieties HD-3059 and HD-3086 utilizing five regression models *viz.*, linear, semi-log_e (X), semi-log_e (Y), log_e-linear and quadratic. Optimum number of sprays to get higher yield was computed to be 2 sprays between 60 to 80 DAS for both the varieties. Further, economic injury levels (EIL) were determined to be 6.3 aphids/ tiller at 60 and 14.4 at 70 DAS for HD-3059 and 34.6 at 60 and 29.3 aphids/ tiller at 70 DAS for HD-3086. These EILs will facilitate timely management practices against the pest.

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DYNAMICS OF FORAGING ACTIVITY OF APIS MELLIFERA IN KASHMIR

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ABSTRACT

Foraging behaviour in honey bee (*Apis mellifera* L.) depends on floral resource availability and diurnal patterns. This study analyses these with experiments done at the Research and Training Centre for Pollinators, Pollinisers and Pollination Management, Division of Entomology SKUAST- K, Shalimar, during March-April 2018. The results suggested that the foraging rate was highest (27.5%) in the afternoon and least (18.3%) in the evening. There was a positive correlation between the foraging and temperature in contrast to the negative ones with relative humidity, rainfall and wind speed.

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GENETIC DIVERSITY OF PINK BOLLWORM PECTINOPHORA GOSSYPIELLA (SAUNDERS) POPULATIONS

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ABSTRACT

Present study evaluates the genetic diversity of *Pectinophora gossypiella* (Saunders) populations collected from different cotton growing zones of India with RAPD-PCR analysis. RAPD decamer primers namely OPI-11 to OPI-20 was used out of which four (OPI-11- OPI-14) produced amplicon of good resolution and enough variation. A total of 153 amplicons produced out of which 118 (92%) are polymorphic bands indicating high genetic polymorphism among the *P. gossypiella* populations. The similarity coefficient values ranged from 0.20 to 0.76 for the pair-wise combination among twelve populations of *P. gossypiella*. An UPGMA dendrogram generated based on Jaccard's similarity coefficient for 12 populations grouped into two clusters. Minimum similarity (0.20) was observed between LAB and GJJ populations. The present investigation shows occurrence of high genetic polymorphism and low genetic diversity among *P. gossypiella* populations in India.

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EFFECT OF ^{60}CO GAMMA IRRADIATION ON THE LIFE STAGES OF *ORYZAEPHILUS SURINAMENSIS* (L.)

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ABSTRACT

Gamma radiation applied at five doses from 0.1- 0.5 kGy was evaluated for its effects on the eggs, larvae, pupae and adults of *Oryzaephilus surinamensis* (L.) maintained at 27±1°C and 75±5%RH. The effect on hatching of egg, pupae formation, adult emergence and mortality were observed to be dose dependent. There was no hatching of egg, larval development and adult emergence at 0.5 kGy. One way ANOVA revealed the significance of variations, and SEm was 1.08, 1.72, 1.68 and 2.49 for hatching of egg, pupae formation, adult emergence and adult mortality, respectively.

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REARING OF *GRAPHIUM AGAMEMNON* (L.) (LEPIDOPTERA: PAPILIONIDAE)

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ABSTRACT

In this study, technique for mass rearing of of *Graphium agamemnon* (Linnaeus, 1758) (Lepidoptera: Papilionidae, Papilioninae) was developed. Instead of gravid females from the wild, larvae and eggs for initiating culture was found to be the best. The observations include: the larvae need to be reared outdoors, on potted plants as well as indoors on leaves in plastic containers, and leaves are to be kept fresh; and there is a need to provide large space for adults facilitating feeding and mating. Hand-pairing was not successful, and periodic augmenting of the culture to maintain viability are is essential. Relevant life history parameters of the laboratory reared population are included.

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MONITORING OF WHITE STEM BORER *SCIRPOPHAGA FUSCIFLUA* WITH LIGHT TRAP AND SWEEP NET

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ABSTRACT

The present study evaluates the activity of white stem borer, *Scirpophaga fusciflua* on rice in Kangra valley deploying light trap and sweep net. The results revealed that moths were active from 29th to 40th (Standard week) SW and 31st to 40th SW, in 2015-16 and 2016-17, respectively, with the peak activity being at 36th and 37th SW, respectively. The population declined thereafter with nil population subsequently. The weather parameters when correlated with population dynamics revealed a positive relationship with maximum and minimum temperature and relative humidity but a negative one with rainfall.

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GONATOPUS SPP. PARASITOIDS ON RICE PLANT HOPPERS

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ABSTRACT

Present study explores the ectoparasitiods of rice plant hoppers viz., *Nilaparvata lugens* (Stål), *Sogatella furcifera* (Horváth) and *Sogatella vibix* (Haupt). It was observed that these are parasitized by drynid wasps, and when analysed for mtCO1, five sequences of parasitoids were inferred with 113 nucleotide variations, which accounted for 17% variation. All the sequences matched with those of *Gonatopus* spp.

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EFFICACY OF TRANSGENIC TOBACCO CARRYING SYNTHETIC PLANT-PREFERRED CODON-OPTIMIZED NOVEL *Vip3Aa44* GENE TOWARDS *HELICOVERPA ARMIGERA* AND *SPODOPTERA LITURA*

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ABSTRACT

Vip3A proteins are synthesized during vegetative growth of *Bacillus thuringiensis* and are toxic against a wide range of lepidopteran insects. Since the mode of action of Vip3A toxins is different from Cry proteins, Vip3A proteins are good candidates for gene pyramiding in transgenic crops to combatdevelopmentofresistance against the currently deployed genes. A synthetic plant-preferred codon-optimized novel *vip3Aa44* gene (NCBI accession number HQ650163) was cloned into *pBINAR* plant transformation vector and tobacco explants were transformed with leaf disc co-cultivation method to evaluatetoxicity of this gene against *Helicoverpa armigera* and *Spodoptera litura*. The putative transgenics were confirmed by PCR and RT-PCR analysis. The bioassayswere performed on detached leaves from putative transgenics using lab-grown population of *H. armigera* and *S. litura*. Mortality after 72 hr ranged from 30-56% for *H. armigera* and 40-60% for *S. litura*, indicating potential of *vip3Aa44*gene against these lepidopteran pests in transgenic development.

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EFFICACY OF INSECTICIDES AGAINST MUSTARD APHID *LIPAPHIS ERYSIMI*

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ABSTRACT

Field experiment was conducted to evaluate the efficacy of insecticides against mustard aphid *Lipaphis erysimi* (Kalt.) on mustard. Significant reduction in population was obtained with imidacloprid 17.8SL followed by acetamiprid 20SP and thiamethoxam 25WG. Thus ,reduction in aphid population was to an extent of 65.83% with imidacloprid 17.8SL followed by thiamethoxam 25 WG and acetamiprid 20 SP. The maximum yield was obtained with acetamiprid followed by imidacloprid and thiamethoxam. NSKE 5% was found to be the least effective. Maximum benefit/cost ratio (5.65:1) was obtained with acetamiprid 20SP.

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OVARIAN DEVELOPMENT IN *BACTROCERA CUCURBITAE* COQUILLETT AS INFLUENCED BY DIET

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ABSTRACT

To enable mass rearing of the melon fly, *Bactrocera cucurbitae* Coquillett, as study was undertaken to evaluate dietary constituents comprising of honey, water, protein hydrolysate and yeast powder. Different diets were prepared consisting of protein hydrolysate (1 g, 3 g, 5 g, and 7 g) and yeast powder (5 g, 10 g, 15 g, and 20 g) mixed in 5 ml honey and water 100 ml. Of these, the two diets viz., protein hydrolysate 7 g + honey 5 ml + water 100 ml and yeast powder (10 g + honey 5 ml + water 100 ml) were found equally effective in terms of ovary development and ovarian index, when dissected at 5^{th}, 10^{th}, 15^{th} and 20^{th} day after adult eclosion. In case of protein hydrolysate 7 g, the ovarian index was 0.38 mm^2, 1.75 mm^2, 3.57 mm^2, and 4.04 mm^2 at 5^{th}, 10^{th}, 15^{th} and 20^{th} day, respectively and in case of yeast powder 10 g the ovarian index was 0.39 mm^2, 1.77 mm^2, 3.63 mm^2, and 4.10 mm^2 at 5^{th}, 10^{th}, 15^{th} and 20^{th} day, respectively, after adult eclosion. In both the treatments, the ovary length and breadth were also significantly more in comparison to other treatments, consisting of different quantities of protein source. Thus, the diets containing 7 g protein hydrolysate and 10 g yeast powder were the most suitable diets for mass rearing of *B. cucurbitae.*

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TOXICITY OF PLANT VOLATILE OILS AGAINST *CALLOSOBRUCHUS MACULATUS*

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ABSTRACT

Five plant volatile oils were evaluated against adults of *Callosobruchus maculatus* with fumigation and contact toxicity methods. Patchouli oil gave the lowest LC_{50} value and thus the most toxic one, followed by cinnamon oil. The descending order of contact toxicity in LC_{50} values was: patchouli oil (0.033%) > cinnamon oil (0.082%) > ginger oil (0.122%) > garlic oil (0.217%) > lemon oil (0.334%). The order of relative toxicity was as: patchouli oil (10.12) > cinnamon oil (4.07) > garlic oil (1.53) > ginger oil (1.26) > lemon oil (1.00) as revealed by the contact toxicity. As regards fumigant toxicity the order with LC_{50} values was: cinnamon oil (0.060%) > ginger oil (0.243%) > lemon oil (1.442%) > patchouli oil (8.358%) > garlic oil (187.416%). In terms of relative toxicity it was: cinnamon oil (3123.6) > ginger oil (771.25) > lemon oil (129.96) > patchouli oil (22.42) > garlic oil (1.00) with fumigation method.

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EFFICACY OF INSECTICIDES AGAINST CERAMBYCIDS IN MULBERRY

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ABSTRACT

The infestation of cerambycids especially *Apriona germari* and *Batocera rufomaculata* on mulberry in Jammu and Kashmir poses serious threat to silkworm, *Bombyx mori*. Hence, five insecticides viz., dichlorvos, endosulfan, imidacloprid, ethion, chlorpyriphos along with mixture of chlorpyriphos and cypermethrin were evaluated with injection in galleries at three doses for mortality of grubs. It was observed that the galleries formed by the larvae got reduced with the injection of these insecticides; at 1% all were effective with dichlorvos ranking first but at 0.05% these were ineffective in causing mortality of the grubs.

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EFFICACY OF *HETERORHABDITIS INDICA* DERIVED FROM THREE HOSTS

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ABSTRACT

The efficacy in terms of virulence and longevity of the entomopathogenic nematode, *Heterorhabditis indica* produced from three hosts- *Gallleria mellonella, Henosepilachna vigintioctopunctata* and *Bactrocera cucurbitae* was evaluated in this study. Application of *H. indica* progenies from different hosts to the fourth instar grubs of *H. vigintioctopunctata* showed that progenies from *G. mellonella* showed maximum efficacy

with respect to virulence and longevity; it was followed by *H. vigintioctopunctata* and *B. cucurbitae*. Virulence in terms of pathogenicity and mortality and longevity (number of days of survival) were observed to be directly influenced by size of the host; and larger parents were able to produce more efficient *H. indica* offspring.

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GENETIC DIVERSITY OF *CONOGETHES* (LEPIDOPTERA: CRAMBIDAE) SPECIES COMPLEX INFESTING CASTOR AND CARDAMOM

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ABSTRACT

Genetic diversity of *Conogethes* species infesting castor and cardamom was studied using mitochondrial cytochrome oxidase I gene. Phylogenetic analysis of *Conogethes* populations collected from different locations gave results of two distinct clades. The pair-wise genetic distance analysis between the individuals varied from 0.000 to 0.076, this indicates the presence of high genetic divergence within the *Conogethes* populations. The maximum intra-specific pair-wise distance in *Conogethes* bred on castor was 0.010 when compared to the maximum intra-specific distance of *Conogethes* bred on cardamom 0.072. The nearest neighbour distance between *Conogethes* bred on castor and cardamom was 5.23 percent, indicating wide genetic variability between two *Conogethes* populations. Two distinct phylogenetic clades and higher genetic divergence of more than 5 percent between *Conogethes* population on castor and cardamom were obtained. This clearly suggests that the variation in *Conogethes* population breeding on castor and cardamom are genetically heterogeneous and are two different species. It is now confirmed that *C. sahyadriensis* infest cardamom and *C. punctiferalis* infest castor.

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SEASONAL INCIDENCE OF WHITEFLY *BEMISIA TABACI* IN BRINJAL

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ABSTRACT

The experiment was conducted at AICRP on Water Management, VNMKV, Parbhani, to study the seasonal incidence of whitefly *Bemicia tabaci* (Genn.) on brinjal during 2nd to 13th meteorological weeks (MW) of summer 2014 and 50th to 9th meteorological weeks of summer 2015. The results indicated that the population was more from second week of January to last week of March (2nd to 13th MW) and third week of December to first week of March (50th to 9th MW). The first peak of 23.00 whitefly/ plant occurred during 7th MW (12 to 18 February) in summer 2014 and during summer 2015, the maximum population of 23.50 whitefly/ plant was observed during 6 to 12th February.

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EFFICACY OF INSECTICIDES AGAINST POMEGRANATE THRIPS *SCIRTOTHRIPS DORSALIS* (HOOD)

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ABSTRACT

A field trial was conducted to evaluate insecticides against the pomegranate thrips *Scirtothrips dorsalis* (Hood) at the Central Horticultural Nursery, Department of Horticulture VNMKV, Parbhani, Maharashtra. The insecticides evaluated include spinosad 45SC, fipronil 5SC, lamdacyhalothrin 5EC, clothianidin 50 WDG, thiamethoxam 25WG, imidacloprid 17.8SL, nitenpyram 10WSG, acetamiprid 20SG, thiacloprid 21.7SC and dinotefuran 20SG. The study revealed that all these were superior, of which the most effective was spinosad followed by fipronil and lamdacyhalothrin, and dinotefuran was the least effective, though significantly superior over control.

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EFFICACY OF INSECTICIDES AGAINST MANGO HOPPERS AND THEIR PREDATORY COCCINELLIDS

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ABSTRACT

An experiment conducted at the AICRP on Water Management, VNMKV, Parbhani, during 2014 and 2015 evaluated the efficacy of insecticides against mango hoppers *Amritodus atkinsoni* L. and their natural enemies. Amongst the eight insecticides evaluted thiamethoxam, clothianidin and dinotefuran were found to be effective against mango hopper. Flonicamid, acetamiprid and imidacloprid were found to be moderately effective,

and buprofezin and dinotefuran were the least effective. Flonicamid, buprofezin and thiamethoxam were observed to be comparatively safe to lady bird beetles.

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EFFECT OF SORGHUM GRAIN QUALITY ON PROGENY EMERGENCE OF *SITOPHILUS ORYZAE* L. (COLEOPTERA: CURCULIONIDAE)

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ABSTRACT

In this study, 20 sorghum *Sorghum bicolor* (L.) Moench germplasm lines had been evaluated for their resistance to the stored grain pest, *Sitophilus oryzae* (L.). Observations were made on grain damage and weight loss, inhibitory effect of gut α-amylases, adult mortality and progeny emergence. The results reveal that grain weight loss and α-amylase inhibitory effect are the most significant factors that influence the progeny emergence. The resistant germplasm line IS 920 exhibited minimum grain weight loss (8.2%) and maximum α-amylase inhibitory effect resulting in significantly lesser progeny emergence along with least grain damage (17%). The inhibitory effect of enzyme inhibitors isolated from sorghum, when examined on gut α-amylase it was observed that amylase inhibitors inhibited *S. oryzae* α- amylases appreciably; maximum inhibition being for IS 920 (82.8%) indicating that these α-amylase inhibitors could be used in IPM. The two parameters viz., grain weight loss and α-amylase inhibitory effect could be relied upon for selecting the resistant genotypes against *S. oryzae* in sorghum.

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EFFECT OF HOST PLANT ON GROWTH, TISSUE PROTEINS AND GUT ENZYMES OF PINK BORER *SESAMIA INFERENS*

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ABSTRACT

In this study, pink borer *Sesamia inferens* (Walker), a polyphagous insect and a major pest on millets is explored for analyzing the influence of host plants on the growth, tissue proteins and midgut digestive enzymes of their larvae. The impact of feeding on different food plants on the activity of amylase, trehalase, and invertase in the midgut of the final instar larvae were assayed *in vitro*. The results showed that the larval feeding on the five millet hosts had significant effect on body mass, with maximum body mass being achieved when larvae fed on sorghum (0.214 g). Significantly more enzyme activity of amylase was observed in the larvae fed on finger millet. The activity of amylase, invertase and trehalase fed on pearl millet was relatively low. The results indicated that the larvae of *S.*

inferens **had more capability to utilize sorghum, finger millet and barnyard millet, suggesting that these plants could become their host plants.**

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LIFETABLES OF *APROAEREMA MODICELLA* DEVENTER ON SOYBEAN AND SOYBEAN INTERCROPPED WITH PIGEONPEA

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ABSTRACT

Field lifetables were prepared for determining mortality factors of leaf miner *Aproaerema modicella* Deventer on sole soybean and soybean intercropped with pigeonpea during *kharif* 2015. It was observed that the *A. modicella* completed three regular overlapping generations on sole soybean and as well on soybean intercropped with pigeonpea. Lifetable of field collected life stages revealed that late instar larval and pupal stages were the most vulnerable ones for mortality due to unknown reasons (predation and adverse climatic factors). The natural enemies viz., *Apanteles* sp. and *Goniozus* sp. also contributed some degree of mortality in larvae. Maximum larval parasitisation was observed with intercropped soybean. The negative values of trend index (<1) during the second and third generations showed that the mortality factors were effective in causing decline. The generation survival rate on sole soybean was 0.65, 0.70 and 0.63 got reduced to 0.53, 0.69 and 0.62 on intercropped soybean, in the 1st, 2nd and 3rd generation, respectively. Thus, soybean intercropping with pigeonpea exhibited positive significant impact on key mortality factors of *A. modicella*.