

The female lines viz. CMS234#272 and DSF15#15 recorded high GCA effect for plant height, 100 seed weight and oil content. The testers RHA857#101 and 6D-1#5 were good general combiners for head diameter, 100 seed weight and seed yield per plant. A positive and significant SCA effect for seed yield was observed in two hybrids CMS234A#272xHA857#236 and CMS234A#231x 6D-1#46. The latter also exhibited high seed yield over checks (10.05%) and hence need further evaluation.

The genetic diversity of the parents was assessed based on morphological traits (D2 analysis) and isozyme variation and their relation to the extent of heterosis was assessed. There was no relation between genetic diversity based on morphological traits and extent of heterosis except % filled seeds and plant height. However, the parents with distinct isozyme pattern involved in crosses produced hybrids with significant heterosis for most of the traits including seed yield indicating the importance of molecular diversity to produce heterotic hybrids.

#### ***In vivo and in vitro Inter-Specific Cross Recovery Studies in Cotton (Gossypium spp.)***

M.K. RAJASHEKHAR

2001

MAJOR ADVISOR: Dr. I.S. KATAGERI

Inter-specific hybridization between different ploidy level species in cotton is hindered due to incompatibility. Therefore, the present investigation was carried out to study the *in vivo* and *in vitro* crossability between cultivated diploid and tetraploid species and cultivated and wild species.

Inter-specific crosses, viz., Jayadhar (2x) x BCS-23 (4x), A82-1-1 (2x) x BCS-23 (4x), Jayadhar (2x) x G. Abadhita (2x), Jayadhar (2x) x G. gossypoides (2x) and Abadhita (4x) x G. australe (2x) were attempted. Indole acetic acid, Naphthalene acetic acid and Gibberellic acid plant growth hormones with three concentrations were applied to crossed buds to prevent shedding. Three and fifteen days old ovules were used as explants in *in vitro* inovoembryo culture studies using MS and BT as basal media. Similarly, ovules from 15-35 DAP were used for embryo axes culture.

Very low frequency (0.047-0.15%) of *in vivo* cross recovery between cultivated diploid and tetraploid and

cultivated and wild diploid, respectively, indicated the presence of post-zygotic incompatibility. Application of PGRS particularly GA<sub>3</sub> @ 0.1 per cent in 2x X 4x crosses prevented abscission of crossed buds at highest frequency. There was 36.69 per cent boll retention as against only 2.70 in control. Among three and fifteen days old ovules from crosses between 2x and 4x development of embryo axes was highest (13.38%) from 3 days than 15 days old ovules (7.58%), indicating the degeneration of embryo in *in vivo*.

Ovules harvested between 15-35 DAP from all these crosses the embryo axes recovery was highest from 15-20 days old ovules but highest number of healthy plants were established from embryo axes obtained from 30-35 days old ovules, indicating that *in vivo* condition is favourable for establishment of healthy seedlings.

Phenotyping revealed the intermediate nature of hybrids for most of the morphological characters. Presence of multiple nuclei at diad and tetrad stage (pentad and hexad) was observed cytologically. It may be due to abnormal segregation of laggards.

#### **Studies on Genetic Variability, Diversity and Stability in Diploid Cotton (*Gossypium herbaceum* L.) Genotypes**

ASHOK R. PATANKAR

2001

MAJOR ADVISOR: Dr. S.S. PATIL

Evaluation of herbaceum genotypes was done in rainfed and protective management situations. This evaluation was done during 1999-2000, at Main Research Station, University of Agricultural Sciences, Dharwad and at Regional Research Station, Raichur, involving the set of 42 G. herbaceum genotypes including checks of other species. The three different environmental situations included viz., E<sub>1</sub> (protective management situation at Dharwad), E<sub>2</sub> (Rainfed situation at Dharwad) and E<sub>3</sub> (Protective management situation at Raichur). The detailed objectives covered evaluation of genetic potentiality of herbaceum genotypes and variability parameters in diverse

environments for assessing genetic diversity existing among herbaceum genotypes, to measure of strength of association of quantitative traits in different environments and to estimate stability parameters and determining genotypes ideally suited for these environments.

The genotypes showed significant variability for nine characters. High variability (PCV and GCV), heritability and GAM was observed for seed cotton yield per hectare, length of sympodia, number of bolls per plant, boll weight, lint index and number of monopodia per plant.

## Abstract of Theses

Seed cotton yield showed strong positive association with number of bolls per plant in all three environments, while inter boll distance showed strong negative association with seed cotton yield in all three environments. Seed cotton yield have shown positive association with boll weight, seed index and lint index in  $E_1$ , with plant height and GOT in  $E_2$  and with length of sympodia in  $E_3$ , thus revealing the greater importance of plant height in rainfed situation.

Seed cotton yield, boll weight and GOT contributed maximum to divergence. In  $E_1$ , cluster III and

cluster IV were the most diverse groups, whereas, cluster III and cluster IX in  $E_2$  and cluster VIII and cluster IX in  $E_3$ . The most distant pairs of herbaceous genotypes identified were RAHS-25 and RAHS-31 in  $E_1$ , DDhc-11 and RAHS-129 in  $E_2$  and RAHS-30 and RAHS-18 in  $E_3$ . Hence, these pairs are ideally suitable as parents in hybridization programme to yield most Productive hybrids.

Stability analysis for seed cotton yield revealed that, the genotypes RAHS-14, RAHS-192 and RAHS-225 were most stable for seed cotton yield. Hence, these genotypes are highly adaptable and are suitable for cultivation over a wide range of environmental conditions.

### Gene Action and Heterosis with Particular Reference to Single Cross Hybrid of Maize (*Zea mays* L.)

ALAMNIE ATANAW

2001

MAJOR ADVISOR : Dr. N.Y. NAYAKAR

The study was conducted to assess the magnitude of heterosis, combining ability and nature of gene action with respect to yield and its components in maize. A line x tester set was obtained by crossing thirty-four lines with three testers. One hundred-two new crosses along with their parents and five commercial checks were planted in 12 x 12 simple lattice design in Kharif, 2000 at Agricultural Research Station, Arabhavi.

Hybrids exhibited significant variability for fourteen characters studied. The computed variance ratios  $\sigma^2_{GCA}/\sigma^2_{SCA}$  and  $\sigma^2_{A/cr}/\sigma^2_D$  revealed the predominance of additive gene action in the inheritance of days to 50 per cent tasseling, days to 50 per cent silking, ear diameter, 100-grain weight, and shelling percentage. On the other hand, the non-additive gene action was predominant for grain yield per plant, grain yield per plot, reaction to TLB disease, plant height, ear height, days to 50 per cent brown husk maturity, ear length, number of kernel rows per cob and number of kernels per row.

From the study on the combining ability, HYD. SEL 13 among lines and CI-5 among testers were found to be the better general combiners than the rest. HYD.SEL 8 X CI-5 and NG-4 X CM-111 were found to be the best two crosses in their sca effects for grain yield. Eleven single crosses showed positive standard heterosis for grain yield. HYD. SEL 13 x CI-5, which showed the highest heterosis percentage in grain yield, was also found to be early maturing. This cross is from parents with high x high gca combinations.

Other promising crosses, viz., CAR 68 (7)-#-# x CI-5, CM 137 x CI-4, CM 137 x CI-5, CML 68 (7)-#-# x CI-4, CMI 113-#-# x CI-4 and HYD.SEL 14 x CI-4 were also from parents with high x high gca combinations. In such crosses, one can go either for direct hybrid production or selection for segregating materials for developing better parental lines. The four promising crosses, viz., HYD. SEL 8 x CI-5, CML 114-#-# x CI-4, CML 68 (7)-#-# x CM-111 and NG-4 x CM-111 had high sca effects, and thus are best suited for exploitation of hybrid vigour.

### Heterosis and Combining Ability Studies for Bulb Yield, Its Components and Quality Parameters in Onion (*Allium cepa* L.)

M.S. DIVAKARA

2001

MAJOR ADVISOR : S. GANGAPRASAD

The study was undertaken to estimate heterosis and combining ability for bulb yield and component characters through diallel cross analysis. A total of 10 parents and 45 hybrids (excluding reciprocals) were evaluated in RBD with two replications. Observations were recorded on sixteen characters.

Results of heterosis indicated that the cross AFLR x AFDR showed significant heterosis over mid parent and standard check (Nasik red) for bulb weight. Heterosis effect for bulb weight was also reflected in component characters. Heterosis over better parent was to the extent of 125.59 (AFLR x Arka Pragati) per cent for bulb weight. Significant

positive heterosis over mid and better parent for total soluble solids was exhibited by the cross Arka Pragati x Agri found dark red-2. Significant negative heterosis over better parent for storage loss due to rotting, sprouting and loss in weight was exhibited by the crosses Paman Kallur x Agri found rose, Agri found dark red-2 x Arka Pitamber and Arka Pragati x Arka Pitamber respectively. For marketable bulb, the cross AFLR x Agri found dark red-2 showed significant heterosis in desirable direction.

Both GCA and SCA variances were significant for all the characters except for dry matter and neck thickness, indicating thereby that both additive and non-additive types of genetic variance were involved in the

inheritance of these traits. However, variances due to GCA were greater than SCA variances for all the characters revealing the greater role of additive genetic variance. The parent Arka Pitamber was good general combiner for bulb yield, since it had significant gca effect for yield attributing traits like plant height, number of leaves per plant. Parents Arka Pragati, AFDR, Agri found dark red-2 and Arka Pitamber were found to be best general combiners for high per cent bulb yield and low storage losses due to loss in weight, rotting and sprouting. In general, the crosses showing high sca effect for the trait involved atleast one good general combiner.

## BIO-TECHNOLOGY

### Molecular Characterization of Native Entomopathogenic Fungi

MAHESH S. PADANAD

2001

MAJOR ADVISOR : Dr. P.U. KRISHNARAJ

The focus of the present study was to isolate entomopathogenic fungi from native niches, assess their insecticidal activity and to characterize their molecular diversity. Eight isolates of *Nomuraea rileyi* and two isolates of *Metarhizium anisopliae* were isolated from the insect cadavers collected from different sampling sites of Northern Karnataka. Two isolates of each fungus obtained from other sources were also included in the study. All the ten isolates of *N. rileyi* and four isolates of *M. anisopliae* were insecticidal against leaf eating caterpillar (*Spodoptera litura*) and rhinoceros beetle (*Oryctes rhinoceros*) respectively. The NR-D isolate of *N. rileyi* from Dharwad location had the highest insecticidal activity. However, statistically there was no significant difference among the isolates with respect to insecticidal activity. The isolates were characterized by PCR- product profiles using random primers obtained from

Operon Technologies Inc. Alamedas, USA. All the 24 primers used for assessing the molecular diversity among the *N. rileyi* isolates generated 122 polymorphic bands (72.61 % polymorphism). Among 24 primers, the primer OPO-18 had the lowest minimum (0.00) and least average (0.55) genetic similarity values. Hence, it can be used to distinguish the isolates and to fingerprint the *N. rileyi* isolates under consideration. Similarly, all the nine primers used for assessing the molecular diversity among *M. anisopliae* isolates generated still higher level of polymorphism (97.89%) producing 93 polymorphic bands. Of the nine primers, OPC-02 produced the lowest minimum (0.00) and least average (0.06) genetic similarity values. Thus, this can be used to differentiate and to fingerprint the *M. anisopliae* isolates.

## SEEDS SCIENCE AND TECHNOLOGY

### Synchronization Studies in Parental Lines of Rice Hybrids

VEERANAGOUDA PATIL

2001

MAJOR ADVISOR : Dr. N.K. BIRADAR PATIL

The field experiments were carried out at Main Research Station, Dharwad and Agricultural Research Station, Siruguppa during kharif 2000-01 on synchronization of flowering in parental lines of rice hybrids.

Among the parental lines the restorer line KMR-3 required more effective accumulated temperature and produced more number of leaves, where as another restorer line IR9761-19-01 required less effective,

accumulated temperature and produced less number of leaves till 50 per cent flowering at both the locations. The maintainer line required less effective accumulated temperature and produced less number of leaves compared to their respective CMS lines. The growth duration and effective accumulated temperature requirement of the parental lines varied with locations, where as, the number of leaves produced by the parental lines was relatively stable. Hence, the leaf number difference method was

## **Abstract of Theses**

found to be more reliable for adjusting the planting dates of parental lines at both the locations.

The maintainer line (IR58025B) was early by 4.7 days in 50 per cent flowering than the female line (IR58025A). Sowing of maintainer line, five days later than the female line was found to achieve better synchronization and increased the seed yield by 45.3 per cent, over simultaneous planting (control). The foliar spray of gibberellic acid (100 ppm) or single super phosphate (1.0%) to female parent at panicle initiation enhanced the 50 per

cent flowering by 3.4 and 2.4 days and increased the seed yield of female line by 46.1 and 29.4 per cent, respectively over control. Foliar spray of urea (2.0%) to maintainer line or jerking the seedling of maintainer line at panicle initiation delayed 50 per cent flowering by 2.7 and 2.0 days and increased the seed yield by 30.8 and 27.4 per cent, respectively over control. Spraying of gibberellic acid 100 ppm and simultaneous planting recorded significantly higher germination (93.3%), shoot length (12.6 cm), root length (12.7 cm), seedling dry weight (134.6 mg) and vigour index (2356) compared to all other treatments.

### **Synchronization Studies in Parental Lines of Sorghum Hybrids**

SHIVASHEKAR V. PATIL

2001

MAJOR ADVISOR : Dr. N.K. BIRADAR PATIL

A field experiment was conducted during 2000-2001 at Main Research Station, Dharwad, to study the effect of date of sowing on flowering behaviour of parental lines of sorghum hybrids. Sowing dates influenced the flowering behaviour of the parental lines. June planting caused early flowering. The days to 50 per cent flowering increased gradually upto February 15<sup>th</sup> sowing. A difference of 4.1, 8.6, 4.7 and 5.9 days for 50 per cent flowering was noticed in parental lines of CSH-16, CSH-17, DSH-3 and DSH-4 sorghum hybrid, respectively from June 1<sup>st</sup> to February 15<sup>th</sup> sowing. The difference in days to 50 per cent flowering between the male and female parent was minimum in June 1<sup>st</sup> sowing in all the hybrids and it gradually increased upto February 15<sup>th</sup> sowing. Among the parental lines, the male parent of CSH-16, CSH-17 and DSH-4 flowered later than their respective female parent, while that of DSH-3 flowered early.

Apart from this, another field experiment was conducted during 2000 Kharif to identify the suitable technique to achieve synchronization of flowering between the parents of CSH-16 sorghum hybrid, staggered sowing of male parent three days early resulted in better synchronization of flowering the parents and resulted in 15.7 per cent higher seed yield over simultaneous sowing. Foliar application of urea (2%) and GA3 (250 ppm) to male parent at primordial stage hastened the 50 per cent flowering of male by 3.0 and 2.7 days and increased the seed yield 15.0 and 12.5 per cent respectively over control. Foliar application of 0.2 per cent borax at flowering to female parent increased the seed yield by 13.1 per cent, seed germination and vigour index by 5.0 and 16.3 per cent higher over control. Thiram spray (0.2%) at heading stage to female parent recorded higher seed quality parameters.

### **Studies on Nipping of Auxillary Flower Buds And Micronutrient Application On Seed Yield and Quality of Sunflower Restorer Line, RHA-857**

SHIVASHANKARAGOUDA PATIL

2001

MAJOR ADVISOR : Dr. B.S. VYAKARNAHAL

Most of the restorer parents used in sunflower hybrid seed production are of multi branched with low productivity. To solve these constraints, an investigation on nipping of auxillary flower buds and micronutrient application on seed yield and quality of sunflower restorer line, RHA-857 was carried out by conducting a field experiment at Main Research Station, University of Agricultural Sciences, Dharwad. The experiment was laid out in Randomized Block Design with factorial concept and consisted of two factors viz., Nipping (2) and micronutrients application (5) and with one control (no nipping/no micronutrient).

In restorer line, continuous nipping of auxillary flower buds from 35 days after sowing (DAS) onwards recorded significantly higher yield and its attributes. Seed yield per hectare increased 65.8 per cent over control. The yield attributes like yield per plant, capitulum diameter, filled seed number, seed filling per cent, seed recovery per cent and 100 seed weight were also increased in this treatment. This was followed by nipping of side branches once at 55 DAS over control. Plant height and chlorophyll content in leaf were significantly higher in nipped plants, while higher dry matter was found in control plants. Seed quality parameters like germination percentage, rate of germination, root length, shoot length, vigour index, dry weight and oil content were significantly higher in the seeds of nipped plants over control.

Among the micronutrient application, foliar spray of boron or  $ZnSO_4$  @ 0.1% at ray floret stage (55 DAS) increased the seed yield by 38.2 and 18.0%, respectively over control. Similarly boron @ 2 kg/ha dusting at ray floret stage,  $ZnSO_4$  @ 10 and 20 kg/ha through soil application also increased the seed yield by 27.3, 7.9 and 15.0%,

respectively over control. Further, it is also observed that application of boron (0.1%) increased the capitulum diameter, filled seed number, seed weight per capitulum, seed set percentage, 100 seed weight, germination, rate of germination, root length, shoot length, vigour index, dry weight of seedling and oil content of seed.

#### **Influence of Date of Planting and Harvesting Stage on Seed Yield and Quality of Aster (*Callistephus chinensis* L. Nees) Genotypes**

RAKESH C. MATHAD

2001

MAJOR ADVISOR : Dr.B.S. VYAKARANAHAL

In an attempt to find out the influence of date of planting and harvesting stage on seed yield and quality of aster genotypes, two field experiments were conducted in rabi 2000 at Main Research Station, University of Agricultural Sciences, Dharwad. The first experiment had 36 treatment combinations comprising of four planting dates (September, October, November and December), three genotypes (Kamini, Poomima and Sarpan purple) and three picking stages (120, 140 and 160 days after transplanting). The results revealed that October planting increased all growth parameters like plant height, number of branches, number of leaves, leaf area index, leaf area per plant and took less number of days to 50% flowering; yield parameters like capitulum diameter, capitulum weight, number of capitula per plant, filled seed percentage, filled seed weight per capitulum, 1000 seed weight, seed weight per capitulum and all quality parameters like seed germination, rate of

germination, seedling dry weight, shoot length, root length and seedling vigour index. Among the genotypes Kamini performed better than Poomima and Sarpan purple. The capitula harvested at 140 DAT gave increased, yield and quality parameters. When Kamini genotype planted in October month and harvested at 140 DAT gave increased yield in the tune of 185% compared to the combination of Sarpan purple when planted in December and harvested at 160 DAT.

In another experiment to find out influence of stages of maturity on seed yield and quality comprising of 24 treatment combinations with 3 genotypes (Kamini, Poomima and Sarpan purple) and 8 maturity stages (7,14, 21, 28, 35, 42, 49 and 56 days after flowering). All aster genotypes can be harvested at 42 DAF for getting higher seed yield and quality parameters, except seed germination which was significantly higher at 49 DAF.

#### **Standardization of Seed Production Techniques in DSH-1 Sunflower Hybrid (*Helianthus annuus* L.)**

PRABHU V. TURAI

2001

MAJOR ADVISOR : Dr. BASAVEGOWDA

Field and laboratory experiments were carried out during kharif and rabi season of 2000-2001 at University of Agricultural Sciences, Dharwad for standardization of the seed production techniques in DSH-1 sunflower hybrid. The study was comprised of two experiments.

The results revealed from different treatments imposed to improve the pollen use efficiency, the  $T_7$  (100% pollen with Bee-Q spray) recorded highest head diameter, filled seeds per head, seed set per cent, 100 seed weight, seed recovery percentage and seed yield (13.70 q/ha). But it was on par with  $T_4$  (100% pollen with sugar) and  $T_8$  (75% pollen + 25% borax with Bee-Q spray). The treatment  $T_3$  (50% pollen + 50% borax) recorded lowest values for above parameters. All the seed quality parameters viz., Germination, root-shoot length, seedling dry weight, field

emergence and seedling vigour index were also higher with seeds obtained from  $T_7$  but were significantly affected in  $T_3$ . Thus the use of Bee-Q and sugar was found very effective when sprayed in addition to hand pollination. The next best treatments improving the pollen efficiency are mixing of 25 per cent borax with 75 per cent pollen on volume basis with 2 spray of Bee-Q.

Among the eight different treatment imposed to obtain flowering synchronization, staggered sowing treatment ( $T_9$ ) recorded maximum head diameter, filled seeds per head, seed set (%), 100 seed weight and seed yield (1167 kg/ha). Compare to remaining treatments. But mulching treatment ( $T_6$ ) was also found effective as the values were on par with staggered sowing ( $T_9$ ).

## Abstract of Theses

The seed from T<sub>2</sub> recorded higher seed quality parameters like germination, root-shoot length, seedling dry weight and seedling vigour index, but seeds from simultaneous sowing treatment (T<sub>1</sub>) recorded lower values lower values for above seed quality traits.

To achieve better synchronization between parental lines staggered sowing may be followed to get higher seed yield and quality. However, mulching of female line can also be practised as an alternative to staggered sowing since better synchrony between parental line was achieved.

## SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

### Utilisation of Solid Waste From Phosphoric Acid Industry As a P-Source in Upland Rice

R. SUMA

2001

MAJOR ADVISOR : Dr. P.A. SARANGAMATH

A field experiment was conducted during kharif season of 2000 to study the utilisation of solid waste from phosphoric acid industry as a P- source in upland rice at Agricultural Research Station, Mugad, University of Agricultural Sciences, Dharwad.

Application of solid waste (SW-P) with single super phosphate (SSP) in 50:50 ratio along with P-solubilizer (P-S) was on par with sole application of SSP with respect to yield (grain+ straw), growth and yield components.

Among the P-fertilizers, significantly more P concentration and uptake was observed with SSP over sole application of SW-P and RP and found on par with SW-P+ SSP (50:50) +P-S. Similarly nitrogen and potassium concentration and uptake was maximum with SSP followed by SW-P SSP (50:50)+P-S.

Available phosphorus in soil during early crop growth stages was highest with SSP while the residual phosphorus after harvest was higher with SW-P SSP(50:50) +P-S.

The data on fluorine concentration and uptake by rice plants revealed that, combined application of SW-P + SSP (50:50) was on par with RP and superior over SSP. Within rice plant, more F was accumulated in straw than grain, while, dehusked grain accumulated a meager amount. Water soluble and total F was highest with sole application of SW-P and decreased significantly by mixing with SSP in 75:25 and 50:50 ratios.

Among the different P-sources used, SSP (50:50) with or without P-solubilizer gave higher grain yield (40.18 and 39.09 q ha<sup>-1</sup>), straw yield (49.62 and 48.47 q ha<sup>-1</sup>) and benefit cost ratio (2.06 and 2.04 respectively).

## AGRICULTURAL ENTOMOLOGY

### Evaluation of Indigenous Products and Boric Acid Against Stored Grain Pests

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2001

MAJOR ADVISOR : Dr. L. KRISHNA NAIK

The survey undertaken in the rural areas of Dharwad taluk to know the various indigenous practices followed by the farmers to control stored grain pests, revealed that sundrying was the most prevalent method (93.0%) followed by the neem leaf and ash combinations (38.5%). However, among the different chemical methods boric acid usage was predominant (10.5%).

Of the 14 indigenous products tested to know their efficacy against *Sitophilus oryzae* in rice, wheat and sorghum grains proved that neem seed powder (5%), custard apple seed powder (5%), black pepper powder (5%), sweet flag powder (1%), ash (30%), neem oil (1%), karanja oil (0.75%), castor oil (1%), palm oil (1%), boric acid (2%) and ayurvedic powder (2%) were the best treatments as

they recorded cent per cent adult mortality and no per cent grain weight loss.

Of the 14 indigenous products tested to know their efficacy against *Callosobruchus chinensis* in cowpea and bengalgram grains proved that custard apple seed powder (5%), black pepper powder (5%), sweet flag powder (1%), ash (30%), neem oil (1%), karanja oil (0.75%), palm oil (1%), boric acid (1%) and ayurvedic powder (2%) were the best treatments as they recorded cent per cent adult mortality and no per cent grain weight loss.

The boric acid residue levels were found increased upto third month of preservation in the commodities rice (292.33 ppm), wheat (293.84 ppm),

sorghum (361.00 ppm), cowpea (305.50 ppm) and bengalgram (323.32 ppm) and the residue levels decreased there after. However, cent per cent adult mortality of *S. Oryzae* and *C. Chinensis* was observed upto six months period. The residue levels of boric acid can be eliminated

to the extent possible by washing and cooking in the rice (12.93 ppm), cowpea (10.84 ppm) and bengalgram (9.10 ppm). Whereas in wheat and sorghum this cannot be achieved since the grain cannot be washed like other grains. Thus carry residue of boric acid

**Utilization of Entomopathogenic Fungi in the Management of *Helicoverpa armigera* (Hubner) in Pigeonpea Ecosystem**

K.P. GUNDANNAVAR

2001

MAJOR ADVISOR : Dr. S. LINGAPPA

Investigations were carried out under laboratory and field conditions during 1999-2000 at the Main campus of University of Agricultural Sciences, Dharwad. Dose mortality response between *Helicoverpa armigera* and *Nomuraea rileyi*, *Beauveria bassiana* and *Metarhizium anisopliae* in the laboratory indicated that cumulative mortality of larvae increased with increase in concentration and exposure period. Younger larvae found to be more susceptible to fungal species than older ones. *Metarhizium anisopliae* proved superior to *B. bassiana* and *N. rileyi* against *H. armigera* larvae, but none proved to be pathogenic to eggs of *H. armigera*.

*Nomuraea rileyi* proved pathogenic to only the larvae of *Plusia orichalcea* by inducing 76.67% mortality, and spared *Alcidodes collaris*, *Cydia ptychora* and *Maruca testulalis*.

The interaction studies between bioagents revealed that the combination of viral (HaNPV) and fungal

(*N. rileyi* or *B. bassiana*) pathogens did not prove superior to individual effect, but exhibited marginal antagonistic action between them. Further, *V. lecanii* proved its dominance over *N. rileyi*, *B. bassiana* and *M. anisopliae*. Compatibility was imminent between *N. rileyi* and *M. anisopliae*. *Beauveria bassiana* found as least dominant among fungal pathogen studied.

None of the intercrops viz., groundnut, soybean and sorghum could influence the incidence of *N. rileyi* on main crop (pigeonpea). *Nomuraea rileyi* was found ineffective in pigeonpea ecosystem. Next to RPP, the spray sequences involving NSKE 5 % *Bacillus thuringiensis* @ 1 kg per ha endosulfan @ 700 g a.i./ha and NSKE 5% - HaNPV @ 250 LE per ha endosulfan 700 g a.i./ha were found not only cost effective, but also eco-friendly in nature in the management of *H. armigera* in pigeonpea.

**Seasonal Activity and Management of Cotton Pink Bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae)**

SURESH

2001

MAJOR ADVISOR: Dr. B.V. PATIL

Studies on cotton pink bollworm, *Pectinophora gossypiella* (Saunders) (Lepidoptera Gelechiidae) were undertaken at the Department of Agricultural Entomology, College of Agriculture and Regional Research Station, Raichur during 2000-2001 to assess seasonal activity of pink bollworm based on male moth catches in delta sex pheromone, traps incidence on flowers, green bolls and open locules, diapausing pattern, larval parasitoids and effectiveness of different management tactics for suppression of pink bollworm on cotton.

Monitoring of *P. gossypiella* moths through delta pheromone traps from April, 2000 to May, 2001 showed its

activity throughout the year with peaks from July 2000 to March, 2001. Maximum and minimum temperature had negative and significant influence, relative humidity (morning and afternoon) had negative and non-significant influence on the trap catches while, incidence on flowers, green bolls and locules was significant and positively correlated with trap catches.

The pink bollworm incidence on cotton flowers was maximum during December, January and February months with on the green bolls and open bolls it was in January and February months in RPP (Recommended

## Abstract of Theses

Package of Practices) cotton plot. PBW undergoes facultative diapause under Raichur condition and diapause duration ranged from 60-116 days. Four farval endoparasitoids viz, *Bracon greeni*, *Apanteles angaleti*, *Aleiodes sp.* and *Cotesia sp.* were found to parasitise the larvae of *P. gossypiella*. Maximum parasitisation of PBW larvae was noticed by *Bracon greeni*.

Superior control of PBW was achieved in extended synthetic pyrethroid sprayed plot and mass trapping plots. Whereas, maximum mean incidence was observed in RPP cotton plots. Accordingly highest seed cotton yield of 23 q/ha was obtained in extended synthetic pyrethroid sprayed plot which was on par with mass trapping plot with 22.70 q/ha of seed cotton.

### Maximisation of Niger Productivity Through Enhancement of Bee Pollination

G.S.GURUPRASAD

2001 MAJOR ADVISOR: Dr. SHASHIDHAR VIRAKTMATH

Studies were made on pollinator fauna, foraging activity, role of bee attractants in enhancing bee visitation, productivity and quality of niger at two locations viz., Salakinakoppa and Main Research Station, University of Agricultural Sciences, Dharwad, during kharif season of 2000. Among 13 Species of pollinators, *Apis dorsata* F. Was most prominent constituting 45.88 per cent, followed by *A. florea* (27.35%), *A. Mellifera* (10.81%), *A. Cerana* (4.17%) and other pollinators (2.45%).

Foraging period of different bee species varied. However, peak activity of *A. dorsata* was observed at 1200 hr and 1600 hr. *A. cerana* and *A. florea* were active at 1000 hr, while *A. mellifera* and other pollinators at 1200 hr.

Spraying of Fruit boost @ 0.5 ml/l and tuberose floral scented water had significant influence in attracting more number of pollinators. Consequently, significantly more number of seeds (30.72 seeds/head vs 23.95 and

23.83 in open pollinated and caged crop, respectively) was recorded in the treatment with Fruit boost. Significantly highest test weight (3.51 g as against 2.71 and 1.98 g in open pollinated and caged crop, respectively) and yield (4.93 q/ha as against 2.72 and 2.01 q/ha in open pollinated and caged crop, respectively) were obtained in the treatment with Fruit boost. Thus there was an increase of 81.25 and 145.27 per cent in yield over the open pollinated and caged crop.

Effect of attractants on oil content of seed differed in location 1 and 2. However, Fruit boost, tuberose floral scented water and cinnamon leaf extract improved the germination percentage to the extent of 81.66 to 88.33 per cent as against 73.33 and 70.00 per cent in open pollinated and caged crop, respectively. Higher shoot length and root length were obtained in all the treatments sprayed with attractants. But application of sugar solution did not improve either shoot length or root length.

### Bioecology and Management of Gall Weevil, *Acidodes collaris* Pascoe on Redgram

MANJUNATH B. HUGAR

2001 MAJOR ADVISOR : Dr. K. BASAVANA GOUD

Investigations on the survey for the pest status, bioecology and management of *Acidodes collaris* Pascoe on redgram were carried out during 2000.

Survey for the pest status of gall weevil in four districts of Northern Karnataka revealed that more than 10 per cent incidence was observed in Dharwad, Gadag and Belgaum districts while it was less than 10 in Haveri district. The rainfall has got nonsignificant negative influence on the pest incidence in these districts. Maximum incidence was noticed in black soils (20.17%) followed by black loamy (19.32%) red loamy (10.92%) and red soils (6.25%). The incidence of the pest was more on sole redgram (17.86%)

and was less in other cropping systems involving redgram as a component crop. Least incidence was observed on redgram intercropped with little millet (3.60%). Beans and fieldbean were recorded as new hosts of the pest.

The incubation period, larval period and pupal period ranged from 5 to 11, 21 to 31 and 6 to 13 days, respectively. A total of 52 to 90 days were required to complete the life cycle.

The pest was active throughout the study period starting from June to September. The incidence reached peak on the crop sown during second fortnight of June

(56.66%). Maximum temperature exhibited significantly negative effect while relative humidity favoured the pest buildup

Of the 20 genotypes evaluated for their reaction against the pest, S<sub>1</sub> brown, S<sub>1</sub> red, PET 3-19, WRP-248 and ICPL-87 were found resistant to the weevil infestation.

Investigations on the management of gall weevil by intercropping method revealed that the intercrops viz.,

cowpea, soybean, greengram and groundnut in different row proportions significantly reduced the incidence of weevil on redgram.

Evaluation of different methods of insecticidal application indicated that drenching of chlorpyrifos and phosphamidon, spraying of phosphamidon and quinalphos were effective in reducing the incidence of weevil on redgram. However, quinalphos and phosphamidon sprays recorded higher B:C ratio (4: 1: 1).

#### Bioecology of Shoot Borer, *Leucinodes orbonalis* Guenee and its Loss Estimation in Potato

P. NIRANJANA MURTHY

2001

MAJOR ADVISOR : Dr. B.S. NANDIHALLI

Studies on bioecology of shoot borer, *Leucinodes orbonalis* Guenee and its loss estimation in potato were carried out under caged and field conditions at the Main Research Station, University of Agricultural Sciences, Dharwad during 2000-2001.

The incubation period (4.15 days), larval period (10.18 days), pupal period (8.10 days) and total developmental period (22.43 days) were significantly shorter when the larvae were reared on brinjal fruit compared to other two food sources brinjal shoot and potato shoot. The larval length, breadth and head capsule width did not differ significantly when the larvae were fed with brinjal fruit, brinjal shoot and potato shoot. However, the larval and pupal weights were significantly high on brinjal fruit compared to other two food sources. The studies on the age specific fecundity life table for the pest on brinjal fruit, brinjal shoot and potato shoot indicated that the net reproductive rate ( $R_0 = 81.07$ ) and innate capacity for increase in numbers

(0.18) were higher when the immature stages of the insect were reared on the brinjal fruit than other two food sources. The seasonal incidence of the pest indicated that the infestation of *L. orbonalis* on potato shoot was relatively more during September month both in protected and unprotected conditions. Both the brinjal and potato crops experienced higher damage during the first transplanting than other two subsequent transplantings.

Crop loss estimation under protected and unprotected conditions, revealed that the avoidable loss of potato was to the extent of 2.25 tonnes per hectare. In field condition significantly higher potato yield was obtained in the insecticide treated check (1 7.02 t/ha).

Highly significant positive correlation was observed between larval density and the yield reduction under caged conditions and the EIL of the pest was 1.08 larvae per plant under caged conditions.

#### PLANT PATHOLOGY

##### Management of Post Harvest Diseases of Mango (*Mangifera indica* L.)

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2001

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The post harvest diseases of mango cause heavy losses to growers, mandi merchants and consumers. Survey conducted in orchards of Raichur, Gabbur and Yergera for two years revealed that, Neeleshan showed maximum per cent disease incidence (31.11). During the years 2001, among three places of survey maximum per cent disease incidence was recorded at Raichur (21.58) followed by Gabbur (20.75) and Yergera (15.95). The mean per cent disease incidence was maximum (31.83) in cv. Neelam and the least (26.00) incidence was noticed in Alampur beneshan.

Among the post harvest pathogens the frequency of *C. gloeosporioides* causing mango anthracnose was

more (37%) followed by *A. alternata* (29%) and association of other pathogens were also noticed. Highest spore germination of *C. gloeosporioides* was recorded at temperature of 25°C (> 90.40 %) and at relative humidity of 100 per cent. In *in vitro* evaluation of four systemic fungicides, tricyclazole was found effective against *C. gloeosporioides* and *A. alternata*. Among non-systemic fungicides, copper oxychloride was effective against *C. gloeosporioides* and iprodione against *A. alternata*. Among three plant extracts ocimum leaf extract was effective against *Gloeosporioides* and *A. alternata* at 5.0 per cent.

Pre harvest spray with 0.1 per cent carbendazim or tricyclazole showed the least per cent disease index (PDI)

## Abstract of Theses

(<26) on 18<sup>th</sup> day of storage. Post harvest dip with 0.1 per cent carbendazim or tricyclazole or benomyl showed least PDI in all the three cultivars viz., khader Beneshan and AURumani on 15<sup>th</sup> day of storage. Hot carbendazim dip for 10 min at 50°C±1°C showed 14.66 PDI on 15<sup>th</sup> day of

storage. Among different packing materials corrugated fibre box was found best. Among eight mango cultivars screened for post harvest disease resistance AURumani and Khader were highly susceptible and Malgoa showed moderately resistant reaction on 15<sup>th</sup> day of storage.

### Studies on Powdery Mildew of Chilli (*Capsicum annum* L.) Caused By *Leveillula taurica* (Lev.) Arn.

A.S. SHARMILA

2001

MAJOR ADVISOR : Dr. M. R. KACHAPUR

Studies on powdery mildew of chilli have revealed that, Kundgol taluk of Dharwad district had maximum severity (81.51%) of powdery mildew and can be considered as "hot spot" to this disease.

It was found that, three sprays of penconazole (0.1%) was optimum in reducing the disease and increasing the yield. Yield loss of 24.41 per cent was noticed due to powdery mildew in unsprayed plots. The relationship between per cent disease index and yield of red chilli was linear, significant and negatively correlated. One per cent increase in disease index, decreased the yield by 0.049 q/ha.

Dusting of conidia using camel hair brush on leaf surface was found to be the most effective method of inoculation. Among nine cultivated hosts tested, bell pepper, brinjal, chickpea, chilli, fenugreek, pigeonpea and tomato exhibited symptoms and are collateral hosts of *L. taurica*. Isolates from bell pepper, pigeonpea and tomato showed cross infectivity to chilli.

Of 77 chilli genotypes screened under field conditions against powdery mildew, PMR-21 was found to be highly resistant and Arka Abir, P-6, Pant C-1 and SIC-10-1666 were resistant.

Among different media tested, maximum conidial germination was noticed in 5 per cent dextrose solution. Of the seven fungicides evaluated in *in vitro*, penconazole (0.1%) was found to be most effective in reducing conidial germination followed by propiconazole (0.1%). Among plant product, plant extracts and bioagents tested in *in vitro*, nimbidin at 0.5 and 0.25 per cent followed by NSKE at 10 per cent were effective in reducing the conidial germination.

Application of penconazole (0.1%) *in vivo* was found to be most effective in reducing the disease and increasing the yield. But the cost benefit ratio was more in carbendazim (0.1%) followed by wettable sulphur (0.3%) and hexaconazole (0.1 %).

### Studies on Seed Mycoflora of Rice (*Oryza sativa* L.)

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2001

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Rice is one of the most important cereal crops. Rice seed may be infected by various organisms before or after harvest, causing discoloration. Common mycoflora isolated from different rice varieties were *Curvularia lunata*, *Exserohilum oryzae*, *Alternaria alternata*, *Pyricularia grisea*, *Fusarium moniliforme*, *Aspergillus flavus* and *Rhizopus* sp.

Blotter method was effective for enumeration of mycoflora from rice seed followed by potato dextrose agar method. The seed infection in blotter method ranged from 13 to 30 per cent followed by potato dextrose agar method which ranged from 10 to 24 per cent.

The reduction in germination due to seed mycoflora ranged from 10 to 24 per cent. The dark brown

discolored seeds (*E.oryzae*) with 76-100 per cent discoloration reduced the germination by 24 per cent and also reduced seedling vigour, fresh seedling and thousand grain weight significantly.

As the per cent discoloration increased there was also an increase in seed rot, pre-emergence and post-emergence death of seedlings. In case of 76-100 per cent discolored seeds the abnormal seedlings, ranged from 24.5 to 46.5 per cent. The pathogenic ability of *E.oryzae*, *P. grisea* and *F.moniliforme* was proved in seedling symptom and transmission study.

The infection of *A.alternata*, *C. lunata*, *E. oryzae* and *F. moniliform* were detected from seed coat and