

Screening of *Karanj*, *Pongamia pinnata* L. against various insect pests under agro-silvi pattern of cropping system at Raipur (C.G.)

■ CHANDRAMANI SAHU*, J. L. GANGULI, A. KERKETTA AND K.L. PAINKRA

Department of Entomology, College of Agriculture, Indira Gandhi Agricultural University, RAIPUR (C.G.) INDIA

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ABSTRACT

Six provenances of *P. pinnata* were screened namely Raipur, Ambikapur, Jabalpur, Nainpur, Zaheerabad and Keesaragutta. Fortnightly recorded of various insect pests along with the number of their associated natural enemies were also recorded. The major insect pests were the common banded awl, leaf webber, leaf blotch miner, pod borer, leaf hopper, leaf eating beetle, mealy bugss and green lace wing, mantis along with some species of spiders were observed as the natural enemies. Maximum population of common banded awl, *Hasora chromus* was recorded as 17.00 larvae/twig on provenance Jabalpur. Maximum infestation (36.3%) seeds were by pod borer, *Ephestia* sp. was recorded on Nainpur. Population of leaf webber was maximum (3.92 larvae/twig) on Jabalpur and Keesaragutta, blotch miner (8.41 blotches/leaf) on Jabalpur, leaf eating beetles (5.25 beetles/twig) Zaheerabad, leaf hoppers 5.58 (nymphs and adults/ leaf) on Keesaragutta, mealy bugss (6.50 nymphs and adults/twig).

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*Corresponding author:

Email : chandrasahu2111@gmail.com

INTRODUCTION

The integration of farming with forestry practices on the farm for the benefit of agriculture is known as agro-forestry. Agro-forestry has a tremendous scope in India as it has achieved self-sufficiency in food production and its attention is becoming more focused on the ecological problems and shortage of fuel, fodder, forest produce and other outputs as well as unemployment.

The present studies on screening of insect pests

against six provenances of *Karanj*, *Pongamia pinnata* L. Pierre. It is a leguminous medium sized glabrous tree. It grows easily from seed. Historically, this plant has long been used as a source of traditional medicines, animal fodder, green manure, timber, fish poison, fuel and recently has been projected as an important source of biodiesel. *P. pinnata* has an added advantage of the nitrogen fixing ability and drought resistance due to its nodulation properties (Sangwan *et al.*, 2010). Losses due to insect pests are considered one of the important constraints responsible for low output in case of many

agricultural, horticultural crops and also in beneficial shrubs and tree sp. There are about 30 species of insect pests recorded to cause damage to *Pongamia* raised usually as avenue planting and strip plantations on marginal lands (Orwa *et al.*, 2009). They include gall inducers, leaf miners, defoliators, shoot bores, sap suckers, flower feeders and fruit seed borers. Some of the important pests are *Parnara mathias* F., *Gracillaria* spp, *Indarbela quadrinotata* (Walker), *Mylocerus* spp. and *Acrocercops* spp. Various insect pests observed about 24 during investigation that includes like gall inducers, leaf miners, defoliators, shoot bores, sap suckers, flower feeders and fruit seed borers. Anonymous (2010) reported about 30 insects feeding on *P. pinnata* including defoliators, blotch miner, sucking pests, bark feeders and pod borers and among these the pod borer, *Ephestia* spp. is an important pest causing deterioration to seed qualitatively and quantitatively there by reducing oil content significantly.

MATERIAL AND METHODS

The present investigation entitled “Studies on various provenances of *Karanj*, *Pongamia pinnata* L. Pierre against major insect pests intercropped with paddy under different Agro-forestry cropping pattern” was conducted at the Agro-forestry farm, College of Agriculture, I.G.K.V., Raipur during August 2013 to April 2014. The experiment was conducted in Randomized Block Design with 6 provenances each replicated three times. For taking observations, the whole experimental field of Agro-forestry system was divided into 6 blocks, each block consisting of 18 trees of *Karanj*, *P. pinnata*. Observations were recorded on the various types and number of insect pests and their related natural enemies at fortnightly intervals from each block on three randomly selected trees on two randomly selected branches at lower and upper canopy levels.

RESULTS AND DISCUSSION

Six provenances of *Karanj*, *Pongamia pinnata* were screened namely Raipur, Ambikapur, Jabalpur, Nainpur, Zaheerabad and Keesaragutta, against pod borer, common banded awl, leaf webber, leaf blotch miner, leaf hopper, leaf gall maker, bark borer, leaf defoliator, beetle, green bug, gundhi bug, thrips, leaf folder, mealy bugs, cow bug, hairy caterpillar, hawk moth and red cotton bug. Observations were recorded at 15 days interval and

the data thus, collected was analyzed in Randomized Block Design using square root transformations. This is a first time recorded of various insect pests on *Karanj*, *P. pinnata* are as follows:

Screening of various provenances of *Karanj*, *P. pinnata* against common banded awl, *Hasora chromus* :

Maximum population of common banded awl, *H. chromus* was observed in the provenance Jabalpur which was recorded as 17.00 larvae/twig and minimum population was observed in the provenance Ambikapur to be of 5.67 larvae/ twig during the period of observation *i.e.* August to April (Table 1 and Plate 1). Hence, it can be concluded that Jabalpur provenance was more susceptible while Ambikapur provenance showed some tolerance against the attack of *H. chromus*. Harinath *et al.* (2012) reported that all the stages of *H. chromus* could be spotted out during August to November, which correspond post monsoon in the study locality.

Screening of various provenances of *Karanj*, *P. pinnata* against leaf webber; *Glyphodes negatalis* Walker (Lepidoptera: Pyralidae) :

Orwa *et al.* (2009) observed that the neonate larvae fed on the leaf and skeletonized the leaves of *Karanj*, while the older larvae folded and webbed the leaves and fed within. Severe infestation was found in standing *Karanj* nursery in this region causing around 50-70 per cent damage. During present investigation, population of leaf webber was observed in the provenance Jabalpur and Keesaragutta with maximum which was recorded to be 3.92 larvae/ twig and minimum population was observed in the provenance Nainpur (Table 1, Plate 2 and 3) which of 1.17 larvae/ twig during the month of August to April. So Jabalpur and Keesaragutta provenances was more susceptible but Nainpur provenance was less susceptible to wards the attack of leaf webber. Alcockm (1903) reported caterpillar of *G.negatalis*, has been found in Kolkata feeding on the leaves of the Piplal tree, *Ficus religiosa* Linn. It also feeds on the fruit of *Dillenia ittdica*. Linnaeus.

Screening of various provenances of *Karanj*, *P. pinnata* against leaf blotch miner :

The mean maximum population of blotch miner was observed in the provenance Jabalpur which was

recorded 8.41 blotches/leaf and minimum in the provenance Zaheerabad which was recorded as 3.33 blotch/leaf during August to April (Table 1, Plate 4 and 5). Hence, it can be concluded that Jabalpur provenance was more susceptible and Zaheerabad provenance was less susceptible to the attack of leaf blotch miner.

Screening of various provenances of *Karanj*, *P. pinnata* against leaf hopper :

The mean maximum population of leaf hoppers was observed in the provenance Keesaragutta recorded as 5.58 nymphs and adults/ leaf and minimum population was observed in the provenance Ambikapur which recorded 1.00 nymphs and adults/ leaf during August to April (Table 1, Plate 8 and 9). Hence, it can be concluded that Keesaragutta provenances was more susceptible but Ambikapur provenance had some tolerance against the attack of leaf hopper.

Screening of various provenances of *Karanj*, *P. pinnata* against leaf eating beetle :

Beetles population were observed maximum in the provenance Zaheerabad which was recorded 5.25 beetles/twig and minimum population was observed in the provenance Keesaragutta which was recorded 2.50 beetles/twig in during the month of August to April (Table 1, Plate 6 and 7). Hence, it can be concluded that Zaheerabad provenance was more susceptible but Keesaragutta provenance was less susceptible to the attack of beetle.

Screening of various provenances of *Karanj*, *P. pinnata* against mealy bugs, *Ferisia virgata* :

Maximum population of mealy bugss was observed in the provenance Jabalpur which was recorded as 6.50 nymphs and adults/twig. No insects were recorded from the provenance Zaheerabad and Keesaragutta in during the month of August to April (Table 1 and Plate 10). Hence, it can be concluded that Zaheerabad and Keesaragutta provenances was tolerant or least prone to the attack of mealy bugs while Jabalpur provenance was susceptible.

Screening of various provenances of *Karanj*, *P. pinnata* against pod borer, *Ephestia* spp. :

Maximum population of pod borer larvae was observed in the provenance Nainpur which recorded 36.3

per cent infested pods and minimum pod damage was observed in the provenances Zaheerabad which recorded 5.0 per cent damaged pods at green immature stage of pod. Hence, it can be concluded that Nainpur provenance was more susceptible in comparison to Zaheerabad and Keesaragutta provenance which was less susceptible to the attack of pod borer. Other provenances showed moderate infestation (Plate 11 and 12)

Screening of various provenances of *Karanj*, *P. pinnata* against leaf defoliator :

Mean maximum population of leaf defoliator was observed in the provenance Ambikapur (Table 1) which was recorded 2.74 larvae/ twig. No insects were recorded from the provenances Jabalpur and Nainpur in during the month of August to April. Hence, it can be concluded that Jabalpur and Nainpur provenance proved to be tolerant or least prone to the attack of leaf defoliator while Ambikapur provenance was susceptible.

Screening of various provenances of *Karanj*, *P. pinnata* against tussock hairy caterpillar, *Euproctis* spp. :

More population of hairy caterpillars was observed in the provenance Nainpur which was recorded as 2.92 larvae / twig. No insects were recorded from the provenances Zaheerabad and Keesaragutta in during the month of August to April (Table 1). Hence, it can be concluded that Zaheerabad and Keesaragutta provenances tolerant or less prone to the attack of hairy caterpillar while Nainpur provenance was susceptible.

Screening of various provenances of *Karanj*, *P. pinnata* against hawk moth :

Population is maximum of hawk moth larvae were observed in the provenance Raipur which was recorded 0.42 larvae/ twig. No insects were recorded from the provenances Ambikapur, Nainpur, Zaheerabad and Keesaragutta during the period of observation (Table 1). Hence, it can be concluded that Ambikapur, Nainpur, Zaheerabad and Keesaragutta provenances were tolerant or less prone to the attack of hawk moth while Raipur provenance was susceptible.

Screening of *Karanj*, *P. pinnata* against bark borer:

The mean maximum population of bark borer was observed in the provenance Nainpur which was recorded



Plate 1: Larva and adult of common banded awl, *Hasora chromus*



Plate 2: Damage caused by leaf webber



Plate 3: Adult leaf webber



Plate 4: Leaf infested by leaf blotch miner



Plate 5: Larva and adult of leaf blotch miner

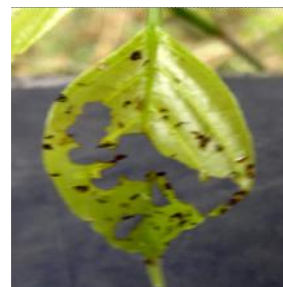


Plate 6: Damage caused by leaf eating beetle



Plate 7: Adult of leaf eating beetle



Plate 8: Damage caused by leaf hopper



Plate 9: Adult of leaf hopper



Plate 10: Mealy bugs



Plate 11: Symptoms of infested fruits due to pod borer, *Ephestia* sp.



Plate 12: Eggs, larva and adult of pod borer, *Ephestia* sp.



Contd... Plate 1

Plate contd...



Plate 13: larva of leaf defoliator



Plate 14: Larva of hairy caterpillar



Plate 15: Adult of hairy caterpillar



Plate 16: Larva of hawk moth



Plate 17: Damage caused by bark borer



Plate 18: Adults of gundhi bug



Plate 19: Adult of green bug



Plate 20: Cow bugs



Plate 21: Red cotton bug



Plate 22: Thrips



Plate 23: Constructed by red ant



Plate 24: Damage caused by leaf gall

Plate: Various insect pests of *Karanj*, *Pongamia pinnata*

as 3.08 larvae/ plant and minimum population in the provenances Keesaragutta and Zaheerabad which was recorded 0.50 larvae/plant in during the period of observation *i.e.* August to April (Table 1). Thus, it can be concluded that Nainpur provenances was more susceptible but Keesaragutta and Zaheerabad provenances showed.

Screening of various provenances of *Karanj*, *P. pinnata* against gundhi bug :

Maximum population of gundhi bugs were observed in the provenance Zaheerabad which was recorded 4.85 nymphs and adults/twig and minimum

population in the provenance Jabalpur of 3.0 nymphs and adults/ twig in during the month of August to April (Table 1). Hence, it can be concluded that Zaheerabad provenance was more susceptible compared to Jabalpur provenance towards the attack of Gundhi bug.

Screening of various provenances of *Karanj*, *P. pinnata* against green bug, *Nazara viridula* :

Maximum population of green bug was observed in the provenance Zaheerabad which was recorded to be 1.17 bug/ twig and minimum in the provenance Ambikapur of 0.42 bug/ twig in during the month of August to April (Table 1). Hence, it can be concluded



Plate 25: Eggs of *Chrysoperla* sp.



Plate 26: Adult of *Chrysoperla* sp.



Plate 27: Mantids

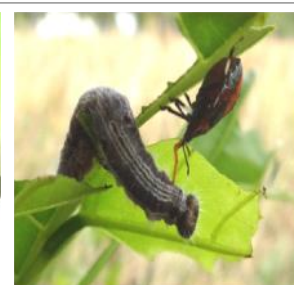


Plate 28: Predatory red stink bug attacked on larva of *H. chromus*

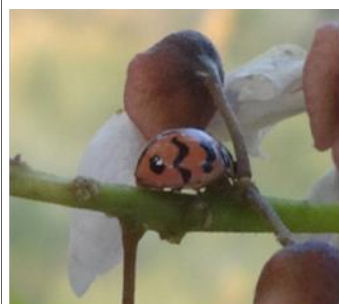


Plate 29: Lady bird beetle



Plate 30: Spiders (Unidentified)

Plate : Some natural enemies observed on *Karanj, P.*

Table 1: Mean population of insect pests on various provenances of *Karanj, P. pinnata*

Sr. No.	Name of insect-pests	Name of provenances						Total	Mean
		Raipur	Ambikapur	Jabalpur	Nainpur	Zaheerabad	Keesaragutta		
Insects pests									
1.	Common banded awl	10.08	5.67	17.00	9.74	12.75	11.00	66.24	11.04
2.	Leaf webber	3.75	3.92	2.50	1.17	1.00	3.92	16.24	2.71
3.	Blotch mine	5.33	8.41	6.41	5.67	3.33	5.66	34.82	5.80
4.	Leaf hopper	1.42	1.00	3.33	2.00	4.58	5.58	18.32	3.05
5.	Leaf eating beetle	3.41	5.00	4.41	5.08	5.25	2.50	25.65	4.27
6.	Mealy bugs	6.33	1.83	6.50	2.00	0.00	0.00	16.66	2.78
7.	Leaf defoliator	0.50	2.75	13.76	0.00	0.42	0.67	18.09	3.02
8.	Hairy caterpillar	0.00	0.83	1.83	2.92	0.00	0.00	5.58	0.93
9.	Hawk moth	0.42	3.08	0.33	0.00	0.00	0.00	0.75	0.15
10.	Bark borer	1.17	0.50	2.25	3.08	0.50	1.17	8.66	1.44
11.	Gundhi bug	2.25	0.92	3.00	1.42	4.55	3.25	12.67	2.11
12.	Green bug	0.67	0.42	1.50	0.58	1.17	0.75	5.08	0.85
13.	Cow bug	1.00	2.08	0.00	0.00	0.00	0.00	3.08	0.62
14.	Red cotton bug	1.08	3.08	2.17	1.17	0.92	0.42	8.83	1.47
15.	Thrips	26.66	29.67	36.08	17.08	31.75	22.00	163.23	27.21
16.	Red ant	2.67	0.58	0.00	0.00	0.00	0.00	3.25	0.54
Natural enemies									
1.	Green lace wing	2.58	2.92	2.33	2.33	3.83	4.08	18.07	3.01
2.	Mantid	2.25	1.00	2.16	1.25	1.58	1.58	9.81	1.64
3.	Spiders	3.66	3.25	3.16	3.16	6.00	4.75	23.98	4.00
4.	Red stink bug	1.08	0.83	0.92	1.00	0.33	0.50	4.65	0.78
5.	Lady bird beetle	1.45	1.25	0.75	1.17	1.42	0.75	6.77	1.13

that Zaheerabad provenances was more susceptible compared to Ambikapur provenance towards the attack of green bug.

Screening of various provenances of *Karanj*, *P. pinnata* against cow bug :

Maximum population of cow bug was observed in the provenance Ambikapur which was recorded to be 2.08 adults and nymphs/twig. No insects were recorded from the provenance Jabalpur, Nainpur, Zaheerabad and Keesaragutta during the period of observation from August to April (Table 1). Hence, it can be concluded that Jabalpur, Nainpur, Zaheerabad and Keesaragutta provenances were tolerant or less prone to the attack of cow bug while Ambikapur provenance was susceptible.

Screening of various provenances of *Karanj*, *P. pinnata* against red cotton bug, *Dysdercus* sp. :

Maximum population of red cotton bugs were observed in the provenance Ambikapur which was recorded 3.08 nymphs and adults/twig and minimum population was observed in the provenance Keesaragutta as 0.42 nymphs and adults/twig in during the month of August to April (Table 1). Hence, it can be concluded that Ambikapur provenances was more susceptible but keesaragutta provenance showed tolerance towards Zaheerabad the attack of red cotton bug. Remaining provenances like Raipur, Jabalpur, Nainpur and Zaheerabad recorded intermediate population of red cotton bugs.

Screening of *Karanj*, *P. pinnata* against thrips :

Maximum population of thrips was observed in the provenance Jabalpur which was recorded 36.08 adults and nymphs/twig and minimum population was observed in the provenance Nainpur which was recorded 17.08 adults and nymphs / twig in during the month of August to April (Table 1). Pest of the provenances showed moderate population of thrips hence, it can be concluded that Jabalpur provenances was more and Nainpur provenance was less susceptible to the attack of thrips.

Screening of various provenances of *Karanj*, *P. pinnata* against red ant, *Oecophyla smaregdina* (Hymenoptera : formicidae) :

Red ant, *O. smaregdina* were observed infesting leaves of *Karanj*, *P. pinnata* by making nests by joining

on an average 4-5 leaves. Population of this insect was recorded on the basis of number of nests. Maximum population of red ant, *O. smaregdina* was observed in the provenance Raipur which was recorded as 2.67 nests/branch (Table 1 and Plate 23). No insects were recorded from the provenance Jabalpur, Nainpur, Zaheerabad and Keesaragutta in during the month of August to April. Hence, it can be concluded that raipur provenance was more susceptible to the attack of red ant.

Some important natural enemies observed on *Karanj*, *P. pinnata* :

Green lacewing, Chrysoperla sp. :

Green lace wing, *Chrysoperla* sp. was observed as a predator on soft bodied insects such as mealy bugss and plant hoppers. Maximum population of green lacewing was observed in the provenance Keesaragutta which was recorded 4.08 larvae/twig (Table 1 and Plate 25 and 26) and minimum population was observed in the provenance Nainpur as 2.33 larvae/ twig in during the month of August to April.

Mantids :

Mantid was observed predating on flying insects which included various species such as plant hoppers beetles, moths and butterflies. The mean maximum population of mantid was observed in the provenance Raipur which was recorded 2.25 nymphs or adult/twig and minimum population was observed in the provenance Ambikapur which was recorded 1.00 nymph or adult/ twig in during the month of August to April (Table 1 and Plate 27). Hence, it can be concluded that Raipur provenance harboured more population of mantids but Ambikapur provenance was found to harbour less number of mantids.

Spiders :

Various species of spiders were recorded on *Karanj*, during the present studies. It was recorded to be a polyphagous predator of various species of insects. Maximum population of spiders was observed in the provenance Zaheerabad as 6.00 spiders/ twig and minimum population was observed in the provenance Jabalpur recorded as 3.16 spider/ twig (Table 1 and Plate 30) in during the month of August to April. Hence, it can be concluded that Zaheerabad provenance was found to accommodate more number of spiders in comparison to

Jabalpur provenance.

Predatory red stink bug, *Euthyrhynchus floridanus* Linnaeus (Hemiptera: Pentatomidae) :

The predatory stink bug was noticed preying on the larvae of *H. chromus*. Maximum population of red stink bugs was observed in the provenance Raipur as 1.08 bugs/ twig and minimum population in the provenance Zaheerabad of 0.33 bugs/ twig in during the month of August to April (Table 1 and Plate 28). Hence, it can be concluded that Zaheerabad provenance was better having more number of predatory bugs compared to Jabalpur.

Lady bird beetle :

Maximum population of lady bird beetle (Plate 29) was observed in the provenance Raipur which was recorded 1.45 beetles/ twig and minimum population was observed in the provenance Jabalpur which was recorded as 0.75 beetles/ twig in during the month of August to April (Table 1 and Plate 29). Hence, it can be concluded that Raipur provenance could host more number of lady bird beetles in comparison to Jabalpur provenance. Similar work related to the present investigation was also carried out by Devaranavadi *et al.* (2011) and Bisen *et al.* (2013).

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