



Diversification of floral resources in pigeonpea to reduce the impact of insecticides on Honey bees

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**D. N. Kambrekar, Megha Raikar, Krishna Gudadur,
Shamarao Jahagirdar and U. K. Hulihalli**

UNIVERSITY OF AGRICULTURAL SCIENCES, DHARWAD KARNATAKA-INDIA

www.uasd.edu



Introduction

50-90%
damage

~~Insect
icides~~

- ➔ Pigeonpea is a major pulse crop in India, grown in an area of 7.7 lakh ha with a productivity of 486 kg/ha.
- ➔ In combination with cereals, pigeonpea make a well-balanced meal and hence, are favoured by nutritionists as an essential ingredient for balanced diets.
- ➔ Pod borer is a major production constraint in pigeonpea –flowers/pods/seeds
- ➔ Pigeonpea is cross pollinated up to 30-50 per cent by honey bees.

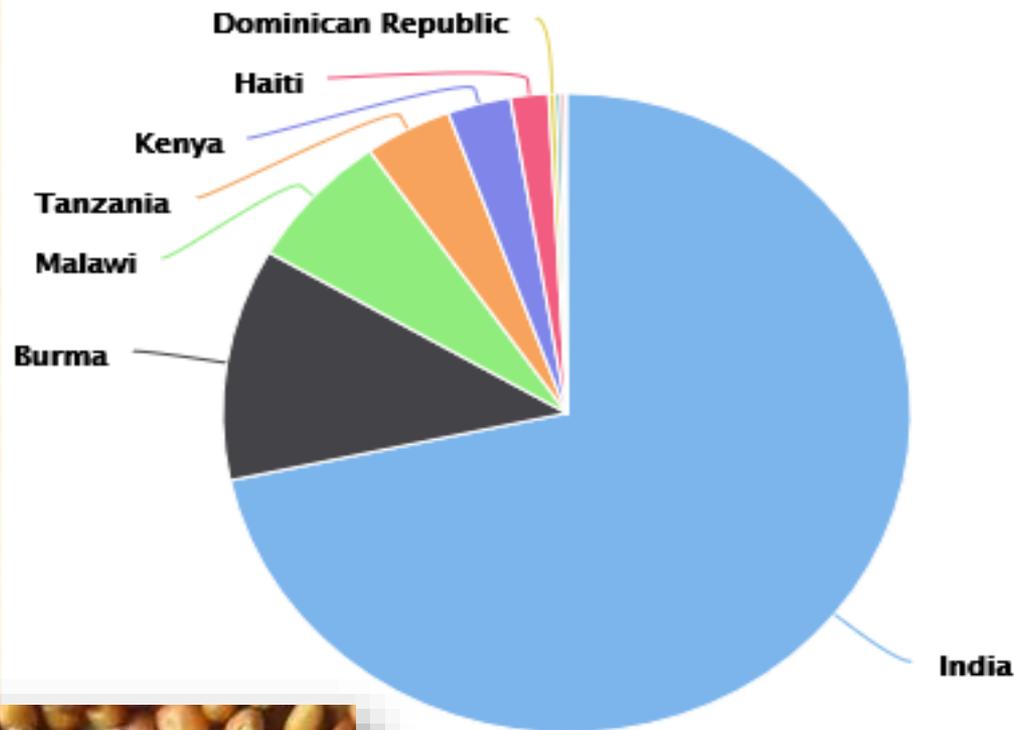


- **Now there is a frightening decline in the population of honey bees around the world because:**
 - ❖ **Conversion of forest and landscape areas into urban areas**
 - ❖ **Indiscriminate use of insecticides**
 - ❖ **Intensive mono-cropping which causes loss of important fundamentals for honey bees.**

- **There is a possibility of restoring the pollinators by introducing the bee attractant marginal crops & use of safe insecticides to pollinators.**

- **Buckwheat was grown around pigeonpea as a marginal crop to enhance the activity of pollinators.**

Per cent share of Pigeon pea Producing Countries in the World (2017)



Rank	Country	Tonnes
1	India	4,870,000
2	Burma	798,689
3	Malawi	470,653
4	Tanzania	279,210
5	Kenya	201,289
6	Haiti	121,700
7	Dominican republic	22,962
8	Nepal	16,497
9	Uganda	11,283
10	Congo	5,962

Source: FAOSTAT 2017

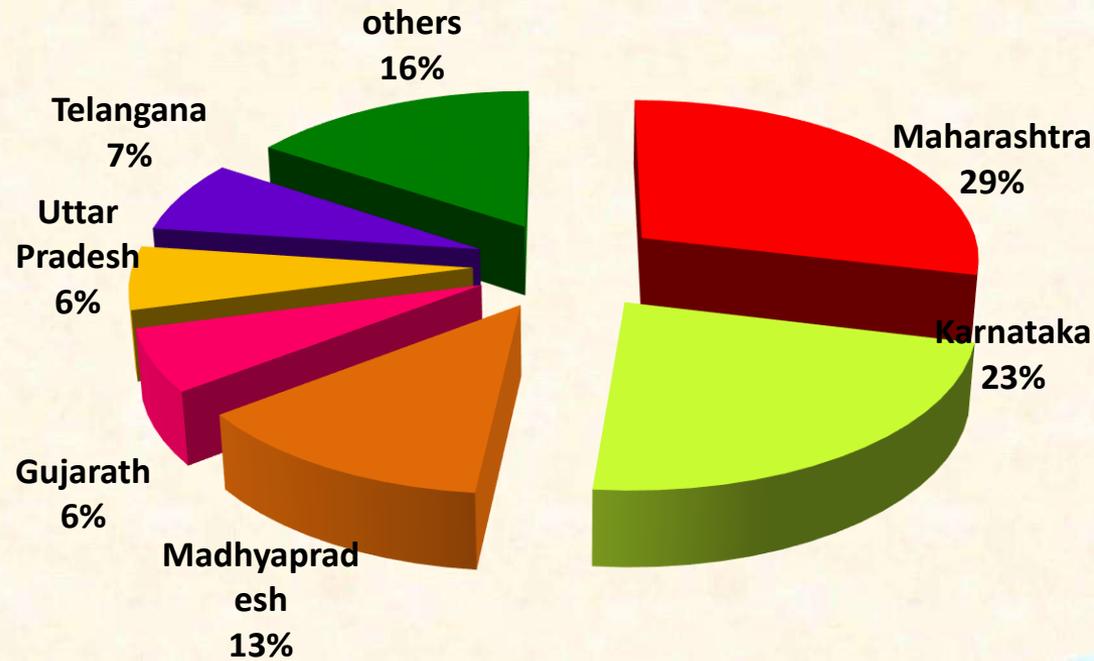




State-wise Area and Production of Pigeonpea

State	Area lakh ha	production Lakh tonnes
Maharashtra	15.33	13.89
Karnataka	12.14	8.66
Madhya Pradesh	6.9	7.82
Gujarath	3.34	3.69
Uttar Pradesh	3.38	3.36
Telangana	3.87	2.15
others	8.28	5.72

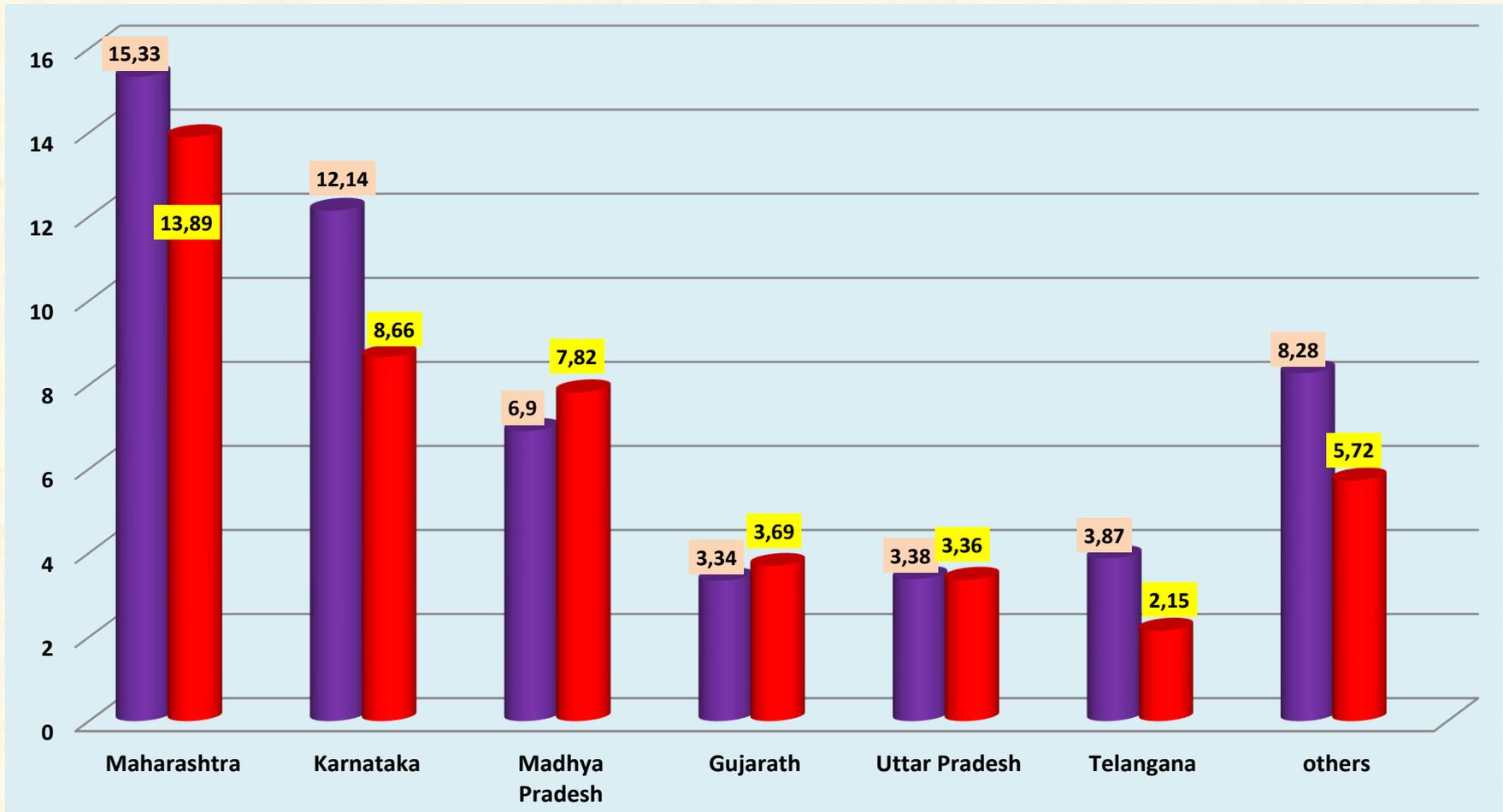
Statewise Area and Production of Pigeonpea 2016-17



State-wise area and production of pigeonpea



Statewise Area and Production of Pigeonpea 2016-17

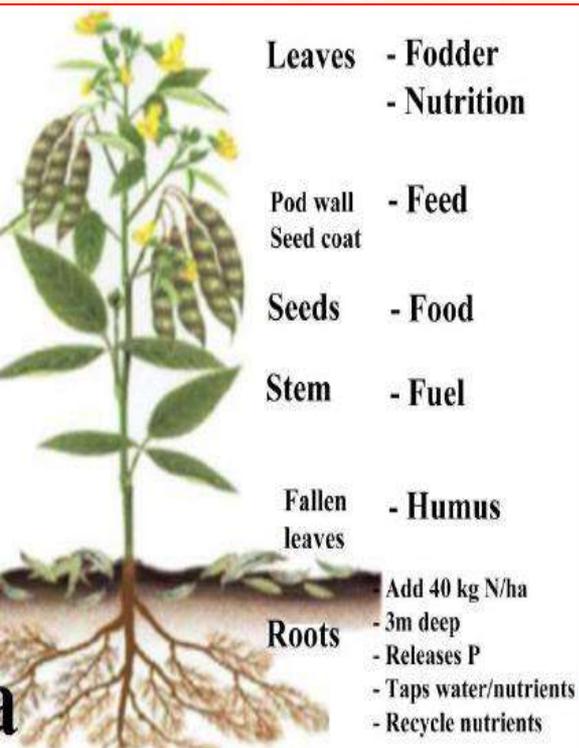


■ Area lakh ha

■ production Lakh tonnes



Economic Importance:



❖ Seeds are rich source of protein and hence become an indispensable part of Indian vegetarian meal.

Contains protein - 22.3%, Fat - 1.7% and

❖ Considerable amount of vitamins and minerals

❖ The ability of red gram to produce high economic yields under soil moisture deficit makes it an important crop in rainfed and dryland agriculture.



Extent of damage caused by major pests of pigeonpea



Pod borer
Helicoverpa armigera



60-90 per cent

Podfly
Melanagromyza obtusa



14.3 - 46.6 per cent

Spotted pod borer
Maruca vitrata



50 to 68 per cent

Pod bug
Clavigralla gibbosa



25 to 40 per cent

Other pests: Red gram plume moth, Bud weevil, Blister beetle, Pulse beetle and Tur bud mite etc.,

Pigeonpea



Recommended insecticides

Thiodicarb

Profenophos

DDVP

NSKE

Chlorantraniliprole

Methomyl

Emamectin benzoate

Flubendiamide

Spinosad

Indoxacarb

Quinalphos

Novaluron

Fenvalerate

Malathion

Pollinators

Apis florea



Apis dorsata



Apis cerana



Xylocopa sp.



Megachilae sp.



Danaus chrysippus



Lampides Boeticus



Musca spp.





Objectives



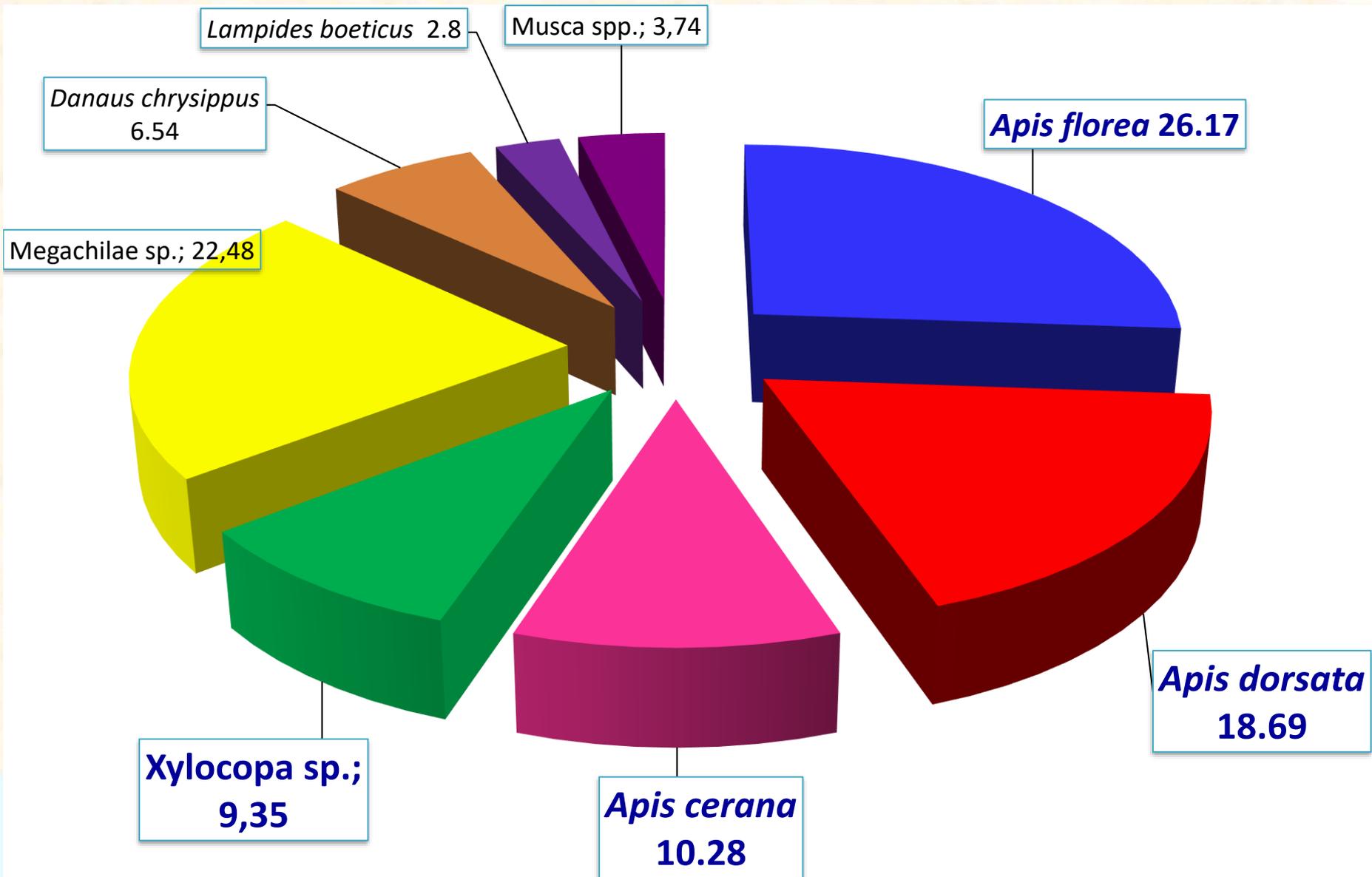
- To study the pollinators fauna of Pigeonpea and Buckwheat.
- To study the foraging time of honey bee.
- Impact of insecticides on honey bees.
- Influence of marginal crop in restoration of honey bees in pigeonpea.



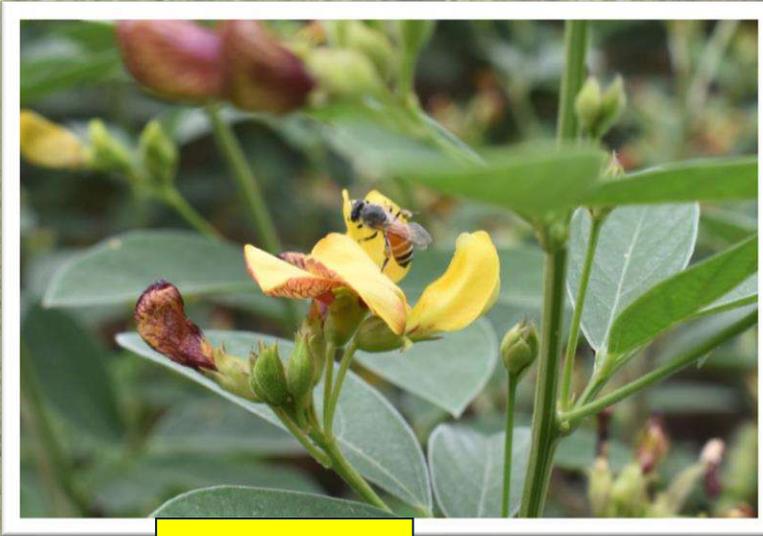
Methodology

- The experiment was conducted in farmers field in Vijayapur and Bagalkot districts during 2018-19.
- Sowing of redgram was undertaken during June-July month
- Sowing of marginal crop was done 45 days after the sowing of redgram so as to synchronize the flowering of both main crop and the marginal crop (Pigeonpea + Buckwheat 3%).
- Thiodicarb 75 WP, NSKE 5 %, Chlorantraniliprole 18.5 SC, Chloratraniliprole (10 %) + Lambda cyhalothrin (5%) ZC, Emamectin benzoate 5% SG and Flubendiamide 480 SC - used for the management of pod borer.

Pollinator fauna recorded on pigeonpea, *Cajanus cajan* during 2018-19 in Bijapur and Bagalkot District



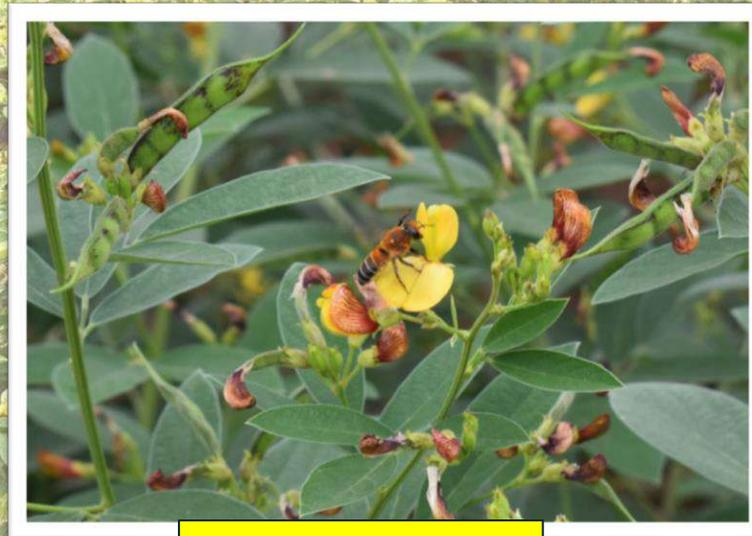
POLLINATOR FAUNA OF PIGEONPEA



Apis florea

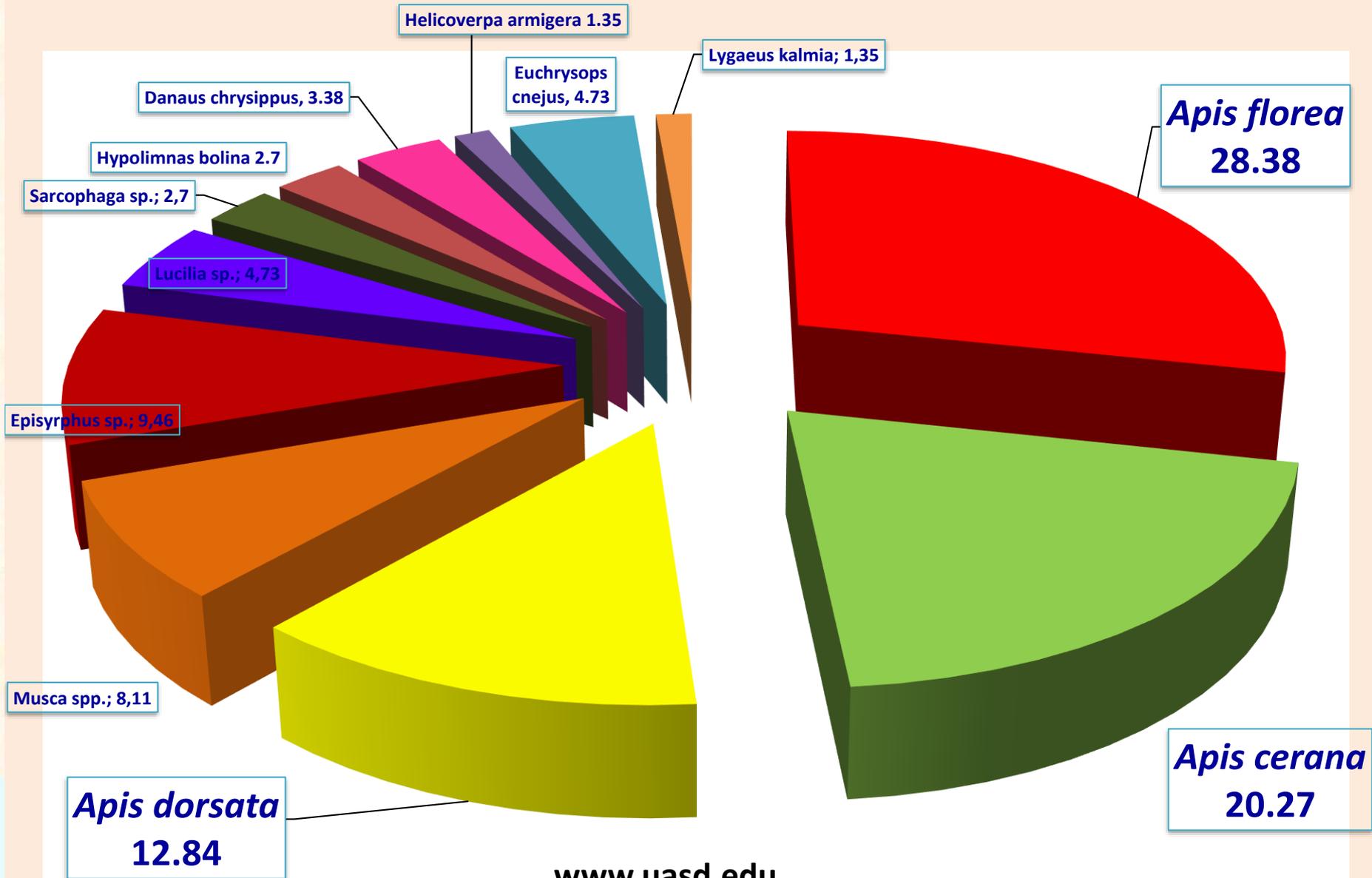


Lampides boeticus



Megachilae sp.,

Pollinator fauna recorded on buckwheat, *Fagopyrum esculentum* at Vijayapur and Bagalkot during 2018-19



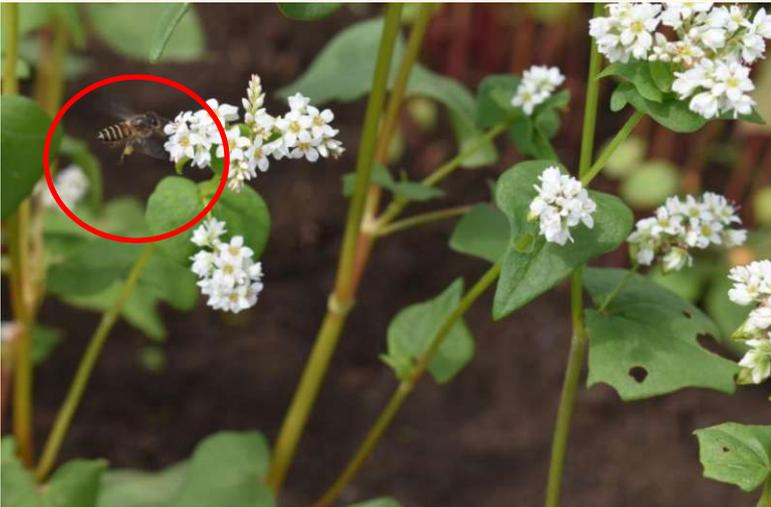
Pollinator fauna of buckwheat



Apis florea



Apis dorsata



Apis cerana



Sarcophaga sp.

Total number of pollinator species observed in pigeon pea and marginal crops



Sl. no	Name of the crop	Name of species	No. of species
1.	Pigeon pea	<i>Apis florea</i> , <i>Apis dorsata</i> , <i>Apis cerana</i> , <i>Danaus chrysippus</i> , <i>Megachilae sp.</i> , <i>Xylocopa sp.</i> , <i>Lampides boeticus</i> and <i>Musca spp</i>	08
2.	Buckwheat	<i>Apis florea</i> , <i>Apis cerana</i> , <i>Apis dorsata</i> , <i>Danaus chrysippus</i> , <i>Musca spp.</i> , <i>Episyrphus sp.</i> , <i>Lucilia sp.</i> , <i>Sarcophaga sp.</i> , <i>Hypolimnas bolina</i> , <i>Helicoverpa armigera</i> , <i>Euchrysops cnejus</i> and <i>Lygaeus kalmia</i>	12

Apis florea, *Apis dorsata* and *Apis cerana* were common and most abundant species found in pigeonpea and buckwheat. Hence, Buckwheat was selected as marginal crop around pigeonpea.

Common species of pollinators found in pigeon pea and marginal crops (Pigeonpea and Buckwheat)



Apis florea

Pigeonpea-26.17
Buckwheat-28.38



Apis dorsata

Pigeonpea-18.69
Buckwheat-12.84



Apis cerana

Pigeonpea-10.28
Buckwheat-20.27



Danaus chrysippus

Pigeonpea-6.54
Buckwheat-3.38

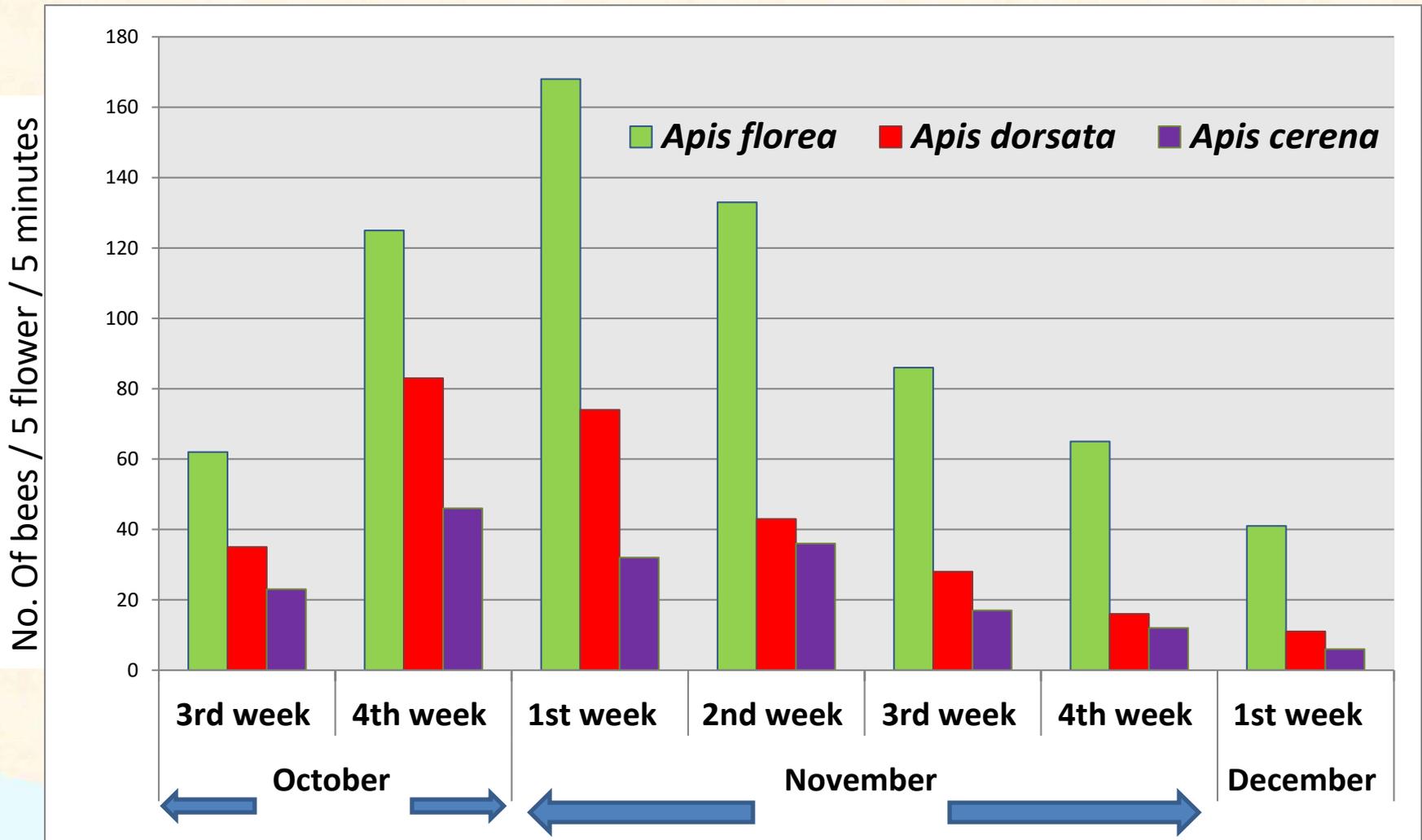


Abundance of pigeonpea flower visitors in different weeks at Vijayapur and Bagalkot 2018

Month	Week	<i>Apis florea</i>	<i>Apis dorsata</i>	<i>Apis cerena</i>
October	3rd week	62	35	23
	4th week	125	83	46
November	1st week	168	74	32
	2nd week	133	43	36
	3rd week	86	28	17
	4th week	65	16	12
December	1st week	41	11	6



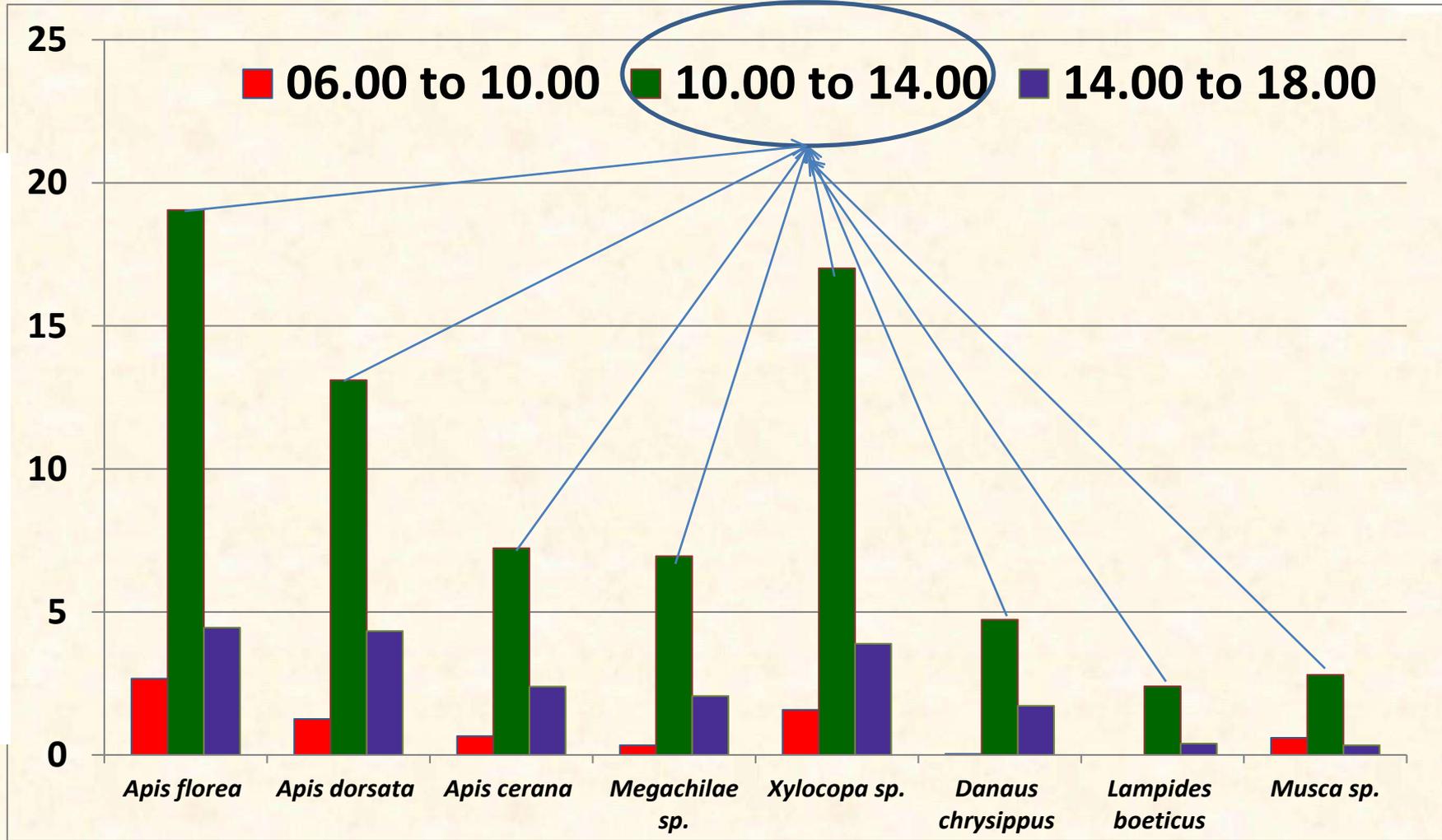
Abundance of pigeonpea flower visitors in different weeks at Vijayapur and Bagalkot 2018



Abundance of different species of flower visitors at different times of day



No. Of bees / 5 flower / minutes





Restoration of *Apis florea* during and after the peak activity as influenced by marginal crop

Treatments	Marginal crop	After the peak activity										At the peak activity								
		2DAS	3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS	2DAS		3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS		
 Thiodicarb	With																			
	Without																			
 NSKE	With																			
	Without																			
 Chlorantraniliprole	With																			
	Without																			
 Lamda-cyhalothrin + chlorantraniliprole	With																			
	Without																			
 Emamectine benzoate	With																			
	Without																			
 Flubendiamide	With																			
	Without																			



Restoration of *Apis dorsata* during and after the peak activity as influenced by marginal crop

Treatments	Marginal crop	Spray after the peak activity									Spray at the peak activity								
		1DAS	2DAS	3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS	1DAS	2DAS	3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS
Thiodicarb	With																		
	Without																		
NSKE	With																		
	Without																		
Chlorantraniliprole	With																		
	Without																		
lambda-cyhalothrin	With																		
	Without																		
chlorantraniliprole	With																		
	Without																		
Emamectine benzoate	With																		
	Without																		
Flubendiamide	With																		
	Without																		



Restoration of *Apis cerena* during and after the peak activity as influenced by marginal crop



Treatments	Marginal crop	After the peak activity									At the peak activity								
		1DAS	2DAS	3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS	1DAS	2DAS	3DAS	4DAS	5DAS	6DAS	7DAS	8DAS	9DAS
Thiodicarb	With					Green	Green	Green	Green	Green							Green	Green	Green
	Without						Yellow	Yellow	Yellow	Yellow								Yellow	Yellow
NSKE	With	Green	Green	Green	Green	Green	Green	Green	Green	Green		Green	Green	Green	Green	Green	Green	Green	Green
	Without			Yellow				Yellow	Yellow	Yellow	Yellow	Yellow	Yellow						
Chlorantranilprole	With			Green				Green	Green	Green	Green	Green	Green						
	Without				Yellow	Yellow	Yellow	Yellow	Yellow	Yellow					Yellow	Yellow	Yellow	Yellow	Yellow
Lamda-cyhalothrin + chlorantranilprole	With				Green	Green	Green	Green	Green	Green						Green	Green	Green	Green
	Without						Yellow	Yellow	Yellow	Yellow								Yellow	Yellow
Emamectine benzoate	With			Green					Green	Green	Green	Green	Green						
	Without					Yellow	Yellow	Yellow	Yellow	Yellow							Yellow	Yellow	Yellow
Flubendiamide	With					Green	Green	Green	Green	Green						Green	Green	Green	Green
	Without						Yellow	Yellow	Yellow	Yellow								Yellow	Yellow



Restoration of honey bees after spraying with and without the marginal crop

Sl. no	Treatments/Time of application of insecticides	Time of recovery after spray
1	Spraying after 2 PM + Marginal crop	2-3 days
3	Spraying after 2 PM - Marginal crop	3-5 days
2	Spraying @ peak activity + Marginal crop	4-7 days
4	Spraying @ peak activity - Marginal Crop	5-8 days
5	Conventional insecticides during the peak activity of pollinators	7-8 days



Yield of pigeonpea as influenced by time of application of insecticides and marginal crop

Sl. no	Treatments/Time of application of insecticides	Yield (Kg/acre)
1	Spraying after 2 PM + Marginal crop	1278
2	Spraying after 2 PM - Marginal crop	1120
3	Spraying @ peak activity + Marginal crop	1007
4	Spraying @ peak activity - Marginal crop	944
5	Conventional insecticides during the peak activity of pollinators	833

Practical significance of the study



- Augment the activity of pollinators.
- Bring Bees Back to the Farms
- Minimise insecticidal toxicity to honey bees

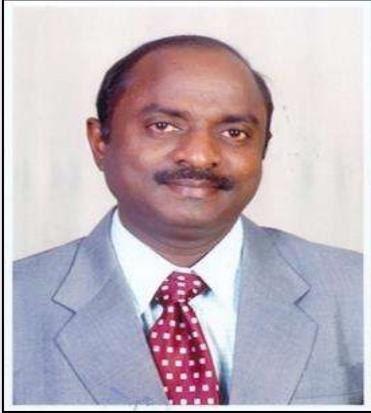


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Our Team



Dr. D. N. Kambrekar



Dr. Shamarao Jahagirdar



Dr. U.K. Hulihalli

Senior Research Fellows



Megha Raikar



Krishna Gudadur



Thank You

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