

## Succession of Potential Insect and Mite Pests and Known Insect Predators and Parasitoids on *Jatropha curcas* L. in Andhra Pradesh, India

J. Satyanarayana<sup>1</sup>, R. Sudhakar<sup>2</sup>, G. Sreenivas<sup>3</sup>, D. V. V. Reddy<sup>4</sup> and T. V. K. Singh<sup>1\*</sup>

<sup>1</sup>Department of Entomology, <sup>2</sup>Department of Plant Pathology, <sup>4</sup>Department of Plant Physiology  
College of Agriculture, ANGRAU, Rajendranagar, Hyderabad, Andhra Pradesh (500 030), India

<sup>3</sup>Tree Borne Oilseeds India Ltd, Hyderabad, Andhra Pradesh, India

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### Correspondence to

\*E-mail: tvksingh@yahoo.com

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### Abstract

Field experiments were conducted at Tree Oils India Limited (TOIL) farm near Zahirabad, Medak District, Andhra Pradesh, India on succession of insect pests of *Jatropha curcas* L. during January 2010 and December, 2011. *Jatropha* was infested by an overlapping sequence of 18 insect species. Out of these, the leaf webber, *Salebria morosalis* (Saalm Uller); bugs, *Chrysocoris purpureus* (Westw.) and *Scutelleria nobilis* (Fabricius); papaya mealy bug, *Paracoccus marginatus* Williams and Granara de Willink and stem girdler, *Sthenias grisator* (Fabricius) occurred right through the crop growth from their first appearance and were, therefore, designated as 'major' pests. A group of predatory coccinellids, *Brumoides suturalis* (Fabricius), *Coccinella septempunctata* L. and *Menochilus sexmaculatus* (Fabricius); spiders; green lacewing, *Chrysopa scelestes* Banks; black ant; wasps, *Polistes hebraeus* Fabricius and *Vespa orientalis* L.; and parasitoid, *Acerophagous papaya* (Noyes and Schauff) were principal biotic agents found.

### 1. Introduction

*Jatropha curcas* L. is a native of Mexico and tropical America but is naturalized throughout tropical to sub-tropical countries of Asia and Africa. It has been used as a medicinal plant for centuries. Further, oil extracted from the seeds of *J. curcas* has been promoted as a source of bio-fuel. As a response to increasing oil import prices, the Government of India examined various bio-alternatives to mineral oil. In India, *J. curcas* is gaining importance commercially as a biodiesel plant and is being advocated for development of wastelands and dry lands. It is popularly called energy plantation. India has 146 m ha of wasteland (Shankar and Dhyani, 2006), of which 33 m ha can be used for *Jatropha* plantation, in addition to arable land that is being used for plantation. *Jatropha curcas* L. is commonly known as physic nut, purging nut, ratanjot, jamalghota or kalaaranda. It is reported to be cultivated in central and western parts of India, Madhya Pradesh, Maharashtra, Rajasthan, Gujarat and also southern states like Andhra Pradesh and Tamil Nadu (Kumar et al., 2004).

The seed oil and nut extracts of this crop showed insecticidal

properties against crop pests forming a source for botanical pesticides (Grainage and Ahmed, 1998; Solsoloy, 1993). Contrary to popular belief that toxicity and insecticidal properties of *J. curcas* are a sufficient deterrent for insects that cause economic damage, several groups of insects have overcome this barrier. Particularly noteworthy is the insect order Heteroptera that has at least 15 species in Nicaragua, which can infest the crop (Grimm and Fuhrer, 1998). The global list of phytophagous insects consisting of 60 species in 21 families and four orders has been compiled in Australia (Shankar and Dhyani, 2006),

The crop is infested by numerous pests including a millipede, *Julus* sp.; locust, *Oedaleus senegalensis* (Krauss); cushion scale, *Pinnapis strachani* (Cooley); tailed mealy bug, *Ferrisia virgata* Ckii.; blue bug, *Calidea dregei*; Green stink bug, *Nezara viridula* (L.); and *Spodoptera litura* (F.) (Meshram and Joshi, 1994) causing considerable yield loss. Twelve species of bugs were reported to feed on physic nut. In addition, the stem borer *Lagocheirus undatus* (Voet) (Coleoptera; Cerambycidae), grasshoppers, leaf eating beetles and caterpillars, and leaf



hoppers were found to damage the crop in Nicaragua (Grimm and Maes, 1997). Heteropteran bugs, *Pachycoris klugii* (Burmeister) and *Leptoglossus zonatus* (Dallus) were found to suck sap from leaves and unripe fruits of *Jatropha* in Nicaragua and a Cape Verdean Provenance (Grimm and Fuhrer, 1998). *Retithrips syriacus* (Mayet) was initially detected in 1993 on *Jatropha* leaf during a pre-departure quarantine inspection in Puerto Rico (Medina-Gaud and Franqui, 2001). Gour et al. (1994) identified leaf miner, *Acrocercops conflua* Meyrick infesting *Jatropha* in Andhra Pradesh, India.

Though a few workers in the recent past have attempted to study the pest complex of *Jatropha*, it appears that no concerted effort has been made to work out the pest complex in relation to crop phenology in detail in a set of agroclimatic conditions.

The crop phenology observed in the seven year old *Jatropha* plantation was as follows. In general, the crop goes to dormancy in winter (i.e November-January) by shedding its leaves. With the rise in temperatures during last week of January the plant breaks its dormancy and starts its vegetative stage. *Jatropha* flowering starts from March and reaches peak during May-June and gives different flushes up to September.

In order to evolve pest management strategies which are ecologically sound, economically feasible and sociologically acceptable with rational approach to the pest problem in *Jatropha*, the present study on insect pest succession with regard to crop phenology was under taken under Andhra Pradesh conditions.

## 2. Materials and Methods

Field experiments were conducted at Tree Oils India Limited (TOIL) farm in Zahirabad, Medak District of Andhra Pradesh, India on succession of insect pests of *Jatropha* during January 2010 through December 2011. The crop was planted during *kharif* 2003 in an area of 40 acres with a spacing of 3×3 m<sup>2</sup>. Observations were recorded at fortnightly interval on seven years old plantation during various stages of crop on 25 randomly selected plants. Each plant was examined for the live stages of insects and their damages.

## 3. Results and Discussion

Eighteen insect and mite species belonging to different groups were found causing damage to *Jatropha curcas* L. at different stages of crop growth. The succession of insect pests on *J. curcas* reveals that the population of different pest species occur in an overlapping manner and the crop is continuously under attack by one or the other insect pest and some of them causing serious damage (Table 1 and Plates).

Appearance of insect pests begun with damage of leaf webber, *Salebria morosalis* (Saalm Uller) (Plate a) causing webbing of twig and terminal leaves along with shoots and feeding on it followed by leaf miner, *Acrocercops conflua* Meyrick (Plate c) and mealy bugs *Ferrisia virgata* (Ckll.) (Plate i), *Paracoccus marginatus* Williams and Granara de Willink. Though the webber damage was continued up to pod formation stage, the infestation was serious during active vegetative stage and flowering stages. Leaf miner population attained peak during late vegetative stage and infested the crop entering in to deciduous condition. Mealy bugs are active during late vegetative stage. The Papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink was recorded for the first time on *Jatropha* in Andhra Pradesh. It attained peak levels during April-May, 2011 during which the crop was at its peak flowering and first flush of fruits are formed.

The papaya mealybug feeds on the sap of plants by inserting its stylets into the epidermis of the leaf, as well as into the fruit and stem. In doing so, it injects a toxic substance into the leaves resulting-chlorosis, plant stunting, leaf deformation, early leaf and fruit drop, a heavy buildup of honeydew, and death (Plate j).

The defoliator pests viz., black hairy caterpillar, *Estigmene lactinea* (Gram.), tussock caterpillar, *Orygia postica* (Walker.) and grasshoppers, *Atractomorpha ranacea* (Fabricius) (Plate n), appeared at active vegetative stage of the crop and sucking pests viz., *Eurybrachys tomentosa* (Fabricius) and *Pulvinaria floccifera* (Green) (Plate k) appeared at flowering-pod formation stage of the crop in 'stray' instances. Ash weevils, *Myloccerus maculosus* (Guer.) appeared from vegetative to flowering stage of the crop growth causing notching of leaves.

Spotted bugs recorded during pod formation were *Chrysocoris purpureus* (Westw.) (Plate e) and *Scutelleria nobilis* (Fabricius) (Plate f). After the leaf webber, the bugs were the major pests causing damage by sucking sap leading to flower fall, fruit abortion and development of malformed hollow seeds. From the feeding punctures of the fruit, fungus gains entry into the pods and rotting of fruits takes place during rainy season. Yellow mite, *Polyphagotarsonemus latus* (Banks) (Plate l), bihar hairy caterpillar, *Spilosoma obliqua* Walker (Plate m) and semilooper, *Achaea janata* L., appeared sporadically at different stages of the crop growth in both the years. During fag end of the crop, thrips, *Retithrips syriacus* (Mayet) (Plate d) and red spider mite, *Tetranychus urticae* (Koch) were active and persisted throughout the winter months till February.

Stem girdler, *Sthenias grisator* (Fabricius) (Plate b) on *Jatropha* was recorded at Zahirabad, Medak district of Andhra Pradesh





Plate a: *Salebria morosalis* webbing inflorescence



Plate e: *Chrysocoris purpureus* adults



Plate b: *Sthenias grisator* adult damaging on branch



Plate f: *Scutelleria nobilis* adult



Plate c: *Acrocercops conflua* on leaves



Plate g: Spotted bugs damage on pods



Plate d: *Retithrips syriacus* damage on leaves

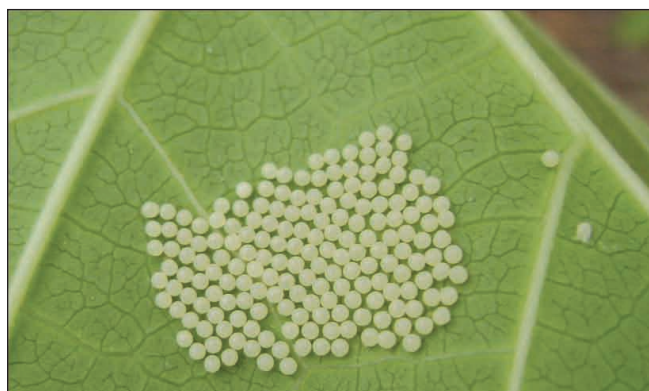


Plate h: Eggs of spotted bugs





Plate i: *Ferrisia virgata* infestation



Plate k: *Pulvinaria floccifera* infestation



Plate l: *Polyphagotarsonemus latus* damage



Plate m: *Spilosoma obliqua* larvae



Plate j: *Paracoccus marginatus* damage on Jatropha



Plate n: *Atractomorpha ranacea* adult

and this is the first record of this pest attacking a crop. The pest appeared during pod maturity stage of the crop. The adult beetle characteristically girdles the branches leading to breaking of branches.

Matching complex of natural enemies started with the appearance of coccinellids, *Brumoides suturalis* (Fabricius), spiders, green lacewings, *Chrysopa scelestes* Banks, black ant

at active vegetative stage and were found active till flowering and pod formation stage of the crop. Wasps, *Polystes hebreus* Fabricius and *Vespa orientalis* Linnaeus were active during flowering and pod formation stage of the crop. Ladybird beetles, *Coccinella septempunctata* Linn. and *Menochilus sexmaculatus* (Fabricius) and parasitoid wasp, *Acerophagus papaya* (Noyes and Schauff) on papaya mealybug were active

Table 1: Succession of insect Pests on *Jatropha curcas* L. between January, 2010 and December, 2011

Common Name	Scientific name	Crop stage	Occurrence		Status	
			2010	2011	2010	2011
Leaf webber	<i>Salebria morosalis</i> (Saalm Uller) ( <i>Pempelia morosalis</i> ), Pyralidae, Lepidoptera	Vegetative-pod formation	Regular	Regular	Major	Major
Leaf miner	<i>Acrocercops conflua</i> Meyrick, Gracillaridae, Lepidoptera	Vegetative-pod formation	Regular	Regular	Minor	Minor
Spotted bug	<i>Chrysocoris purpureus</i> (Westw.), Scutelleridae, Hemiptera	Flowering-pod maturity	Regular	Regular	Major	Major
Spotted bug	<i>Scutelleria nobilis</i> (Fabricius), Scutelleridae, Hemiptera	Flowering-pod maturity	Regular	Regular	Major	Major
Thrips	<i>Retithrips syriacus</i> (Mayet), Thripidae, Thysanoptera	Pod formation	Regular	Regular	Minor	Minor
Mealy bugs	<i>Ferrisia virgata</i> (Ckll.), Pseudococcidae, Hemiptera	Vegetative-pod formation	Sporadic	Sporadic	Minor	Minor
Papaya Mealy bug	<i>Paracoccus marginatus</i> Williams and Granara de Willink, Pseudococcidae, Hemiptera	Vegetative-pod formation	Sporadic	Sporadic	Minor	Major
Leaf hopper	<i>Eurybrachys tomentosa</i> (Fabricius), Eurybrachidae, Hemiptera	Vegetative	Stray	Stray	Occasional	Occasional
Soft scales	<i>Pulvinaria floccifera</i> (Green), Coccidae, Hemiptera	Flowering-pod maturity	Stray	Stray	Minor	Minor
Red spider mite	<i>Tetranychus urticae</i> (Koch), Tetranychidae, Acarina	Flowering-pod maturity	Regular	Regular	Minor	Minor
Black hairy caterpillar	<i>Estigmene lactinea</i> (Gram.), Arctiidae, Lepidoptera	Vegetative	Stray	Stray	Occasional	Occasional
Tussock caterpillar	<i>Orygia postica</i> (Walker.), Lymantriidae, Lepidoptera	Vegetative	Stray	Stray	Occasional	Occasional
Yellow mite	<i>Polyphagotarsonemus latus</i> (Banks), Tarsonemidae, Acarina	Flowering-pod maturity	Sporadic	Sporadic	Minor	Minor
Stem girdler	<i>Sthenias grisator</i> (Fabricius), Cerambycidae, Coleoptera	Pod maturity	Regular	Regular	Major	Major
Grass hoppers	<i>Atractomorpha ranacea</i> (Fabricius), Acrididae, Orthoptera	Vegetative	Stray	Stray	Occasional	Occasional
Ash weevil	<i>Myloccerus maculosus</i> (Guer.), Curculionidae, Coleoptera	Vegetative-Flowering	Sporadic	Sporadic	Occasional	Occasional
Bihar Hairy caterpillar	<i>Spilosoma obliqua</i> Walker, Arctiidae, Lepidoptera	Pod maturity	Sporadic	Sporadic	Occasional	Occasional
Semilooper	<i>Achaea janata</i> L., Noctuidae, Lepidoptera	Vegetative	Sporadic	Sporadic	Occasional	Occasional





Table 2: Succession of natural enemy complex of *Jatropha* between January, 2010 and December, 2011

Common name	Scientific name	Crop stage
Lady bird beetle	<i>Coccinella septempunctata</i> Linn.	Pod formation
Lady bird beetle	<i>Menochilus sexmaculatus</i> (Fabricius)	Pod formation
Lady bird beetle	<i>Brumoides suturalis</i> (Fabricius)	Vegetative-flowering
Spiders	<i>Unidentified</i>	Vegetative-pod formation
Green lacewing	<i>Chrysopa scelestes</i> Banks	Active vegetative-pod maturity
Yellow wasp	<i>Polystes hebreus</i> Fabricius	Flowering - pod formation
Banded wasp	<i>Vespa orientalis</i> Linnaeus	Flowering - pod formation
Black ant	<i>Unidentified</i>	Vegetative-pod formation
Endoparasitoid wasps	<i>Acerophagus papaya</i> (Noyes and Schauff)	Pod formation

only during pod formation stage of the crop (Table 2).

#### 4. Conclusion

Out of eighteen insect and mite species infesting *Jatropha*, the leaf webber, *S. morosalis*; bugs, *C. purpureus* and *S. nobilis*; papaya mealy bug, *P. marginatus* and stem girdler, *S. grisator* occurred right through the crop growth from their first appearance and were, therefore, designated as 'major' pests. The papaya mealy bug, *P. marginatus* and stem girdler, *S. grisator* were recorded for the first time on *Jatropha* in Andhra Pradesh. A group of predatory coccinellids, *B. suturalis*, *C. septempunctata*, and *M. sexmaculatus*; spiders; green lacewing, *C. scelestes*; black ant; wasps, *P. hebreus* and *V. orientalis*; and parasitoid, *A. papaya* were principal biotic agents found.

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