Agricultural Entomology

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Agricultural Entomology

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1. TAXONOMY OF THRIPS IN VEGETABLE CROP ECOSYSTEM WITH SPECIAL REFERENCE TO MOLECULAR DIVERSITY AND ENDOSYMBIONTS IN INVASIVE CHILLI THRIPS, *Thrips parvispinus* (KARNY)

(DURGA, G.)

ABSTRACT

The study on taxonomy of thrips in vegetable crop ecosystem with special reference to molecular diversity and endosymbionts in invasive chilli thrips, *Thrips parvispinus* (Karny) was carried out in the Department of Entomology, College of Agriculture, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga during 2020-2023. During the present study, a total of 31 species of thrips *viz.*, *Anaphothrips sudanensis*, *Ayyaria chaetophora*, *Bathrips melanicornis*, *Caliothrips quadrifasciatus*, *Ceratothripoides claratris*, *Craspedothrips minor*, *Frankliniella schultzei*, *Gynaikothrips uzeli*, *Heliothrips haemorrhoidalis*, *Liothrips* spp., *Megalurothrips distalis*, *Megalurothrips usitatus*, *Microcephalothrips abdominalis*, *Panchaetothrips indicus*, *Retithrips syriacus*, *Rhipiphorothrips cruentatus*, *Selenothrips rubrocinctus*, *Sciothrips cardamomi*, *Scirtothrips dorsalis*, *Stenchaetothrips biformis*, *Stenchaetothrips minutus*, *Taeniothrips* sp, *Thrips apicatus*, *Thrips florum*, *Thrips hawaiiensis*, *Thrips orientalis*, *Thrips palmi*, *Thrips parvispinus*, *Thrips simplex*, *Thrips subnudula* and *Thrips tabaci* belonging to 21 genera from two suborders, Terebrantia and Tubulifera were recorded infesting 96 host plants belonging to different families. Among the recorded thrips species, *Thrips parvispinus* was found dominant of infesting 17 hosts representing a potential threat, followed by *Scirtothrips dorsalis* on 10 hosts. *Panchaetothrips indicus* and *Retithrips syriacus* were new records on the hosts, *Elettaria cardamomum* and *Terminalia catappa*, respectively. DNA barcodes for 13 thrips species were characterised molecularly using *mtCOI* gene, and the sequences were submitted to the NCBI GenBank database and accession numbers were obtained. The *mtCOI* sequencing resulted in 658bp sequences for the 10 populations of *T. parvispinus*. The phylogram revealed that there were two minor clades, of which the clade I represented 8 populations from GKVK, Kolar, IIHR, Bheemarayangudi of Karnataka, Chittoor, Chandraiah Gari Palli, Pileru, Paaturu of Andhra Pradesh; the clade II had 2 populations, one from Ballari district and the other from the Thambrahalli village of Vijayanagara district of Karnataka. The endosymbionts Wolbachia, *Rickettsia* and *Fritschea* were isolated from thrips samples collected from 21 different locations.

August, 2023

(B.C. Hanumanthaswamy)
Major Advisor

Agronomy

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Agronomy

1. INFLUENCE OF MULCHING MATERIALS, BIOCHAR AND BIOSTIMULANTS ON MICROMETEOROLOGICAL PARAMETERS, GROWTH AND YIELD OF TOMATO

(ASHWINI AMBADI)

ABSTRACT

Field experiments were conducted at the College of Agriculture, KSNUAHS, Shivamogga during the *kharif* 2020 and 2021 on red sandy clay loam soil on the influence of mulching materials, biochar and biostimulants on micrometeorological parameters, growth and yield of tomato.The experiment-I was laid out in RCBD with a factorial concept involving four mulching materials *viz.*, Pongamia leaves @ 4 t ha^{-1}, Polythene mulch, Paddy straw @ 10 t ha^{-1} and no mulch with three biostimulants namely Nano nitrogen @ 4 ml lit^{-1}, Brassinolide @ 5 ml lit^{-1} and Control. Among the different mulching materials, paddy straw @ 10 t ha^{-1} recorded significantly higher plant height (158.91 cm), yield (81.36 t ha^{-1}) and quality parameters as compared to other mulching materials. Among the biostimulants, brassinolide @ 5 ml lit^{-1} recorded higher plant height (157.67 cm), yield (78.36 t ha^{-1}) and quality parameters as compared to other biostimulants. The experiment-II was laid out in RCBD with a factorial concept involving five biochars *viz.*, Biochar 1 @ 5 t ha^{-1}, Biochar 2 @ 5 t ha^{-1}, BC_1+ FYM (2.5 t ha^{-1} + 5 t ha^{-1}), BC_2 + FYM (2.5 t ha^{-1} + 5 t ha^{-1}) and FYM @ 10 t ha^{-1} and with three biostimulants namely Humetus @ 5 ml lit^{-1}, Brassinolide @ 5 ml lit^{-1} and Control. Among the different biochars, biochar 2 @ 5 t ha^{-1} recorded significantly higher plant height (129.47 cm), yield (71.56 t ha^{-1}) and quality parameters as compared to other biochar. Among the biostimulants, brassinolide @ 5 ml lit^{-1} recorded higher plant height (128.53 cm), yield (73.89 t ha^{-1}) and quality parameters compared to other biostimulants.

August, 2023

(S. Sridhara)
Major Advisor

2. PERFORMANCE OF DIFFERENT FARMING TYPES IN FINGER MILLET BASED INTER CROPPING SYSTEM UNDER SOUTHERN TRANSITION ZONE OF KARNATAKA

(ABDULGANI NABOOJI)

ABSTRACT

A field experiment was conducted at Agronomy field unit, College of Agriculture, KSNUAHS, Shivamogga during *kharif* 2019-20 and 2020-21 on sandy loam soil to study the performance of different farming types in finger millet based inter cropping system. The experimental design adopted was split plot with three farming types *viz*., conventional, organic and natural farming as main plots and five finger millet based cropping systems *viz*., finger millet + red gram, finger millet + field bean, sole finger millet, sole red gram and sole field bean as sub plots. All the fifteen treatments were replicated three times. Among the different farming types, conventional farming recorded significantly higher number of productive tillers (5.14 plant^{-1}), number of fingers (6.31 ear head^{-1}), grain yield (2450 kg ha^{-1}), straw yield (3957 kg ha^{-1}), total nitrogen (70.16 kg ha^{-1}), phosphorus (19.85 kg ha^{-1}), potassium (65.05 kg ha^{-1}) uptake and net returns (₹ 48118 ha^{-1}) as compared to organic and natural farming. However, higher benefit cost ratio (3.02), improved microbial population and enhanced phosphatase (9.38 µg pNP g^{-1} of soil day^{-1}) and dehydrogenase (16.66 µg TPF formed g^{-1} soil day^{-1}) activity was recorded in natural farming. Among the finger millet based cropping system, finger millet + red gram recorded significantly higher finger millet equivalent yield (2727 kg ha^{-1}), net returns (₹ 63362 ha^{-1}), benefit cost ratio (2.51), total nitrogen (64.99 kg ha^{-1}), phosphorus (18.46 kg ha^{-1}), potassium (69.34 kg ha^{-1}) uptake and enzymatic activities (phosphatase: 8.46 µg pNP g^{-1} of soil day^{-1} and dehydrogenase: 17.39 µg TPF formed g^{-1} soil day^{-1} respectively) than rest of cropping systems. Organic farming recorded significantly higher available soil nitrogen (244.65 kg ha^{-1}), phosphorus (91.42 kg ha^{-1}) and potassium (285.02 kg ha^{-1}) status compared to rest of farming types.

October, 2023

(H. K. Veeranna)
Major Advisor

Genetics and Plant Breeding

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Genetics and Plant Breeding

1. MAPPING GENOMIC REGIONS ASSOCIATED WITH YIELD AND YIELD RELATED TRAITS UNDER AEROBIC CONDITIONS IN RICE (*Oryza sativa* L.)

(VISHAL REDDY)

ABSTRACT

The root and yield related traits are critical for initial establishment and high yield under aerobic system of rice cultivation. Identification of Quantitative trait loci (QTLs) conferring root and yield related traits under aerobic adaptation is essential to facilitate the development of high yielding aerobic rice varieties. The present investigation was carried out in 150 Recombinant Inbred Lines (F_7) along with parents (TI-128×BPT-5204) and seven checks for root traits under poly house aerobic controlled condition at panicle initiation stage (PI), for yield and yield related traits under irrigated field condition in *Kharif* 2022 and *Rabi* 2022 at ICAR-IIRR, Hyderabad (E1), KSNUAHS, Shivamogga (E2) and under aerobic field condition in *Rabi* 2022 at ICAR-IIRR, Hyderabad (E1), KSNUAHS, Shivamogga (E2), RARS, Karjat (E3), MRRS, Nawagam (E4) and RRS, Rohtas (E5). Significant positive correlation of grain yield per plant with root length, root volume and shoot length was recorded indicating the role of root traits in improving yield through improved water or nutrient uptake. Genotyping was executed using 1k-Rice Custom Amplicon (1k-RiCA) genotyping platform. A total of 91 QTLs were identified for yield and yield related traits under aerobic conditions, among them four QTLs (*qDFF*-2.1, *qPT*-1.1, *qYPP*-12.1 and *qTW*-3.1) were found consistent associated with days to 50 per cent flowering, number of productive tillers, grain yield per plant and number of grains per panicle. *In-Silico* analysis identified abiotic stress-related genes *viz.*, ABA, ARF, MADS, WAK, SAM, LTPL, zinc finger spanning the nearby regions of the markers implying of the marker with the root and yield traits contributing to aerobic adaptation. A novel QTL from 3.46 to 3.48 Mb on chromosome 4 governing root length and root dry weight was identified. The lines TB 66, TB 143, TB 144, TB 17, TB 8, TB 6, TB 44 and TB 59 were identified better than parents and checks for high yield, root length and root volume under aerobic condition.

December, 2023

(R. Lokesha)
Major Advisor

Plant Pathology

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Plant Pathology

1. STUDIES ON EPIDEMIOLOGY, VARIABILITY AND MOLECULAR CHARACTERIZATION OF *Alternaria porri* (ELLIS) CIF INCITANT OF PURPLE BLOTCH OF ONION

(RAVICHANDRA)

ABSTRACT

Onion purple blotch is economically significant disease, which is most severe from bulb formation to harvesting stage of the crop. Random survey results revealed the prevalence of the disease which helped to identify hotspots of disease prone areas in major onion growing areas of Sothern Karnataka. Total of 42 isolates were collected from different geographical locations were confirmed as *Alternaria porri* by cultural, morphological and molecular characterization. These 42 isolates ITS sequences were deposited and obtained accession numbers through NCBI GenBank and phylogenetic tree was constructed by using MEGA 11 software. Further confirmed through specific primers targeting specific genes. Correlation between purple blotch disease and weather factors during 2022 (September to December), indicated, the disease development has positive correlation co-efficient with sunshine hours (0.37) and during 2023 (January to April) indicated the disease development has positive correlation co-efficient with maximum (0.96) and minimum temperature (0.89), maximum (0.04) and minimum (0.64) relative humidity, rainfall (0.47), sunshine hours (0.08) wind speed (0.28) and evapotranspiration (0.93). When comparing the effects of toxins from three different isolates, it became evident that the highly virulent isolate at 2000 ppm had the most significant impact on the growth of onion roots and shoots. Various defense enzymes production *i.e.*, catalase, PO, PPO, SOD and PAL in both pathogen inoculated and toxin inoculated plants were studied. Evaluation of modules revealed that the significantly highest yield in both seasons *i.e.*, 32.73 t/ha and 30.92 t/ha during 2022 (September to December) and 2023 (January to April) respectively in module 4, corresponded with the lowest terminal disease severity and apparent rate of infection (units/day) was found to be lower in all the modules compared to the unsprayed check in both the seasons.

December, 2023

(Suresha D Ekabote)

Major Advisor

Silviculture and Agroforestry

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga

Ph.D. theses abstracts produced in Silviculture and Agroforestry

1. PERFORMANCE OF *Dendrocalamus brandisii* (MUNRO)KURZ. BASED AGROFORESTRY PRACTICES IN TROPICAL HUMID REGIONS OF KARNATAKA

(CLARA MANASA, P. A.)

ABSTRACT

Bamboo-based agroforestry is recently recognized as the potential land use system to achieve ecological stability and economic efficiency for the farmer community. In this regard a, spacing and nutrient trial to assess the growth performance of the bamboo and intercrops in agroforestry systems was undertaken in the farmer's field at Halligattu, Ponnampet, Kodagu, Karnataka during the year 2020-2022. *Dendrocalamus brandisii* based agroforestry system was established with spacing of 4 m × 5 m and 5 m × 5 m, in June 2020 and three nutrient dosages were applied as treatments. Intercrops such as okra/ black gram were cultivated in the interspaces of Bamboo. Further, to understand the impact of bamboo and intercrops on soil's physico-chemical properties and soil nutrient dynamics under bamboo-based agroforestry practice were also studied over the period of two years. The results revealed that spacing and nutrient regime significantly influenced the growth of the bamboo plants, wherein spacing of 5 m × 5 m with higher dosage S3 (N:37.50 g plant^{-1}; P: 13.50 g plant^{-1}; K: 37.50 g plant^{-1}) recorded maximum value for number of culms per clump, average collar diameter, clump girth and clump width. However, no significant influence was observed on clump height. Intercrops yield was found to be higher in the wider spacing and the influence of nutrient regimes on the intercrop performance was not evident. The nutrient dynamics study revealed bamboo-based agroforestry systems positively impacted soil physical and chemical properties over two years, especially improving soil bulk density and nutrient status (OC, N, P, K, Ca, and Mg). After two years, it can be inferred from the study that bamboo-based agroforestry systems have greater potential to be identified as agroforestry systems in the sub-humid regions of Karnataka.

January, 2023

(Ramakrishna Hegde)
Major Advisor

2. GROWTH AND WOOD TRAITS OF IMPORTANT TREE SPECIES UNDER CONTRASTING ENVIRONMENTAL CONDITIONS

(SUPRIYA K SALIMATH)

ABSTRACT

The world's woods are projected to experience major changes due to climate change in the recent decades and there is an urgent need to understand the response of tropical trees in terms of their growth and physiology. Hence, a study was conducted to evaluate the growth and wood traits of four important tree species *viz., Acacia auriculiformis* A. Cunn. ex Beth, *Casuarina junghuhniana* Miq, Eucalyptus sps, and *Tectona grandis* Linn. f. at three rainfall zones (RFZ) namely, high (Mean annual rainfall of 3000 mm), medium (Mean annual rainfall of 1500 mm), and low (Mean annual rainfall of 1000 mm). Observations on the tree growth parameters were recorded and wood core samples were collected for the estimation of anatomical traits. To understand the variations in the soil physical and chemical properties soil samples at five depths (0-20 cm, 20-40 cm, 40-60 cm, 60-80 cm, and 80-100 cm) were collected and analyzed. The study revealed that the high rainfall zone recorded a higher value for volume accumulation for all the species with *A. auriculiformis* recording an MAI of 11.2 $m^3ha^{-1}yr^{-1}$, *Casuarina junghuhniana* of 4.2 $m^3ha^{-1}yr^{-1}$ *Eucalyptus* of 18.1 $m^3ha^{-1}yr^{-1}$ and *Tectona grandis* of 4.6 $m^3ha^{-1}yr^{-1}$. The low rainfall zone recorded the higher values for basic density in all the species *viz*., 0.53 gcc^{-1} in *A. auriculiformis*, 0.84 gcc^{-1} in *C. junghuhniana*, 0.63 gcc^{-1} in *Eucalyptus sps.* and 0.73 gcc^{-1} in *T. grandis*. All the species recorded higher vessel diameter, lumen width, area under high RFZ and high wall thickness and frequency under low rainfall zone. Further, the depiction of the proportion of vessels under varied vessel classes showed the varied strategies adopted by the species in modifying the vessel dimension and arrangements to reduce the vulnerability to hydraulic failure. The higher value for N content was recorded in high rainfall zone under *A. auriculiformis* and C. *junghuhniana* of 22.5 Kg ha^{-1} and 191.5 Kg ha^{-1} respectively. Further, a relatively higher value for the K content was recorded under the high rainfall zone of Eucalyptus and *T. grandis* (74.4 Kg ha^{-1} and 199.7 Kg ha^{-1} respectively).

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(Ramakrishna Hegde)
Major Advisor