Incidence of red spider mite (Tetranychus urticae) on ladysfinger and their sustainable management

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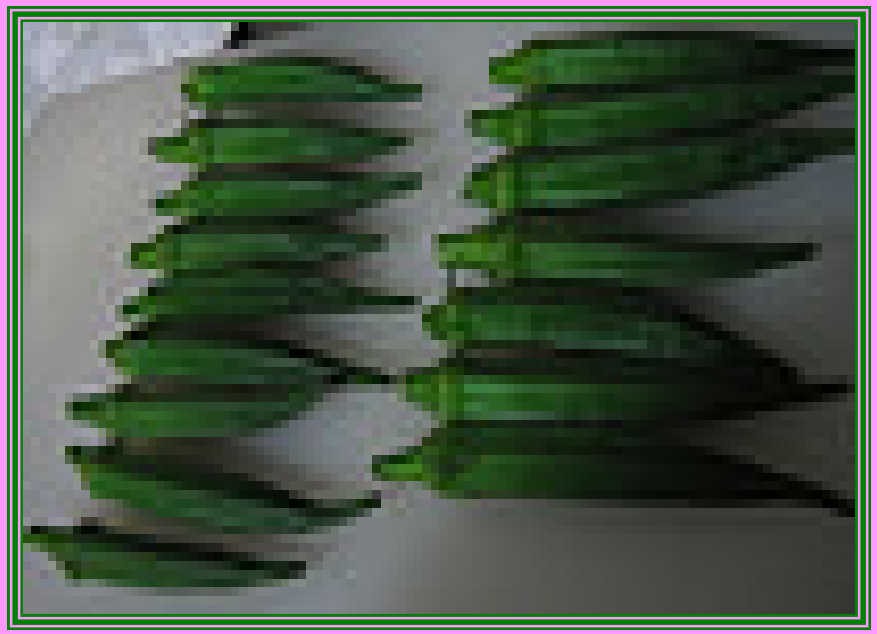
Ladysfinger (*Abelmoschus esculentus* L.) belongs to the family Malvaceae is one of the most important vegetable crops grown in various parts of tropical and sub-tropical areas of the globe.



In the sub-Himalayan region of north east India Ladysfinger is cultivated round the year except winter at a commercial scale but insect and mite pest constitute limiting factors in successful production.

The major pests causing damage to okra

- **Leaf hopper/ Jassid-** *Amrasca biguttula biguttula* (Cicadellidae, Hemiptera)
- **Shoot and fruit borer-** *Earias vitella, E. insulana* (Noctuidae,Lepidoptera)
- **Leaf roller-** *Sylepta derogata* (Pyraustidae,Lepidoptera)
- **Red cotton bug-***Dysdercus cingulatus* (Pyrrhocoridae, Hemiptera)
- **Aphid-** *Aphis gossypii* (Aphididae, Hemiptera)
- **White fly-** *Bemisia tabaci* (Aleyrodidae, hemiptera)
- **Different species of Flea Beetle**
- **Red Spider Mite-** ***Tetranychus urticae*** **(Tetranychidae, Acarina)--- Target Pest**

The Flea beetle found dominated in the ladysfinger field

Altica ambiens

Phyllotreta striolata

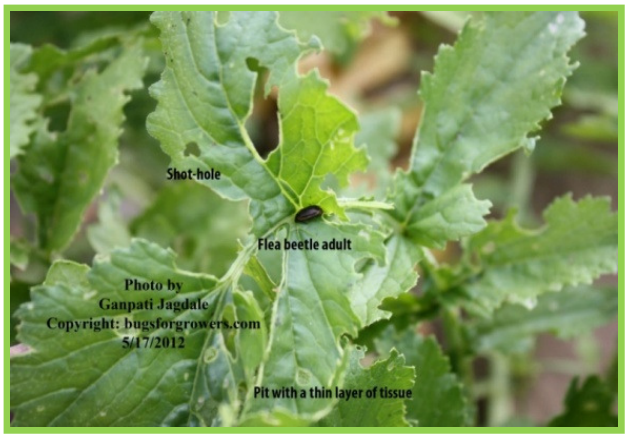
Podagrica bowringi

Agelastica alni

Agelastica alni

Syagrus calcaratus

The Flea beetle damage symptoms



Jassid- the pest

- Both nymphs and adults suck the sap from the undersurface of leaves
- While feeding, they inject toxic saliva into plant tissue.



Aphid

Damage

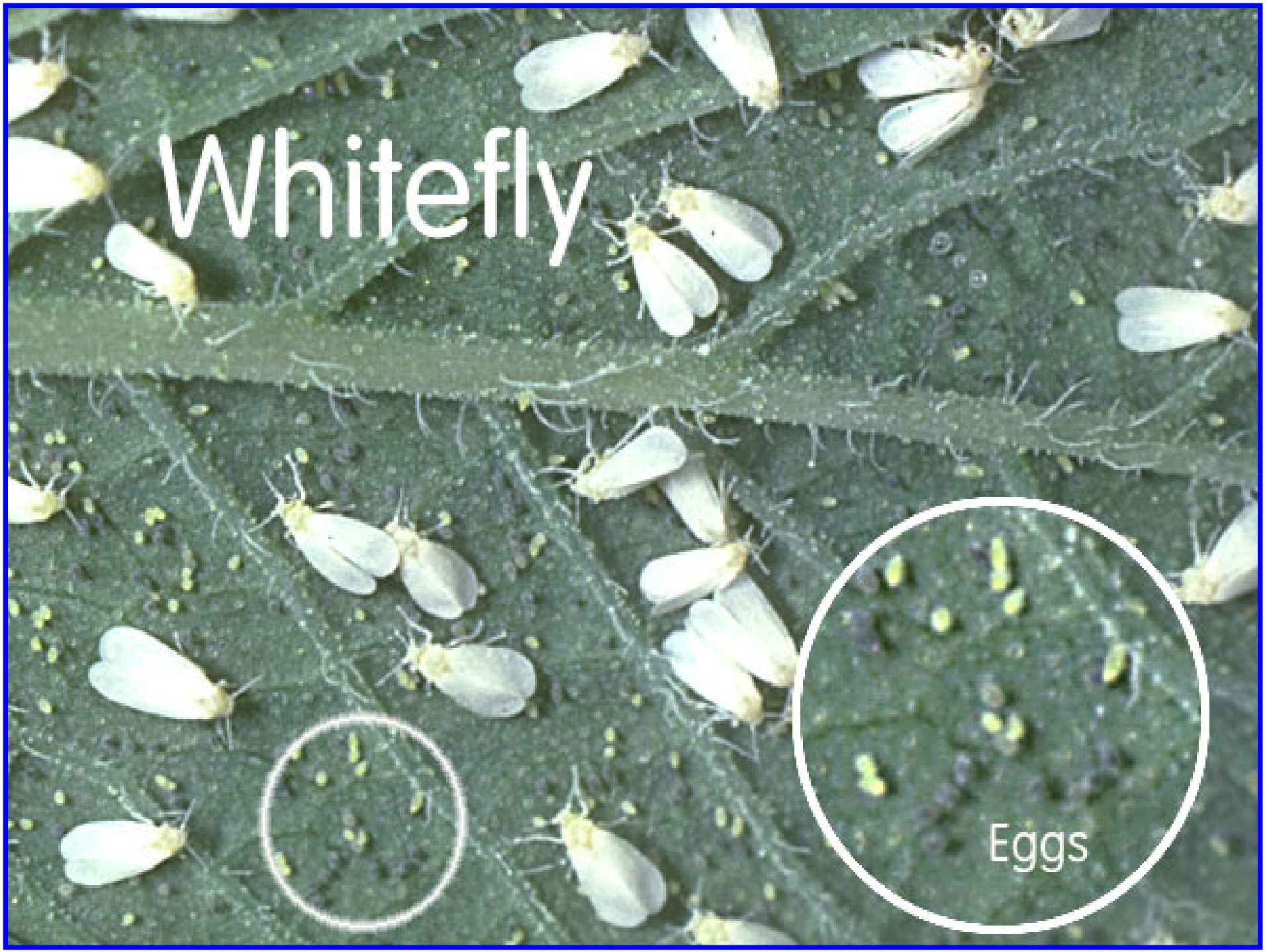
FRUIT BORER

They directly damage the edible part i.e., fruits

White fly:

Nymph and adult

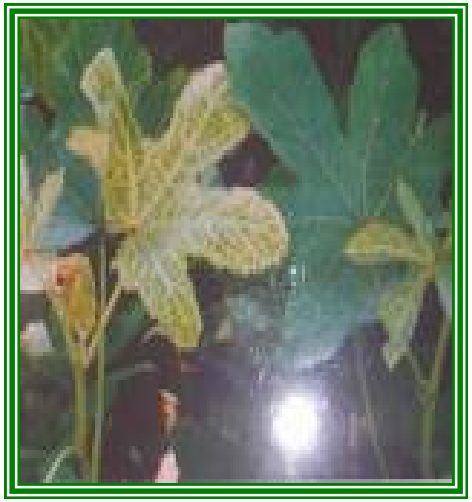
Vector of YVM


Whitefly
Eggs

White fly- the damage it cause

- Affected leaves yellowing, drying
- Stunted growth, reduces flower and fruit setting, fruits smaller in size
- Transmit viral disease like mosaic
- Cause up to 63.41% yield loss

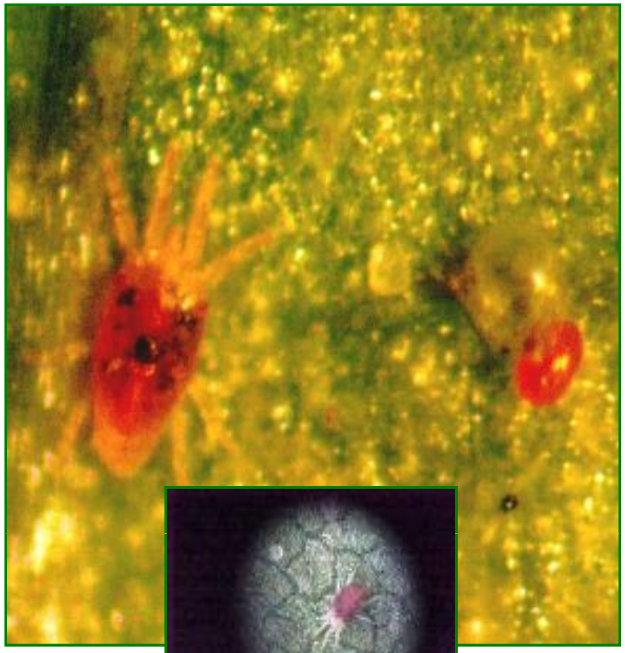


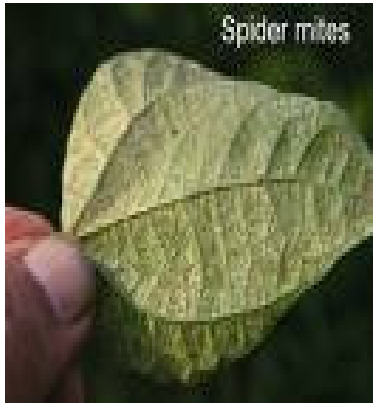



Tetranychus urticae

Mites

Tetranychus urticae





Tetranychus urticae

Tetranychus urticae

Incidence of spider mite on okra plant

Objective: Record on pest incidence help to formulate suitable control measure

Experimental site:

Instructional farm, UVKV at Pundibari, West Bengal

Experimental location:

Sub-himalayan region of north-east India

- **Period of study:**
  2010 and 2011
- **Season of study:**
  - *throughout the yr. except winter (9-45 SMW)*
- *Variety : Nirmal 101*
- **Agronomic practices to raise the crop:**
  As recommended
- **Design followed:**
  RBD


WEST BENGAL
Darjiling
Jalpaiguri
Koch Bihar
Uttar Dinajpur
Dakshin Dinajpur
Malda
Murshidabad
Birbhum
Nadia
Barddhaman
Puruliya
Bankura
Hugli
North Twenty
Four Parganas
Haora
Calcutta
Medinipur
South Twenty
Four Parganas

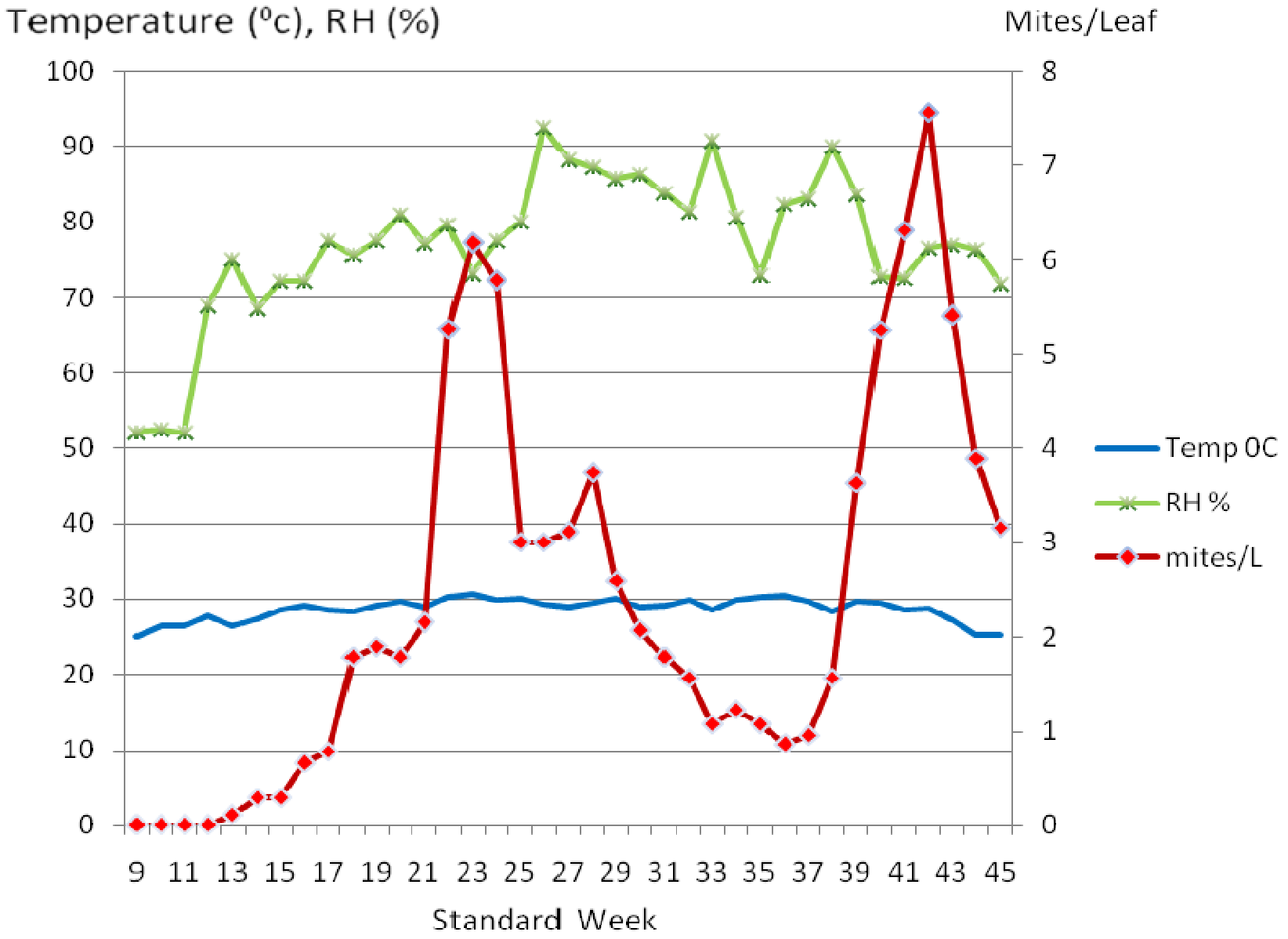


Fig. 1 Incidence of *Tetranychus urticae* as influence by temperature and RH

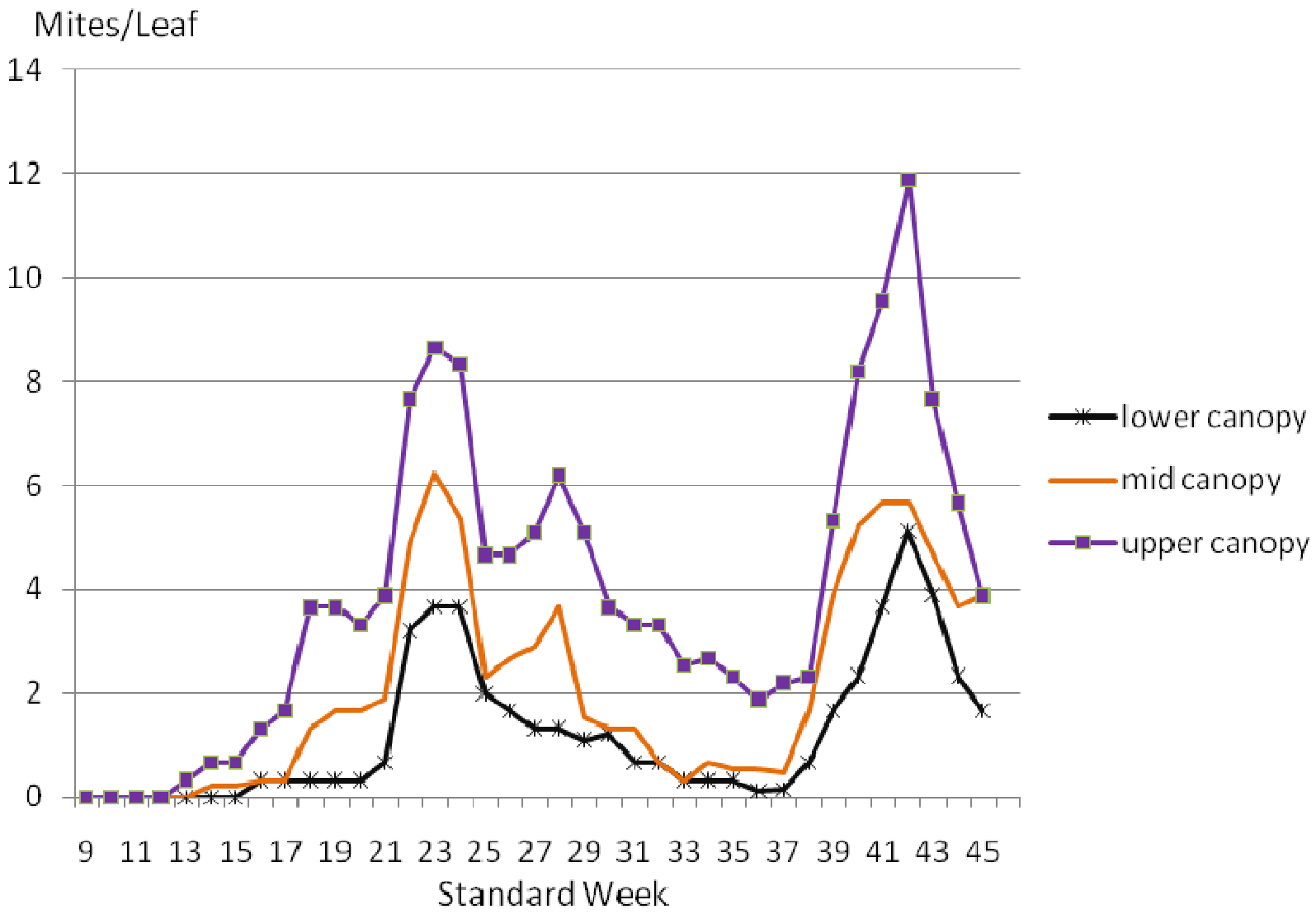


Fig. 2 Distribution of *Tetranychus urticae* on different leaves within okra plant

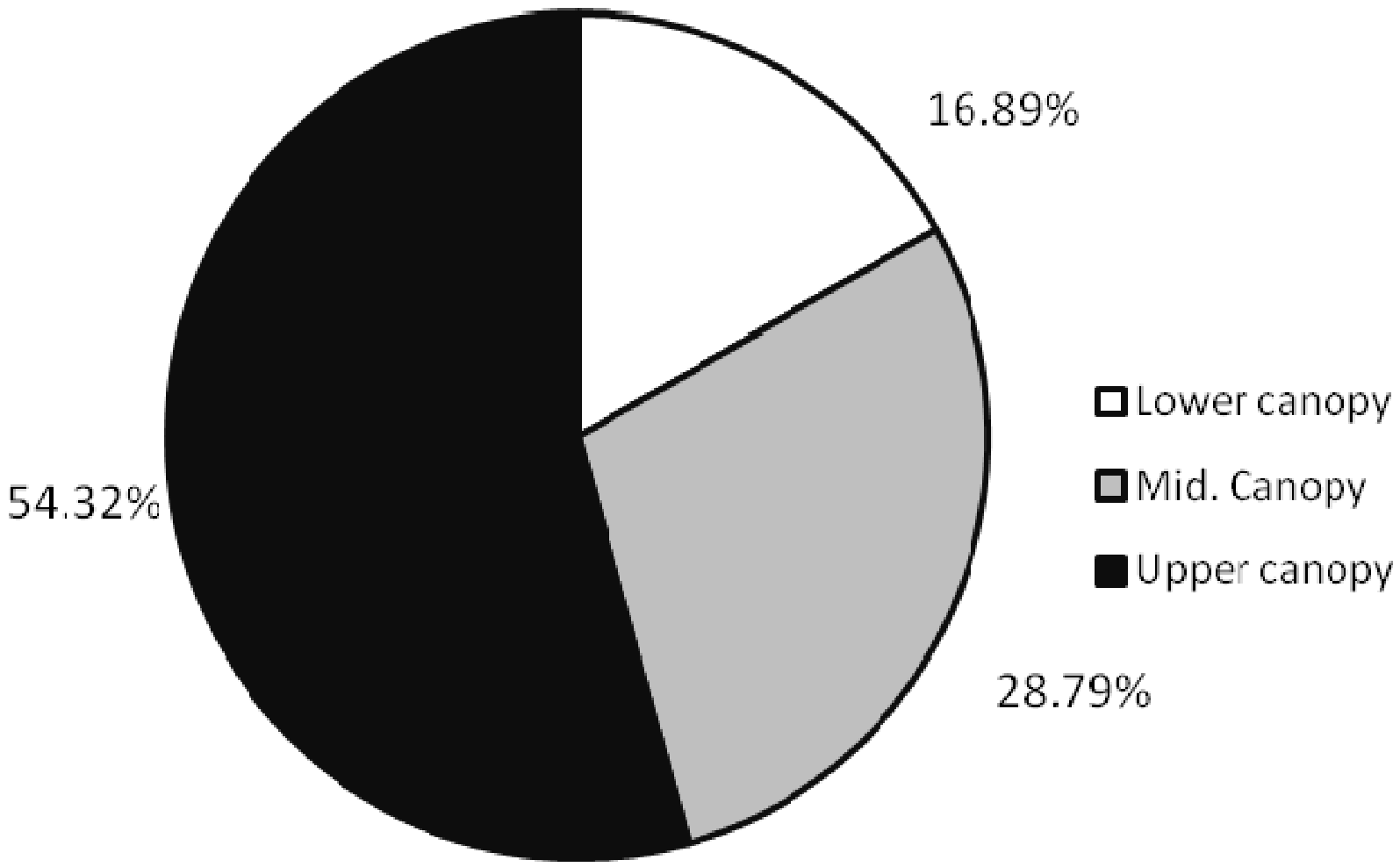


Fig. 3 Distribution of *Tetranychus urticae* within okra plant

Table 1 Correlation co-efficient between weather parameters and incidence of mite

Environmental parameter		Correlation co-efficient (r)	Co-efficient of determination (R^2)	Regression equation
Temperature ^{0}C	**Maximum**	0.226	0.051	Y = 0.106x + 32.38
	Minimum	0.226	0.051	Y = 0.270x + 23.90
	Difference	(-)0.147	0.021	Y = -0.164x + 8.48
	Average	0.263	0.069	Y = 0.188x + 28.14
Relative Humidity (%)	**Maximum**	0.228	0.082	Y = 0.993x + 79.58
	Minimum	0.384*	0.147	Y = 1.998x + 69.25
	Average	0.355*	0.126	Y = 1.497x + 74.42
Weekly rainfall	**Total**	0.057	0.003	Y=1.566x+54.75

*Significant at 5% level of significance **Significant at 1% level of significance

Results and discussion

- Highest population(6.18/leaf) during 23rd SMW (last week of May) in the pre-kharif crop
- Highest population (7.56/leaf) on the 42nd SMW (1st week of October) in the post - kharif crop
- Most active during May and September- October in this region
- Low population was found because of heavy rains during monsoon
- Non-significant positive correlation (p=0.05) with temp. and significant positive correlation with minimum and average RH
- Significant negative correlation with temp. gradient and with weekly total rainfall.

Results and discussion

Fig. 2 and 3 represents mite distribution within the plants as follows

- Most densely populated on the upper canopy (54.32 % population)
- Moderately populated on the middle canopy (28.79 % population)
- Thin population on the lower canopy (16.89 % population)

Control of pests with synthetic insecticides

- Pests on vegetable crops can be ontrolled easily with highly toxic insecticides viz. BHC, aldrin, dieldrin, heptachlor, toxaphene, methyl parathion, monocrotophos, phorate, carbofuran, dimethoate, etc.

Problems arise from synthetic insecticides

- Pesticides accumulate in the environment
- Contaminate all the systems i.e. air, water, soil, plant, animal etc.
- Destroy biodiversity
- bring out ecological disturbance and environmental pollution.
- The uptake of insecticide residues by some crops particularly vegetables adversely affects our health.

Destroy eco-friendly bio-control agent

- pesticides disturb the microbial activity of the soil, adversely affect earth worm, predatory mites.
- Adverse affect on some invertebrates who were responsible soil fertility.
- Destroy **Lady bird beetle and spider** population and thus hamper natural control of pest in vegetable field

Lady Bird Beetle As Predator (Bio-control agent)

C. septempunctata adults

Brumus suturalis feeding on white flies

Menochilus sexmaculatus

spider

Management of the pests

The Objectives

- *An attempt has been made to formulate suitable control measure with the use of:*

  - Botanical Insecticides (Biopesticides)
  - Botanical Extracts (Biopesticides)
  - Microbial toxins (Biopesticides)

Safe management of pest

Sustainable management
-Need of the hour

Experimental details

- **Experimental site:**
  - *Instructional farm, UVKV at Pundibari, Coochbehar, West Bengal, India*

  - Biopesticide Laboratory, Deptt. of Agril. Entomology

- **Experimental location:**
  - *Sub-himalayan region of north-east India (26° 20' latitude and 89°24' longitude)*

- **Period of study:**
  - *2010 and 2011*
- **Season of study:**

  - Post-kharif

  (Early September)
- **Agronomic practices to raise the crop:**
  - *As recommended*
- **Design followed:**
  - *RBD*

Materials used

- **Ladysfinger:** *Variety 'Nirmal-101'*
- **One botanical insecticides**
  - *Azadiractin (Neemactin 0.15 EC) @ 2.5 ml/L*
- **One botanical extracts**
  - ***Spilanthes paniculata* floral parts extract @ 1%, 5.0%**
- **One microbial toxin**
  - **Avermectin (vertimec 1.9 EC) @ 1 ml/L**
- **Sulphur (Sulfex 80 WP) @ 5g/ L and Fenazaquin (Magister 10 EC) @ 2 ml/L, chemical insecticides used as check**

Methodology followed

Methanol extraction of Spilanthes paniculata flower

Treatment details

Treatments	Pesticides/ Biopesticides	Formulation and doses
T_1	*Avermectin*	(Vertimen 1.9 EC) 1 ml/L
T_2	*Azadiractin/Neem*	(Nemactin 0.15 EC) 2.5 ml/L
T_3	Spilanthes flower extract	(1 %) @ 10 ml/L
T_4	Spilanthes flower extract	(5%) 50.00 ml/L
T_5	Neem + Spilanthes 5%	2.5 ml/ L + 50 ml/L
T_6	Sulphur	(Sulfex 80 WDP) 5 g/L
T_7	*Fenazaquin*	(Magister 10 EC) 2 ml/L
T_8	Untreated control	-

Four sprays at an interval of 10 days were made, starting with the initiation of infestation.

Recording observations

- Mite population recorded at 3, 6, and 9 days after each spraying
- population per leaf basis recorded
- The data computed on the per cent of mite suppressed over control and analyzed statistically
- Yield calculated on the basis of fruit yield per plot and converted to quintal/ha

Overall efficacy of biopesticides against *mite*, and fruit yield of ladysfinger

Treatments	Dose ml or g/L(%)	Pretreatment observation (mites/Leaf)	Overall efficacy (% reduction) Days after treatment				Fruit yield(q/h)
			3	6	9	Mean	
T_1=Avermectin (Vertimec 1.9 EC)	1 ml/L	3.89	85.39 (67.62)	72.62 (58.52)	71.19 (57.54)	**76.40** (61.23)	**32.45**
T_2=Neem (Nemactin 0.15 EC)	2.5 ml/L	4.33	48.15 (43.94)	45.94 (42.65)	37.08 (37.51)	43.72 (41.37)	27.44
T_3=*Spilanthes* flower extract (1%)	10 ml/L	4.21	33.93 (35.61)	34.56 (36.01)	27.33 (31.52)	31.94 (34.38)	23.47
T_4= *Spilanthes* flower extract (5%)	50 ml/L	3.89	44.93 (35.61)	34.56 (36.01)	36.47 (37.13)	38.65 (36.25)	26.11
T_5= Neem+*Spilanthes* extract (5%)	2.5 ml/L+ 50 ml/L	4.56	73.42 (57.95)	70.10 (56.79)	68.47 (55.89)	**70.66 (56.88)**	**34.58**
T_6= Sulphur (Sulfex 80 WP)	5 g/L	3.78	80.16 (63.38)	59.01 (51.49)	64.59 (53.50)	**67.92** (56.12)	**31.55**
T_7= Fenazaquin(Magister 10EC)	2ml/L	4.33	86.35 (68.40)	79.97 (64.36)	71.41 (57.37)	**79.24** (63.38)	**31.23**
T_8=Untreated check(control)	-	4.21	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	21.72
SEm(±)	-	-	1.94	2.41	2.03	-	1.71
CD(p=0.05)	-	NS	5.77	7.18	6.03	-	5.08

Figures in parentheses are angular transformed values, NS = Not significant

Results and discussion

- **Fenazaquin resulted best suppression of flea beetle population (79.24% suppression), closely followed by Avermectin (76 .40%) and mixed formulation neem and spilanthes *(70.66%).***

- **However, among the biopesticides, Avermectin was found most effective followed by mixed formulation neem and spilanthes.**

CONCLUSION

From overall observations:

- **most active during May--June and September--October in this region, deliberate control measure should be adopted. Upper canopy densely populated, so properly treated.**

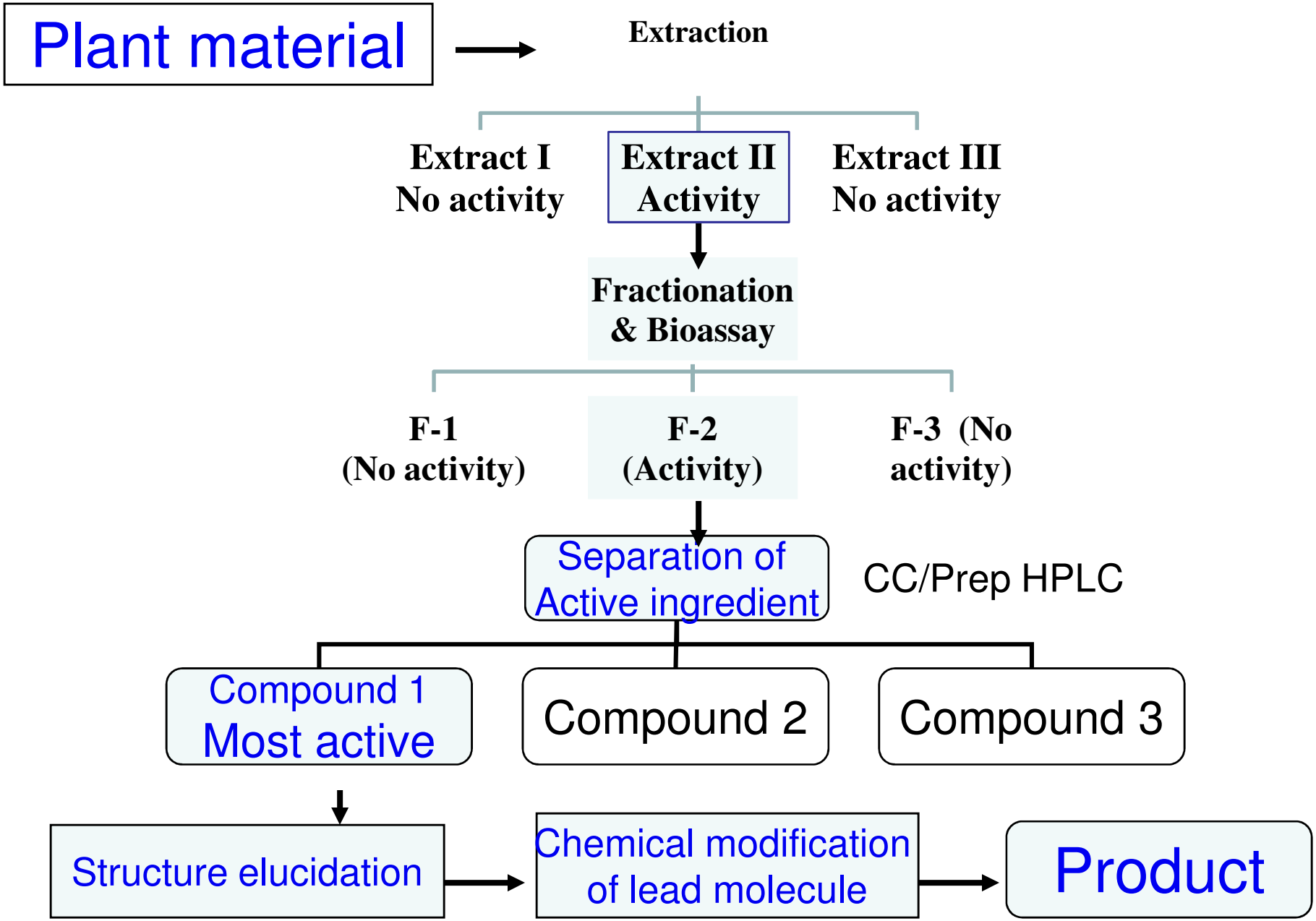
- **Avermectin and Azadiractin with Plant extracts spilanthes (bio-pesticides) gave better control, be incorporated in IPM programme and organic farming in vegetable cultivation due to their:**
  - **moderate to higher efficacy**
  - **Lower toxicity for natural enemies**
  - **Minimum adverse impact on human health**
  - **Safer to the environment**
  - **moderate to high yield potentiality**

Further Scope-- Chemical Analysis of plant parts

NOVEL EXTRACTION TECHNOLOGIES

- Phytosol (fluorinated solvent) extraction
- Super-critical fluid extraction with CO_2
- Pressurized Solvent extraction
- HPCCC or centrifugal Column chromatography
- Microwave assisted Extraction
- Sonicated extraction
- Accelerated solvent extraction

Bioassay Guided Extraction & Isolation

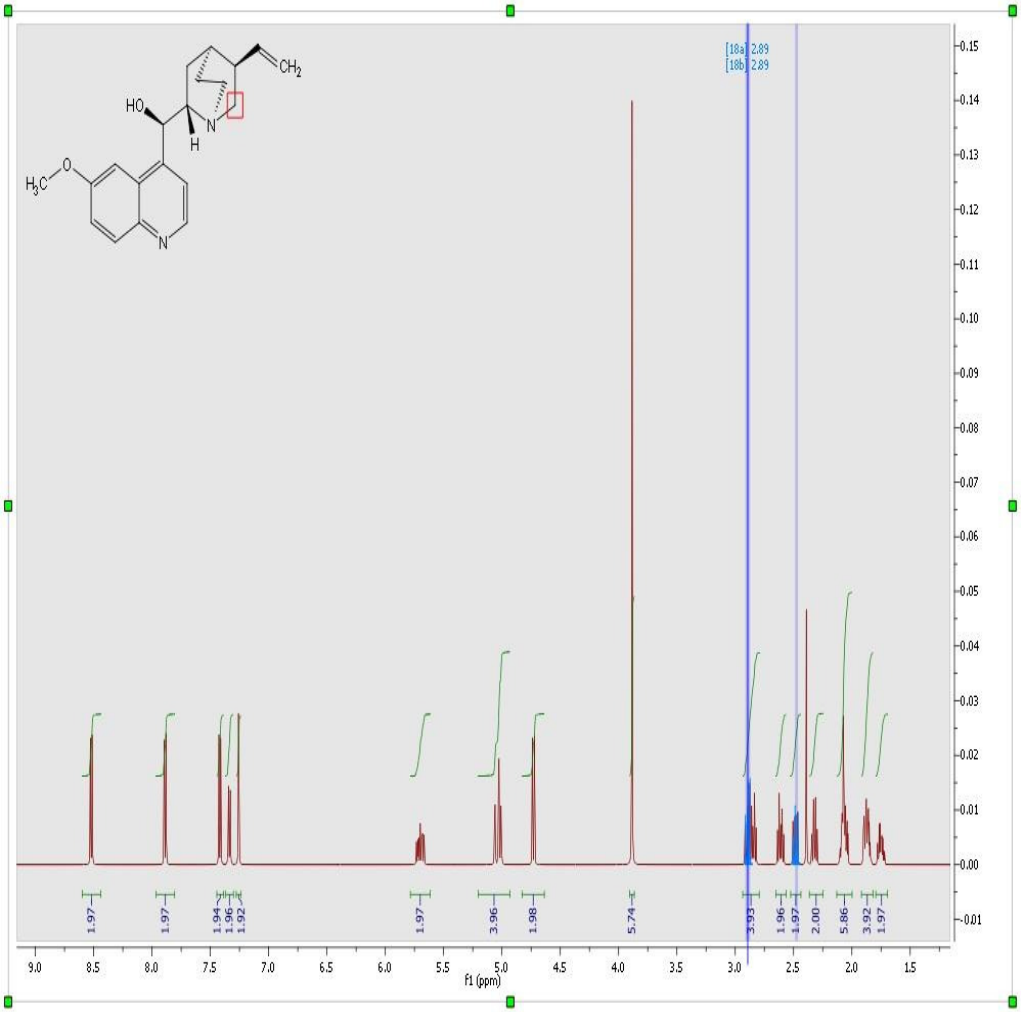


High-Tech ANALYTICAL TECHNIQUES USED

- HP-TLC
- Gas chromatography (GC)
- High performance liquid chromatography (HPLC)
- Mass spectroscopy (MS)
- GC-MS, GC-MS-MS
- HPLC-MS, HPLC-MS-MS
- NMR (Nuclear Magnetic Resonance Spectroscopy)

Structure Identification of Chemicals Using Nuclear Magnetic Resonance (NMR) Spectroscopy

NMR (900 M HZ) spectroscopy



Acquired Proton NMR spectrurm


Thank
You