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MANAGING RICE GALL MIDGE AND YELLOW STEM BORER WITH VARIETAL RESISTANCE AND INSECTICIDES

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ABSTRACT

Rice gall midge (*Orseolia oryzae* WM) and yellow stem borer (*Scirpophaga incertulas* WLK.) are two major insect pests of rice in wet season in the state of Jharkhand In the present study, host plant resistance coupled with judicious insecticidal application was evaluated against these pests in field trials. The experiment was conducted in wet season during 2013 and 2014 with eight rice varieties in the randomized block design under protected and unprotected conditions. The pooled data reveal that the least incidence of silver shoot (1.85% SS) was obtained with variety Naveen (protected condition) and it was at par with that in IR-36 (1.98% SS) and Lalat (2.02% SS). Similarly, the least incidence of dead heart (2.22% DH) was observed in the variety Lalat (protected conditions), and it was at par with that of IR-36 (2.65%DH) and Naveen (3.51% DH). Need based protection measures remained effective in all the eight varieties. Under unprotected condition, tolerant/ resistant varieties like IR- 36, Naveen and Lalat exhibited less silver shoot, dead heart and white ear head. This is in comparison to the susceptible ones viz. IR- 64, Birsa Mati, PAC- 801, PAC- 807 and TN-1. These observations conclude that the susceptible varieties require more insecticides, and need based protection proved effective. Also, yield enhancement from 28.72 to 40.97 q/ha; 24.92 to 40.85 q/ha; 24.92 to 39.34 q/ha; 27.20 to 37.97 q/ha and 30.38 to 37.30 q/ha was obtained with the varieties viz. PAC- 807, Naveen, Birsa Mati, IR- 64 and PAC- 801, which accrues on account of the varietal intervention and need based insecticidal application. Hence, HPR and need based insecticide application is to be practiced as IPM tool for minimizing yield loss caused by the major insect pests of rice.

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SCREENING OF GREEN GRAM ACCESSIONS AGAINST PULSE BEETLE *CALLOSOBRUCHUS CHINENSIS* (L.)

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ABSTRACT

A total of 85 green gram [*Vigna radiata* (L.) Wilczek] accessions were screened under laboratory condition against pulse beetle *Callosobruchus chinensis* to identify sources of resistance. Accessions which exhibited lesser growth index (GI) during the preliminary 'free choice' test were further subjected to 'force choice' test for confirmation of resistance. No green gram accession was observed to be immune to bruchid, yet showed significant differences in terms of oviposition, developmental period, adult emergence and seed weight loss. Two accessions viz., KM-11-11 and KM-11-10 resulted in the least adult emergence (12.33 and 25.56% respectively), prolonged developmental period (31.77 and 30.30 days) and lesser growth index (0.034 and 0.046), respectively. The accession Pusa 0831 was observed to be susceptible with survival of 76.54%, developmental period of 23.33 days and growth index 0.081. Correlation between GI and other growth parameters of *C. chinensis* on the accessions indicated that GI was significantly positively correlated with adult emergence (r = 0.974) and weight loss (r = 0.954); however, developmental period (r = -0.982) was negatively correlated; and oviposition showed a non-significant positive correlation (r = 0.332). Hence, these accessions will be promising as donors for developing bruchid resistant varieties in green gram.

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EFFICACY OF AQUEOUS EXTRACT OF CURRY LEAF *MURRAYA KOENIGII* (L.) AGAINST RED RUST FLOUR BEETLE TRIBOLIUM *CASTANEUM* (HERBST)

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ABSTRACT

Agricultural produce suffers losses due to damage by storage pests and finding ecofriendly measures to counter this is necessary. Present study evaluates the effects of aqueous extract of leaves of the curry leaf *Murraya koenigii* (L.) (Rutaceae) against storage pest, the red rust flour beetle *Tribolium castaneum* (Herbst) (Tenebrionidae: Coleoptera). The extract was observed to contain catechins and glycosides in addition to alkaloids and phenolic compounds, the tannins and saponins. The extract has insecticidal and larvicidal effects. The rate of repellency was observed to be concentration dependent. The results reveal the curry leaf extract can be used to repel storage pests.

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EFFICACY OF EXTRACTS OF SOME FERNS AGAINST *PLUTELLA XYLOSTELLA*

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ABSTRACT

The use of dried leaves of ferns for crop protection is a traditional age-old practice in North Eastern India. Evaluations of their efficacy against crop pests is required. The present study evaluates the aqueous extract of dried leaves of eight species of filicinophytic ferns commonly available in Manipur against diamondback moth (DBM) *Plutella xylostella* L. on cabbage. The results revealed that the extracts of *Diplazium esculentum* was superior of the ones evaluated. Phagodeterrence property of *D. esculentum* caused the maximum mortality (54.7%) of larvae with the least consumption of leaves giving maximum protection (59.9%) to cabbage. This fern extract could be incorporated as an ITK-based tool in the Biointensive IPM module against DBM.

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BIOCHEMICAL RESPONSE OF *FLEMINGIA SEMIALATA* (ROXB.) TO SAP SUCKING LAC INSECT *KERRIA LACCA* KERR

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ABSTRACT

Lac insect *Kerria lacca* (Kerr), an exclusive stem phloem feeder, produces a resinous secretion known as lac, over its body for protection which has several commercial applications. By sucking phloem sap from certain host plants, lac insect exerts stress. To elucidate its feeding effect on the host plant biochemical response, *Flemingia semialata* was infested with lac insect. From the pooled data over months and years it was observed that total sugar, soluble protein, free phenol, total chlorophyll and carotenoid contents increased in the leaves of lac insect infested host plant. A reverse trend was observed with leaf starch, and it decreased under lac insect infested condition. The study reveals that lac insect feeding significantly alters primary and secondary metabolism of host plants to ensure its survival as well that of its host plant.

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DIVERSITY AND SEASONAL ABUNDANCE OF TETRANYCHID MITES IN POLYHOUSES IN HIMACHAL PRADESH

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ABSTRACT

Studies undertaken to record the diversity and abundance of tetranychid mites with the crops grown under protected environment in four agro-ecological zones of Himachal Pradesh resulted in five mite species namely, *Eutetranychus* sp., *Panonychus ulmi* (Koch), *Tetranychus ludeni* Zacher, *Tetranychus urticae* Koch and *Tetranychus* sp. (Acari: Tetranychidae). Amongst them, *T. urticae* was the most abundant and diverse in distribution and was followed by *T. ludeni.* The species diversity was more in agro-ecological Zone II with the altitude ranging from 1001 to 1500 masl. However, in Zone IV (>2500 masl) only one tetranychid mite specie was observed to be prevalent. Eleven plant species grown under protected environment acted as host to tetranychid mites. The hosts comprised seven vegetables (capsicum, cucumber, French bean, okra, pak-choi, summer squash and tomato), two flower (carnation and gerbera) and fruit crops (apple seedlings and strawberry). *T. urticae* infested maximum number of crops (eight) grown under protected environment. Abundance of mites was maximum in carnation, followed by strawberry, cucumber, French bean and okra. Tetranychid mites remained active throughout the year under protected environment in Zone I and II.

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LIFE TABLES OF THE SPOTTED STEM BORER *CHILO PARTELLUS* (SWINHOE) ON MAIZE CULTIVARS

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ABSTRACT

Forty- eight lifetables were constructed for *Chilo partellus* (Swinhoe) on six maize cultivars *viz*., DHM 117, DHM 121, Madhuri sweet corn, Priya sweet corn, Amber popcorn and 30V92. In each season of *kharif* and *rabi* 2014-15 and 2015-16 two generations were studied. The survivorship curves drawn indicated that the mortality rate was in the early larval stage. Generation survival declined from first generation in first crop during *kharif* 2014 to second generation in fourth crop during *rabi* 2015-16 in all maize cultivars (0.33 to 0.23 in DHM 117, 0.39 to 0.22 in DHM 121, 0.37 to 0.24 in Madhuri, 0.38 to 0.25 in Priya, 0.32 to 0.21 in Amber and 0.43 to 0.28 in 30V92). The trend index was positive (>1) and varied in all the generations. Key factor analysis revealed that the major mortality factors are the larval parasitoids particularly *Cotesia flavipes* (21.60 to 47.00%) and unknown causes during early and middle larval stages. Density dependant mortality was observed in all the cultivars except mortality due to diseases in middle stage larvae in DHM 117 and pupal mortality due to *Tetrastichus howardi* in Amber popcorn which exhibited inverse density dependence. The highest mean values of generation survival (0.38) and the trend index (40.2) were obtained on the 30V92 cultivar and the least values for generation survival (0.27) and the trend index (25.2) being with the cultivar Amber popcorn.

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OCCURRENCE OF LAC INSECTS AND THEIR HOST PLANTS IN TAMIL NADU AND KERALA

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ABSTRACT

Occurrence of natural populations of lac insects (Hemiptera: Tachardiidae) were observed on *Amherstia nobilis* at Thrissur of Kerala; on *Albizia saman* at Madurai, Salem, Vellore and Thiruvallur of Tamil Nadu and on *Ficus religiosa* at Erode and Vellore of Tamil Nadu. Dead lac insects were observed on *A. saman,* at Thenkasi and Theni in Tamil Nadu. *Albizia saman, Albizia lebbek, Ficus religiosa, Ficus bengalensis* and *Ziziphus mauritiana* were the most common lac host plants found in surveyed areas, but lac insect populations were observed only at some locations. The survey led to identification of two new species of *Kerria*. The molecular analysis based on *cox1* sequence classified the collected lac insects from Tamil Nadu and Kerala under *rangeeni* strain. Newly collected lac insect lines from Tamil Nadu and Kerala clustered with *K. lacca* in phylogenetic tree. Hence, there is a need for a detailed survey in unexplored parts. The study also revealed that Madurai and Thrissur accessions did not perform well in Jharkhand. Agroecological region wise survey and maintenance is suggested for conserving lac associated faunal and floral diversity.

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EFFECT OF POTASSIUM FERTILIZERS AND FARMSCAPING ON MAJOR INSECT PESTS IN SOYBEAN

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ABSTRACT

Soybean cultivated with enhanced potassium, comprising application of potassium (K_2O @ 20 kg ha^{-1}) through muriate of potash had significantly less populations of whiteflies, jassids, weevils, leaf folder, semiloopers, tobacco caterpillar and other lepidopteran pests. Without enhanced potassium fertilisation the crop harboured significantly more pests. Farmscaping soybean with marigold significantly reduced the population of whiteflies, weevils, leaf folder, semiloopers and tobacco caterpillar. However, jassids did not show any significant variation.

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TRAINING NEED OF AGRO-INPUT DEALERS IN RAMGARH DISTRICT OF NORTH CHOTA NAGPUR REGION IN JHARKHAND

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ABSTRACT

It is very essential to know the knowledge level of input dealers with modern crop production technology and agro machine importance through refresher training. The present study was conduction during 2016-17 in Ramgarh district of North Chota Nagpur region of Jharkhand to prioritize the needs of training of agro-input dealers. Data was collected through personnel interview of 40 retailers using structured interview schedule with details information. Respondents were found to be 50% young (35 yr), and 42.5% with higher education. Around 55% respondents mobilized their own resources for the business and only 27.5% sought bank credit facility. Identification of disease in vegetables emerged as the most needed training area followed by pest of cereals and vegetables. Training in computer and its application with record keeping software was another preferred area.

Among crop specific training need regarding major staple food crop rice ranked first followed by vegetables. As constraints faced by agro-input dealers need based farmers training, stock maintenance and requirements planning follow by lack of capital and lack of technical knowledge of new product. Mostly seed based requirement was highest business followed by fertilizers and agrochemicals. As most preferred input sale by input dealers to farmers is paddy seed in cereals crops followed maize, and in vegetables tomato followed by cole crop/ potato/ cucurbits. In fertilizers, urea followed by DAP. In fungicide mancozeb/ bavistin followed by blue copper and Amistar were important. In insecticides Rogor/ Superkiller/ Koragene followed by profenophos/ cypermethrin/ quinalphos. In weedicides, Nominigold/ Topstar followed by Turgasuper/ Pretilachlor were common. The annual growth of business was- seed 9.68%, fertilizers 6.78%, agrochemicals 7.34%, and agromachines and others 6.9% in district of Ramgarh.

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FOLIAR CONSTITUENTS OF CASSAVA VARIETIES AND THEIR EFFECTS ON REARING PARAMETERS OF ERI SILK WORM *SAMIA CYNTHIA RICINI* BOISDUVAL

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ABSTRACT

Foliar constituents of seven cassava varieties viz. CO2, CO3, CO(TP)4, H165, H226, MVD1 and Kunguma Rose in relation to crop age at 6, 8 and 10 months after plantation and its influence on rearing parameters of eri silkworm (*Samia cynthia ricini* Boisduval) was studied. This was studied to find out the suitable variety for ericulture. Among the varieties, highest nutrient contents viz., leaf moisture crude protein, total carbohydrate, nitrogen, phosphorus, potassium and total minerals and low values in anti-nutritional contents i.e. tannin and HCN were observed with H165, closely followed by MVD1. The CO2 variety was found to be having the least nutritional levels and exhibiting higher values of anti-nutrient contents. The biochemical contents except that of total carbohydrates and tannins decreased with crop age and all the nutrients were positively correlated with economic traits of eri silkworm. Only, tannins and HCN showed negative correlations. The economic traits viz., ERR, cocoon yield, shell yield, SR %, fecundity and hatching % were superior in H165 and MVD1 followed by CO4; the least values of were observed in variety CO2. The varieties H165 and MVD1 cultivated under semi irrigated conditions might be exploited for ericulture to generate additional income to the cassava growers.

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FORAGING BEHAVIOUR OF ASIATIC HONEY BEE *APIS CERANA INDICA* (F.) DURING SUMMER IN MADURAI, TAMIL NADU

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ABSTRACT

The present study was conducted at the Insectary, Department of Agricultural Entomology, Agricultural College and Research Institute, Madurai, Tamil Nadu. The seasonal and diurnal variations in foraging activity of *Apis cerana indica* (F.) during summer, from March to May of 2017 was analysed. The activity was observed to be maximum in morning hours (188.3 incoming bees/ 5 min). This is due to the optimal air temperature, relative humidity, wind speed and flower availability. Each group of workers differently responded to the weather parameters. The minimum temperature of 21.56°C and maximum of 37.30 °C, relative humidity of 64.97%, rainfall of 5.94 mm and wind velocity of 1.65 kmph were the weather parameters in the study period. Maximum temperature was observed to have a negative correlation with all the foraging bee groups viz., outgoing bees, incoming bees with nectar and pollen, respectively (correlation coefficients being -0.309, -0.062 and -0.197,

respectively. Wind velocity too exhibited a negative influence on foraging activity (r values being -0.096, 0.052 and -0.080, respectively for outgoing, incoming bees with nectar and pollen). In summer from 13th standard week onwards the foraging activity of *A. cerana indica* gradually increased. While the pollen gatherers were low by 60 to 95/ 5 min, the nectar gatherers were of 80 to 140/ 5 min approaching the hive.

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EMERGENCE PROFILE OF ENTOMOFAUNA ASSOCIATED WITH LAC INSECT *KERRIA LACCA* (KERR) IN WESTERN PLAINS OF INDIA

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ABSTRACT

Fauna associated with lac insect when analysed revealed that it was represented by the predators- *Eublemma amabilis* Moore, *Pseudohypatopa pulverea* Meyrick, *Chrysopa zastrowi* (Esben-Petersen); primary parasitoids- *Tachardiaephagus tachardiae* Howard, *Aprostocetus purpureus* Cameron, *Tyndarichus* (*Parechthrodryinus*) *clavicornis* Mashhood alam, *Erencyrtus dewitzi* Mahdihassan; and the hyperparasitoids- *Apanteles fakhrulhajiae* Mahd., *Eupelmus tachardiae* Howard, *Bracon greeni* Ashmead, *Brachymeria tachardiae* Cameron. Predators emerged up to VIII week during October and up to VI week in July. Parasitoids emerged up to V and IV week in October and July, respectively. Hyperparasitoids emerged up to V week in October and IV- V week during July. All these took more time to complete emergence during October- November than June - July.

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IMPACT OF CERTAIN INSECTICIDES ON PEST SUPPRESSION AND PRODUCTIVITY OF *KUSMI* LAC FROM *ZIZIPHUS MAURITIANA*

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ABSTRACT

Some novel insecticides were evaluated for their response on population of two lepidopteran pests of lac insect *Kerria lacca* (Kerr) and yield of brood lac from *kusmi* winter crop raised on *Ziziphus mauritiana* (ber). Indoxacarb, fipronil, spinosad and flubendiamide were sprayed on

standing lac crop under different treatments of one, two and three applications. Application of fipronil, spinosad and flubendiamide resulted 61.24-92.59, 87.08-92.59 and 70.93-96.30 % suppression of *Eublemma amabilis* population, respectively. Whereas, 100% pest suppression was recorded with indoxacarb even with single spray. Similarly, 89.29-96.30, 96.43-100 and 74.99-100% suppression in population of *Pseudohypatopa pulverea* was recorded with fipronil, spinosad and flubendiamide, respectively. Cent per cent suppression of *P. pulverea* was observed with indoxacarb as in case of *E. amabilis.* In respect of broodlac yield, the treatment of indoxacarb, fipronil, spinosad and flubendiamide resulted, 59.53-75.11, 85.21-17.9, 63.81-120.07 and 4.09-83.97% increase, respectively in yield over control. There is a significant increase in yield with one spray of fipronil and spinosad, two sprays of indoxacarb and three spray of flubendiamide. Considering both qualitative (incidence of pest) and quantitative (yield) parameters, one spray of spinosad, two sprays of indoxacarb and fipronil, and three sprays of flubendiamide is suitable treatment.

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BIOLOGY OF POTATO TUBER MOTH *PHTHORIMAEA OPERCULELLA* ON POTATO VARIETIES

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ABSTRACT

Laboratory evaluation was carried out in the Department of Entomology, College of Agriculture, Central Agricultural University, Imphal to study the biology and ovipositional preference of *Phthorimaea operculella* on five potato varieties namely, Kufri Girdhari, Kufri Himalini, Kufri Jyoti, Kufri Kanchan and Kufri Sindhuri. The results revealed that the fecundity was maximum when moths were reared as larvae on Kufri Kanchan, followed by K. Jyoti> K. Girdhari> K. Himalini>K. Sindhuri. The total lifecycle was maximum when larvae were fed on K. Himalini and the least with K. Sindhuri. The larval length varied with the varieties: larvae fed on Kufri Kanchan were longer (11.76 mm) and those fed on Kufri Sindhuri were short (6.48 mm). The egg size, larval breadth, pupal size and adult length did not show any significant variation. Amongst the varieties, K. Jyoti and K. Kanchan were the most preferred ones for oviposition, while the moderately preferred were K. Girdhari and K. Himalini and the least preferred was K. Sindhuri.

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EFFECT OF SOME PLANT VOLATILE OILS ON POTATO TUBER MOTH, *PHTHORIMAEA OPERCULELLA*

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ABSTRACT

Laboratory study was conducted in the Department of Entomology, College of Agriculture, Central Agricultural University, and Imphal to study the effect of three plant volatile oils (citronella oil, lemongrass oil and patchouli oil) against neonate larvae of *Phthorimaea operculella*. The larval mortality was observed to be higher in all the treatments and it increased with concentration. The highest mortality was obtained when treated with patchouli oil @1% (79.99%) followed by citronella oil (73.33%), and lemongrass oil (69.99%) at the same concentration. The pupation success and adult emergence were significantly reduced in all the treatments; larvae treated with patchouli oil @0.8% and 1% and citronella oil 1% failed to pupate. The adult emergence too varied greatly in all the treatments.

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PYMETROZINE 50 WG: A NOVEL INSECTICIDE AGAINST RICE PLANTHOPPERS

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Pymetrozine 50 WG (Chess) is a novel insecticide belonging to pyridine azomethines group. The field efficacy of this against brown plant hopper (BPH), *Nilaparvata lugens* (Stal.) and white backed plant hopper (WBPH), *Sogatella furcifera* (Horvath) populations in basmati and non-basmati rice was evaluated. Pymetrozine @125, 150 and 175 g a.i. ha^{-1} and the checks, imidacloprid 17.8 SL and quinalphos 25 EC applied @ 100 and 2000 ml/ ha, respectively, was evaluated in multilocation trials during *kharif* season of 2015 and 2016 in Punjab. Pymetrozine @150 and 175 g a.i. ha^{-1} was observed to be significantly better against BPH at 7 days after spray (DAS). Similarly, with dose of 150 and 175 g a.i. ha$^{-1,}$ it was superior at 10 DAS. Higher doses of pymetrozine i.e. 150 and 175 g a.i. ha^{-1} at 7 DAS proved significantly superior to its lower dose of 125 g a.i. ha^{-1} and the checks, imidacloprid and quinalphos. The increase in grain yield of non-basmati rice in pymetrozine treatment @ 150 & 175 g a.i. ha^{-1} was more than the checks and untreated control. Similarly, significantly higher grain yield of basmati was obtained with pymetrozine @ 150 & 175 g a.i. ha^{-1}. Non-significant differences were observed among the spiders' population with pymetrozine. Hence, pymetrozine 50 WG @ 150 g a.i. ha^{-1} offers potential in control of rice planthoppers.

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BIOLOGY OF *HERPETOGRAMMA BIPUNCTALIS* (FABRICIUS) WITH DESCRIPTIONS OF LARVAL CHAETOTAXY

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ABSTRACT

This study is on the biology of *Herpetogramma bipunctalis* (Fabricius) as observed on *Solanum trilobatum*, a new host record. These observations revealed that the egg, larval, and pupal periods were 3.75 ± 0.35, 17.22 ± 1.48 and 6.35 ± 0.70 days, respectively. The total life cycle (egg-to-adult) was 32.92 ± 5.27 days. Additionally, descriptions of larval chaetotaxy and morphology of the eggs, larvae and pupae are provided. Eggs are circular to oblong, flattened, transparent, colourless and laid in groups, and measure 1.0045 ± 0.02 mm long and 0.796 ± 0.024 mm broad. Pupae are stout, and 9.14 ± 0.05 cm long. Larval chaetotaxy reveals that the subventral setae are trisetose in first abdominal segment; and D and SD pinacula of mesothorax fused, a characteristic feature of *H bipunctalis*.

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EFFECTS HOST GRAINS ON THE RICE WEEVIL *SITOPHILUS ORYZAE* (L.)

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ABSTRACT

The present study observed the effect of host grains on oviposition, emergence, body length, longevity and sex ratio of adults of *Sitophilus oryzae* (L.), an important storage pest of cereals. Grains of maize, rice, pearl millet and chickpea were evaluated in primary culture under laboratory conditions. The results revealed variations in the developmental period (from egg to adult)- the least was on maize (32.5 days) and maximum with pearl millet (43 days). The body length of the male and female also varied- females were longer than males in all the evaluated grains. Maximum fecundity and longevity were found in maize with 453 adults in the lifespan of 184 days. The female: male ratio was not affected in a significantly manner with cereals (maize- 2.36:1, rice- 2.35:1 and millet- 2.21:1), but decreased to 1.98:1 with chickpea. A linear relationship with a significant correlation between grain loss and adult emergence was observed. These results reveal that S. *oryzae* exhibits host preference as its fecundity and longevity are significantly affected with various host grains.

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CATEGORIZATION OF BANANA BUNCHY TOP VIRUS BETWEEN PIO AND SEA GROUP

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ABSTRACT

Study of the phylogenetic tree of the banana bunchy top virus (BBTV) clustered the same BBTV into two groups viz. Pacific Indian Ocean (PIO) groups and South East Asia (SEA) groups. The data for substantiating these were collected from NCBI nucleotide data base, and analysed with R software. Thus, the present study brings out the difference between the two groups of BBTV viruses using tests like Hotelling T^2, Wald Test, and draws conclusions accordingly.

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POPULATION DYNAMICS OF MAJOR INSECT PESTS OF RICE

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