UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Entomology & Biologicals

Arthropod Pest Management in Organic Vegetables

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Outline

- IPM
- Common vegetable pests
- Common pest management options
- Biopesticides
- Modes of action/mechanisms of infection
- Effective management strategies
- Field examples

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New IPM Model

Dara, 2019

Common pests of vegetables

Coleoptera

- Click beetle
- Colorado potato beetle
- Flea beetle
- Pepper weevil
- Spotted cucumber beetle
- Striped cucumber beetle
- Wireworms

Diptera

- Cabbage maggot
- Leafminers
- Seedcorn maggot

Homoptera

- Aphids
- Bagrada bug
- False chinch bug
- Lygus bug
- Psyllids
- Tomato bug
- Whiteflies

Lepidoptera

- Armyworms
- Budworms
- Cutworms
- Diamondback moth
- Earworms
- Fruitworms
- Hornworms
- Imported cabbageworm
- Leafrollers
- Loopers
- Potato tuberworm
- Tomato pinworm

Thysanoptera

- Thrips

Acarina

- Bulb mites
- Spider mites

Others

- Symphylans
- Spotted snake millipedes

Feeding habit: Chewing, boring, rasping/scraping, piercing and sucking, etc.

Feeding habitat: Surfaces or bored plant tissues (leaves, roots, stems, or fruits), mines, rolls, folds, etc.

Control option: Based on pest biology, feeding behavior/habitat, mode of action of the option, prevention/curative, environmental conditions, and others

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Common pest management options

- Host plant resistance
- Sanitation
  - Starting with clean material
  - Managing alternative/weed hosts
  - Removing and destroying infested plants
  - Managing crop residue
- Modification of agronomic practices
  - Planting time, plant density, crop rotation, trap crops, mixed cropping, and others
  - Nutrient and irrigation management
  - Biostimulants to improve crop health and induce resistance
  - Minerals that strengthen plant tissues and impart pest tolerance
- Biological control
  - Insectary plants and other conservation approaches
  - Releasing natural enemies
- Physical or mechanical control
  - Row covers, screens, sticky tapes, reflective material, and others
  - UV light

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Common pest management options

- Pesticide applications
  - Botanical pesticides
  - Microbial or microbial metabolite-based pesticides
  - Others including diatomaceous earth, minerals, and fatty acids
- Choice of pesticides
  - Chewing vs. sucking insects; surface feeders vs. borers/miners/rollers; underground vs. aboveground
  - Different kinds of products for different life stages
- Microbial control
  - Application of biopesticides based on bacteria, fungi, nematodes, and viruses
  - Natural infections or fungal epizootics
- Behavioral control
  - Baits/traps
  - Mating disruption

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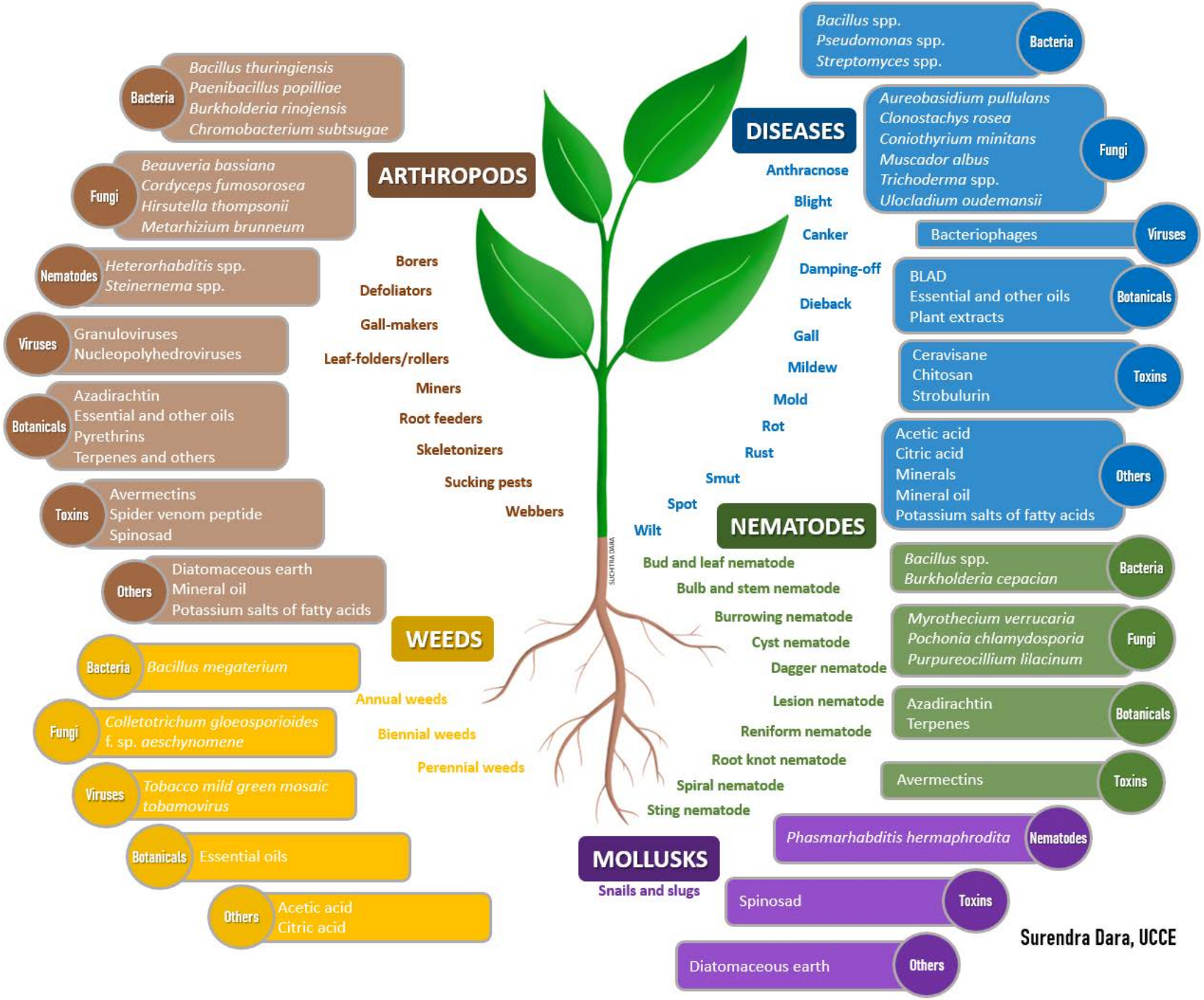
Biopesticides



Surendra Dara, UCCE

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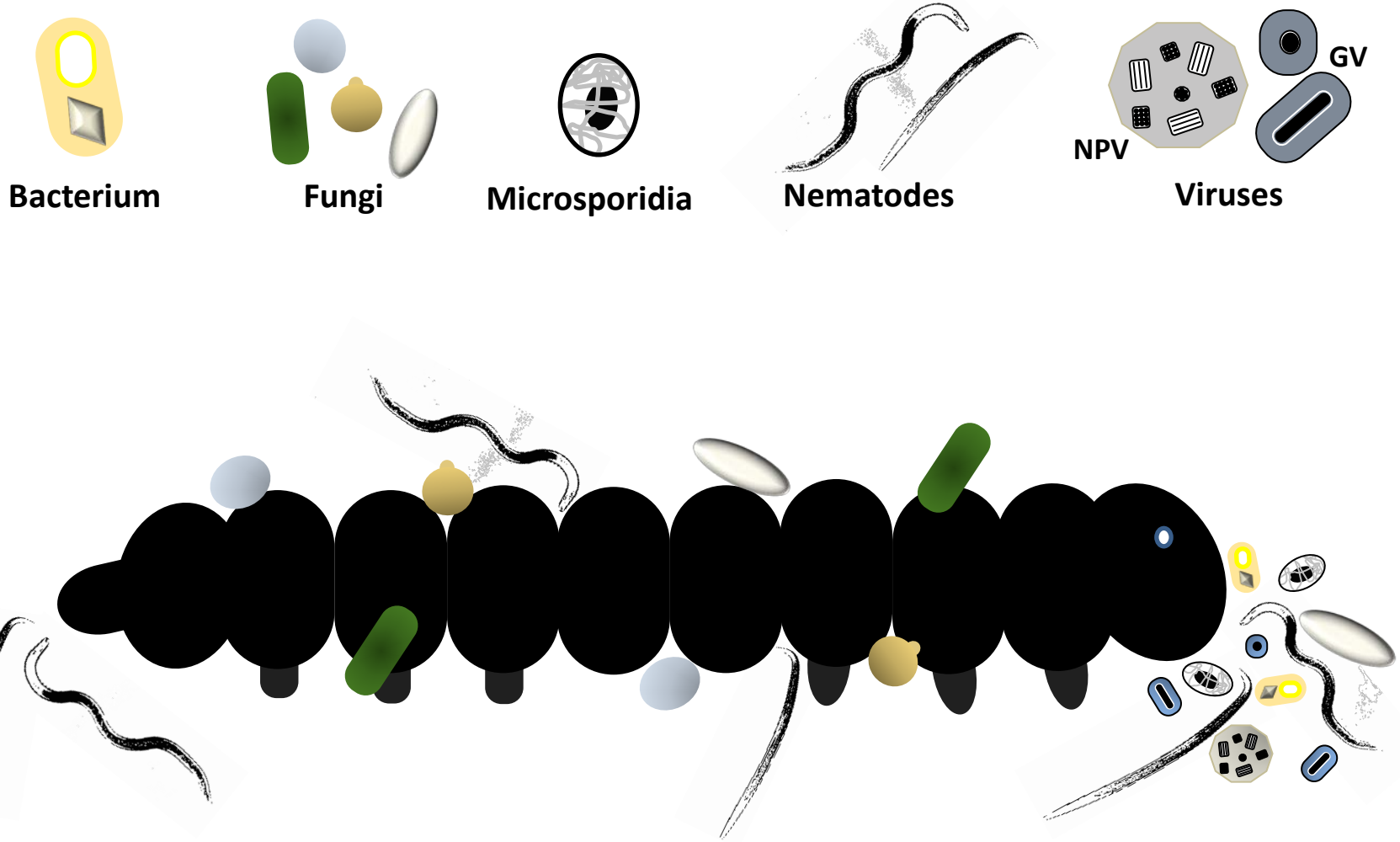
Entomopathogens



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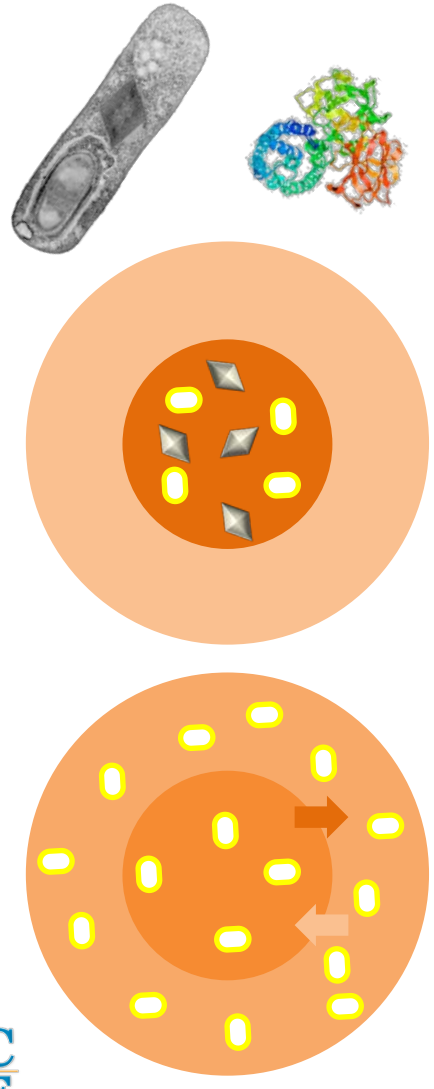
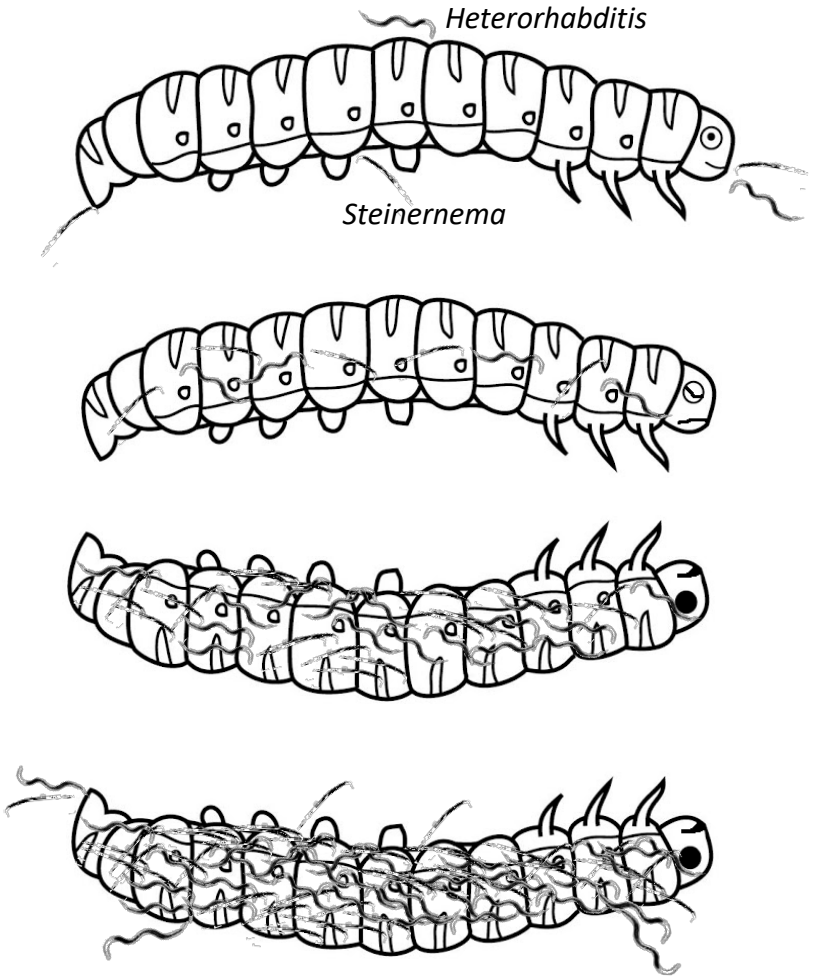
Mechanisms of infection

Bacillus thuringiensis

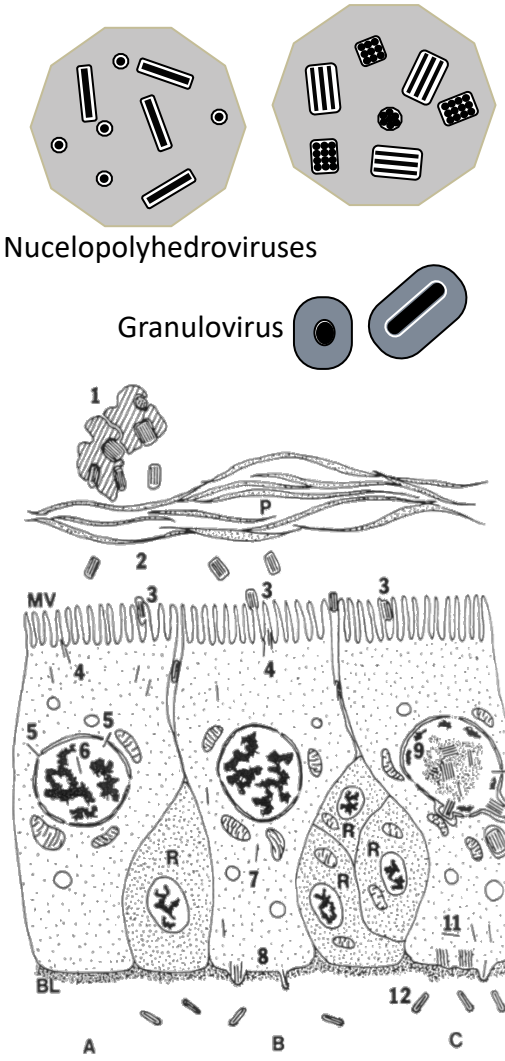


Entomopathogenic Fungi

Entomopathogenic Nematodes



Baculoviruses



Fungal and viral infections

Cordyceps fumosorosea-
Bagrada bug

Beauveria bassiana

Metarhizium brunneum

Beauveria bassiana-Lygus bug

Entomophthora planchoniana-
Strawberry aphid

Entomophthora muscae-
Spotted-wing drosophila

Source: Tom Mann

Pandora neoaphidis-
Green peach aphid

Source: Unknown

Moribund larva

Liquefied larva

NPV-killed beet armyworm

Source: Harry Kaya

GV-killed geometrid larva

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Modes of action

AI	IRAC	Mode of Action
Pyrethrins (*Chrysanthemum cinerariaefolium*)	3	Sodium channel modulators causing hyperexcitation and sometimes nerve block
Spynosyns (*Polysaccharospora spinosa*)	5	Nicotinic acetylcholine receptor allosteric modulators – Site I causing hyperexcitation of the nervous system
Avermectins (*Streptomyces avermitilis*)	6	Glutamate-gated chloride channel allosteric modulators causing paralysis
Spider venom peptide (GS-omega/kappa HXTX-Hv1a peptide) (Australian funnel-web spider)	32	Nicotinic acetylcholine receptor allosteric modulators – Site II causing hyperexcitation of the nervous system
Azadirachtin (*Azadirachta indica*)	UN	Unknown/uncertain Insecticide/antifeedant/repellent/IGR
Botanical extracts/oils	UNE	Unknown/uncertain Insecticide/antifeedant/repellent

No organic label

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Effective management strategies

- Integrated pest management
  - Take advantage of all available options
  - Consider additive and synergistic effect of multiple control options
  - Follow IPM principles beyond pest management
- IPM = GAP (Good Agricultural Practices) = CCC (Comprehensive Crop Care)
- Insecticide resistance management
  - Pests develop resistance to all kinds of pesticides
  - Avoid repetitive use of the same control option that has a risk of resistance development
- Balanced approach for both short-term and long-term benefits
- Use of modern technologies that enhance pest control efficacy
- IPM is especially more important in organic crop production

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Questions

1. Choice of pesticide sometimes depends on the feeding behavior and habitat of the pest

A. True
B. False

2. Adopting an IPM strategy is important

A. As a good agricultural practice
B. For effective pest management
C. For insecticide resistance management
D. For both long-term and short-term benefits
E. All of the above

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Thank you!

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Surendra Dara's Profile:

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