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Doman Singh Tekam
Department of Entomology
Indira Gandhi Krishi
Vishwavidyalaya, Raipur, C.G.,
India

JL Ganguli
Department of Entomology
Indira Gandhi Krishi
Vishwavidyalaya, Raipur, C.G.,
India

Prem Shankar Tiwari
Department of Entomology
Indira Gandhi Krishi
Vishwavidyalaya, Raipur, C.G.,
India

Birendra Tigga
Department of Agronomy
Indira Gandhi Krishi Vishwavidyalaya,
Raipur, C.G, India

Field evaluation of various provenances of *Jatropha curcas* against blue bug *Chrysocoris purpureus* and Leaf webber cum fruit borer, *Pempelia morosalis* (Saalm Uller)

Doman Singh Tekam, JL Ganguli, Prem Shankar Tiwari and Birendra Tigga

Abstract

In the present studies two insect pests viz., Blue bug, *Chrysocoris purpureus* (Westw) and Leaf webber cum fruit borer, *Pempelia morosalis* (Saalm Uller) were recorded as major pests. Field evaluation of 47 provenances against *C. purpureus* revealed that Chandrapur, Keshipur, Kilkila and Chandka to be tolerant while Kot and Jabalpur as susceptible provenance, while Jagdalpur and PKVJ-DHW-1 proved to be tolerant against were as Sagar -1 and Pant J&K set – I was susceptible.

Keywords: *Jatropha curcas*, *Chrysocoris purpureus*, *Pempelia morosalis*

Introduction

Jatropha curcas commonly called as Ratanjyot, Chandrajyot, Jamalghota, Jangli arandi and Kala aranda in Hindi. In Chhattisgarh, rural people call by different names i.e., in Bastar plateau zone it is known as Ranizada, in northern hill zone as Ramredi and in Chhattisgarh plain region as Bagranda (Puri *et al.*, 2005) [2]. It is multipurpose tree of significant economic importance. It is native of Mexico and tropical South America. The genus *Jatropha* belonging to family Euphorbiaceae is one of the prospective biodiesel yielding tree crops. The seeds contain *Jatropha* oil which has a great potential to be used as biofuel in future. Like any other crop, *Jatropha* is also attacked by a number of insect pests which deteriorates the plant growth, vigour and also affects the quality and quantity of oil yield. The use of *J. curcas* is varied and has ranged from serving as medicine to providing slow drying non edible oil known as 'curcas oil'. The wood and fruit of *Jatropha* can be used for numerous purposes including fuel. The important and common insect pests found on *Jatropha* are leaf webber, semi looper, *Pempelia morosalis* (Saalm Uller.) shield backed bug, *Scutellera nobilis* Fab. Blotch miner, *Stomphosistis thraustica* termite (*Odonto termes* sp. aphid, jassid and thrips, *Retithrips syriacus* Among these, shield- backed bugs are the key pest of *Jatropha* in Gujarat. The nymphs and adults suck the cell sap from leaves, tender parts of the plant, flowers and capsules (Shanker and Dhyani, 2006) [3, 4]. A number of insects have been reported on *Jatropha* from Chhattisgarh, among which scutellerid bugs, namely *Chrysocoris purpureus*, *Scutellera nobilis* are observed along with leaf webber cum fruit borer, *Pempelia morosalis* which causes damage to almost all parts i.e. leaves, stems, inflorescence and fruits. The damage is due to dark green active larvae which cause webbing on leaves, apical stems, and inflorescence and even bore into fruits in later stages. (Soman *et al.*, (2006) [5, 6] and Tamrakar *et al.*, (2007) [7]. A couple of year back, Broad mites were observed as a major pest in the Chhattisgarh (Ganguli *et al.*, 2010) [1]. Feeding by the mite cause leaves to bronze and thicken, become brittle, corky or cupped downward and narrower than normal. Young stem growth may be distorted and stunted with terminal buds to die and drop off. Severely damaged plants could die.

Materials and Method

Field evaluation of 47 provenances of *Jatropha curcas* against blue bug, *Chrysocoris purpureus* was conducted by recording the number of nymphs adults bugs/ plant, fortnightly in both season I (September to November) i.e. pre- pruning and season II (April to June) i.e. post-pruning. Observation was computed for obtaining mean population. Similarly the screening the 47 provenances of *J. curcas* against leaf webber cum fruit borer, *P. morosalis* was conducted by recording the number of larvae/plant, fortnightly in both season I and season II; and the pooled analysis of all the observations were done presented.

Correspondence

Doman Singh Tekam
Department of Entomology
Indira Gandhi Krishi
Vishwavidyalaya, Raipur, C.G.,
India

Experiment details

The experiment was conducted in Randomized Block Design with 47 provenances each replicated three times.

Design	RBD
Replications	Three
Number of provenance	47
Plot size	90 x 40 m ²
Age of plant	6 years
Treatments	8

For recording observations, the whole experimental field was divided into 35 blocks, each block having nine plants.

- List of provenances of *Jatropha curcas* are as follows**

S. No.	Name of provenances	S. No.	Name of provenances
1	Sagar-1	25.	J&K Set 2
2	RJ 117 (A)	26.	Jagdapur
3	Dehradoon	27.	Kalyanpur
4	Barbuspur	28.	APOS-2001
5	Pant J&K Set 2	29.	RJ 117 (B)
6	J&K Set 1	30.	TNMC-7
7	Jabalpur	31.	ANOS-201
8	J&K Set 1	32.	PKVJ-SJ-1
9	NRCAF-13	33.	Pendra Road
10	Baikunthpur	34.	PKVJ-DHW-1
11	TNMC-5	35.	NRCAF-14
12	Mandeshwar	36.	Balodabazar
13	Pant J&K Set 1	37.	Kot
14	PKVJ-MKV-1	38.	Tukupoms
15	AMOS-201	39.	Taraipur
16	Bawal	40.	Kilkila
17	NRCAF-15	41.	Chandrapur
18	PKVJ-AKT-1	42.	Mahanrpur
19	Indore-I	43.	Surajpur
20	Korba	44.	Sonhat
21	Chandka	45.	Saheltarai
22	TFRI-1	46.	Churmundra
23	Barmunda	47.	Keshipur
24	NRCAF-18		

Results and Discussion

- Field evaluation of various provenances of *Jatropha curcas* against blue bug, *Chrysocoris purpureus*.**

Pooled analysis of the fortnightly population of blue bug, *Chrysocoris purpureus* recorded on 47 provenances of *Jatropha curcas* was computed and presented in table no. 1. Data depicts that in season I, the mean population of nymphs and adults bugs / plant was significant; but in season II it was non-significant. Minimum population of *C. purpureus* were

recorded in the provenances, Chandrapur (0.13), Keshipur (0.13), Kilkila (0.88) and Chandka (0.88) which can be regarded as provenances showing some level of tolerance while Kot with (0.68) and Jabalpur with (0.71) nymphs & adult/ plant can be regarded as susceptible provenance. This finding as partly is agreement with the findings of Tamrakar *et al.*, (2007)^[7] who also reported the provenance Keshipur as tolerant, but designees with provenance Kot and Jabalpur, which in the present finding showed susceptibility.

Table 1: Population of blue bug recorded fortnightly on various provenances of *J. curcas*.

S. No.	Name of the provenances	Dates											
		04/09/11	19/09/11	04/10/11	19/10/11	06/11/11	22/11/11	05/03/12	20/03/12	05/04/12	20/04/12	05/05/12	20/05/12
1.	Sagar-1	0.00 (0.71)	0.66 (1.08)	0.00 (0.71)	0.00 (0.71)	0.55 (1.02)	0.66 (1.08)	0.55 (1.02)	0.33 (0.91)	0.22 (0.85)	0.44 (0.71)	0.33 (0.91)	1.22 (1.31)
2.	RJ 117 (A)	0.33 (1.91)	0.33 (1.91)	0.00 (0.71)	0.33 (0.91)	0.33 (0.91)	0.00 (0.71)	0.77 (1.13)	0.00 (0.71)	0.00 (0.71)	0.33 (0.91)	0.77 (1.13)	1.11 (1.26)
3.	Dehradoon	0.00 (0.71)	0.00 (0.71)	0.33 (0.91)	0.00 (0.71)	0.11 (0.78)	0.00 (0.71)	0.66 (1.08)	0.66 (1.08)	0.22 (0.85)	0.44 (0.97)	0.77 (1.13)	1.22 (1.31)
4.	Barbuspur	0.33 (1.91)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.22 (0.85)	0.33 (0.91)	0.00 (0.71)	0.55 (1.02)	0.44 (0.97)	0.88 (1.17)	0.88 (1.17)
5.	Pant J&K Set 2	0.33 (1.91)	0.00 (0.71)	0.33 (0.91)	0.00 (0.71)	0.11 (0.78)	1.11 (1.26)	1.66 (1.47)	0.22 (0.85)	0.22 (0.85)	1.22 (1.31)	0.11 (0.78)	1.11 (1.26)
6.	J&K Set 1	0.66 (1.07)	1.00 (1.22)	0.33 (0.91)	0.00 (0.71)	0.55 (1.02)	1.55 (1.43)	0.11 (0.78)	0.33 (0.91)	0.44 (0.97)	0.00 (0.71)	0.00 (0.71)	1.22 (1.31)
7.	Jabalpur	0.00 (0.71)	0.33 (0.91)	0.44 (0.97)	0.33 (0.91)	1.33 (1.35)	0.22 (0.85)	0.11 (0.78)	0.33 (0.91)	0.22 (0.85)	1.33 (1.35)	1.22 (1.31)	1.22 (1.31)

8.	J&K Set 1	1.11	1.66	0.55	0.44	0.00	2.22	0.00	0.11	00.11	0.22	0.66	0.77
		(1.27)	(1.47)	(1.02)	(0.97)	(0.71)	(1.65)	(0.71)	(0.78)	(0.78)	(0.85)	(1.08)	(1.13)
9.	NRCAF-13	1.11	1.11	0.77	0.22	0.00	0.00	0.33	0.11	0.55	0.88	0.66	0.88
		(1.26)	(1.26)	1.13)	(0.85)	(0.71)	(0.71)	(0.91)	(0.78)	(1.03)	(1.17)	(1.08)	(1.17)
10.	Baikunthpur	1.66	0.22	0.22	1.11	1.11	1.11	1.66	0.22	0.22	0.11	1.11	1.22
		(1.47)	(0.85)	(0.85)	(1.26)	(1.26)	(1.26)	(1.47)	(0.85)	(0.85)	(0.78)	(1.26)	(1.31)
11.	TNMC-5	0.66	1.22	0.77	0.66	0.00	0.77	0.00	0.77	0.00	0.66	0.77	1.11
		(1.08)	(1.31)	(1.13)	(1.08)	(0.71)	(1.13)	(0.71)	(1.13)	(0.71)	(1.08)	(1.13)	(1.26)
12.	Mandeshwar	2.22	0.33	0.22	0.00	0.00	0.22	0.11	0.00	0.00	1.22	0.22	0.44
		(1.65)	(0.91)	(0.85)	(0.71)	(0.71)	(0.85)	(0.78)	(0.71)	(0.71)	(1.31)	(0.85)	(0.94)
13.	Pant J&K Set 1	0.66	0.22	0.11	0.00	0.00	0.55	1.11	0.33	0.00	0.44	0.66	0.88
		(1.08)	(0.85)	(0.78)	(0.71)	(0.71)	(1.02)	(1.26)	(0.91)	(0.71)	(0.97)	(1.08)	(1.17)
14.	PKVJ-MKV-1	1.22	0.66	0.33	0.00	1.22	0.44	0.44	0.11	0.00	0.00	0.77	0.88
		(1.31)	(1.08)	(0.91)	(0.71)	(1.31)	(0.97)	(0.97)	(0.78)	(0.71)	(0.71)	(1.13)	(1.17)
15.	AMOS-201	0.00	0.00	0.00	0.00	0.11	0.22	0.00	0.44	0.55	1.11	0.00	1.33
		(0.71)	(0.71)	(0.71)	(0.71)	(0.78)	(0.85)	(0.71)	(0.97)	(1.02)	(1.26)	(0.71)	(1.35)
16.	Bawal	0.33	0.33	0.33	0.33	0.55	0.44	0.11	0.55	0.00	0.00	0.33	0.44
		(0.91)	(0.91)	(0.91)	(0.91)	(1.02)	(0.97)	(0.78)	(1.02)	(0.71)	(0.71)	(0.91)	(0.97)
17.	NRCAF-15	0.00	0.00	0.00	0.00	0.77	0.77	0.66	1.22	1.11	0.44	0.33	0.11
		(0.71)	(0.71)	(0.71)	(0.71)	(1.13)	(1.13)	(1.08)	(1.31)	(1.26)	(0.97)	(0.91)	(0.78)
18.	PKVJ-AKT-1	0.33	0.00	0.00	0.11	0.22	0.00	0.66	0.77	0.33	0.11	0.22	0.66
		(0.91)	(0.71)	(0.71)	(0.78)	(0.85)	(0.71)	(1.08)	(1.13)	(0.91)	(0.78)	(0.85)	(1.08)
19.	Indore-I	7.67	0.00	0.33	0.11	0.66	0.66	2.22	0.00	0.44	0.00	0.44	1.11
		(2.85)	(0.71)	(0.91)	(0.78)	(1.08)	(1.08)	(0.85)	(0.71)	(0.97)	(0.71)	(0.97)	(1.26)
20.	Korba	0.88	0.00	0.33	0.22	0.44	0.00	0.11	0.22	0.66	0.00	0.33	0.66
		(1.17)	(0.71)	(0.91)	(0.85)	(0.97)	(0.71)	(0.78)	(0.85)	(1.08)	(0.71)	(0.91)	(1.08)
21.	Chandka	1.11	0.00	0.00	0.33	0.22	0.55	0.33	0.00	0.33	0.00	0.22	0.22
		(1.26)	(0.71)	(0.71)	(0.91)	(0.85)	(1.02)	(0.91)	(0.71)	(0.91)	(0.71)	(0.85)	(0.85)
22.	TFRI-1	0.33	0.00	0.00	0.11	0.44	0.88	0.00	0.00	0.55	0.22	0.11	1.11
		(0.91)	(0.71)	(0.71)	(0.78)	(0.97)	(1.17)	(0.71)	(0.71)	(1.02)	(0.85)	(0.78)	(1.26)
23.	Barmunda	0.11	0.00	0.00	0.44	0.55	0.00	0.66	1.11	0.22	0.00	0.00	0.00
		(0.78)	(0.71)	(0.71)	(0.97)	(1.02)	(0.71)	(1.08)	(1.26)	(0.85)	(0.71)	(0.71)	(0.71)
24.	NRCAF-18	0.88	0.22	0.33	0.44	0.00	0.11	0.44	0.44	0.22	0.00	0.11	0.55
		(1.17)	(0.85)	(0.91)	(0.97)	(0.71)	(0.78)	(0.97)	(0.97)	(0.85)	(0.71)	(0.78)	(1.02)
25.	J&K Set 2	0.77	0.11	0.00	0.44	1.66	0.33	0.66	0.55	0.22	1.11	0.00	0.33
		(1.13)	(0.78)	(0.71)	(0.97)	(1.47)	(0.91)	(1.08)	(1.02)	(0.85)	(1.26)	(0.71)	(0.91)
26.	Jagdapur	0.88	0.77	0.11	0.00	0.22	1.33	0.22	0.22	0.11	0.00	0.22	1.33
		(1.17)	(1.13)	(1.78)	(0.71)	(0.78)	(1.35)	(0.85)	(0.85)	(0.78)	(0.71)	(0.85)	(1.35)
27.	Kalyanpur	0.66	0.00	0.22	0.11	0.00	0.33	1.33	0.22	0.88	0.33	0.11	0.00
		(1.08)	(0.71)	(0.85)	(0.78)	(0.71)	(0.91)	(1.35)	(0.85)	(1.17)	(0.91)	(0.78)	(0.71)
28.	APOS-2001	0.55	0.00	0.00	0.22	0.11	0.11	0.44	1.11	0.00	1.11	0.00	0.77
		(1.02)	(0.71)	(0.71)	(0.85)	(0.78)	(0.78)	(0.97)	(1.26)	(0.71)	(1.26)	(0.71)	(1.13)
29.	RJ 117 (B)	0.88	0.33	0.11	0.22	0.55	1.33	0.11	0.33	0.44	0.00	0.00	1.22
		(1.17)	(0.91)	(0.78)	(0.85)	(1.02)	(1.35)	(0.78)	(0.91)	(0.97)	(0.71)	(0.71)	(1.31)
30.	TNMC-7	0.77	0.44	1.22	0.00	0.11	0.33	0.66	0.55	0.55	0.11	0.22	0.33
		(0.70)	(0.97)	(1.31)	(0.71)	(0.78)	(0.91)	(1.08)	(1.02)	(1.03)	(0.78)	(0.85)	(0.91)
31.	ANOS-201	0.11	1.66	0.00	0.00	0.22	0.22	0.11	0.11	0.55	0.44	0.33	0.44
		(1.13)	(1.47)	(0.71)	(0.71)	(0.85)	(0.85)	(0.78)	(1.78)	(1.02)	(0.97)	(0.91)	(0.97)
32.	PKVJ-SJ-1	0.44	0.00	0.00	0.00	0.22	0.11	0.00	0.00	0.11	0.33	0.77	0.33
		(0.97)	(0.71)	(0.71)	(0.71)	(0.85)	(0.78)	(0.71)	(0.71)	(0.78)	(0.91)	(1.13)	(0.91)
33.	Pendra Road	0.00	0.00	0.00	0.00	0.44	0.00	1.22	0.22	0.66	0.00	0.33	0.66
		(0.71)	(0.71)	(0.71)	(0.71)	(0.97)	(0.71)	(1.31)	(0.85)	(1.08)	(0.71)	(0.91)	(1.08)
34.	PKVJ-DHW-1	0.33	0.33	0.00	1.00	0.00	0.22	0.00	0.00	0.11	0.00	0.33	0.33
		(0.91)	(0.91)	(0.71)	(1.22)	(0.71)	(0.85)	(0.78)	(0.71)	(0.78)	(0.71)	(0.91)	(0.91)
35.	NRCAF-14	4.00	0.66	0.00	0.00	1.11	0.44	0.33	0.44	0.77	0.00	0.11	0.11
		(2.12)	(1.08)	(0.71)	(0.71)	(1.26)	(0.97)	(0.91)	(0.97)	(1.13)	(0.71)	(0.78)	(0.78)
36.	Balodabazar	0.33	0.00	0.33	0.00	0.55	0.55	0.22	0.55	0.00	0.00	0.66	0.44
		(0.91)	(0.71)	(0.91)	(0.71)	(1.02)	(1.02)	(0.85)	(1.02)	(0.71)	(0.71)	(1.08)	(0.97)
37.	Kot	0.33	1.00	1.00	0.33	0.00	0.00	1.33	0.22	1.11	0.44	0.66	0.55
		(0.91)	(1.22)	(1.22)	(0.91)	(0.71)	(0.71)	(1.35)	(0.85)	(1.26)	(0.97)	(1.08)	(1.02)
38.	Tukupoms	0.00	0.33	0.00	0.33	0.00	0.00	0.11	0.00	0.22	0.00	0.55	0.22
		(0.71)	(0.91)	(0.71)	(0.91)	(0.71)	(0.71)	(0.78)	(0.71)	(0.85)	(0.71)	(1.02)	(0.85)
39.	Taraipur	0.33	0.66	0.00	0.11	0.33	0.44	0.11	0.33	0.00	0.66	0.44	0.00
		(0.91)	(1.08)	(0.71)	(0.78)	(0.91)	(0.97)	(0.78)	(0.91)	(0.70)	(1.08)	(0.97)	(0.71)
40.	Kilkila	1.22	0.55	0.22	1.11	0.00	0.11	0.00	0.22	0.44	0.33	0.11	0.55
		(1.31)	(1.02)	(0.85)	(1.26)	(0.71)	(0.78)	(0.71)	(0.85)	(0.97)	(0.91)	(0.78)	(1.02)
41.	Chandrapur	0.66	0.44	1.22	1.66	0.22	0.55	0.33	0.00	0.00	0.00	0.22	0.22
		(1.08)	(0.97)	(1.31)	(1.47)	(0.85)	(1.02)	(0.91)	(0.71)	(0.71)	(0.71)	(0.85)	(0.85)
42.	Mahanrpur	0.66	0.66	1.11	0.33	0.55	0.55	0.00	0.00	0.00	0.44	0.22	1.11

		(1.08)	(1.08)	(1.26)	(0.91)	(1.02)	(1.02)	(0.71)	(0.71)	(0.71)	(0.97)	(0.85)	(1.26)
43.	Surajpur	0.88	0.11	0.00	0.00	0.66	0.11	0.55	0.33	0.33	0.00	0.00	0.55
		(1.17)	(0.78)	(0.71)	(0.71)	(1.08)	(0.78)	(1.02)	(0.91)	(0.91)	(0.71)	(0.71)	(1.02)
44.	Sonhat	1.11	0.00	0.33	0.11	0.55	0.44	0.11	0.33	0.00	0.88	0.44	0.55
		(1.26)	(0.71)	(0.91)	(0.78)	(1.02)	(0.97)	(0.78)	(0.91)	(0.71)	(1.17)	(0.97)	(1.02)
45.	Saheltarai	0.33	1.00	0.00	1.11	0.33	0.44	1.33	0.33	0.00	0.66	0.44	0.00
		(0.91)	(1.22)	(0.71)	(1.26)	(0.91)	(0.97)	(1.35)	(0.91)	(0.71)	(1.08)	(0.97)	(0.71)
46.	Churmundra	0.66	0.33	2.00	1.22	1.11	0.00	0.66	0.00	0.33	0.22	0.00	0.55
		(1.08)	(0.91)	(1.58)	(1.31)	(1.26)	(0.71)	(1.08)	(0.71)	(0.91)	(0.85)	(0.71)	(1.02)
47.	Keshipur	0.00	0.00	0.33	0.00	0.55	0.66	0.22	0.33	0.00	0.44	0.55	0.44
		(0.71)	(0.71)	(0.91)	(0.71)	(1.02)	(1.08)	(0.85)	(0.91)	(0.71)	(0.97)	(1.02)	(0.97)
	SEm±	0.04	0.01	0.04	0.01	0.04	0.05	0.02	0.04	0.01	0.05	0.04	0.02
	CD (5%)	0.12	0.01	0.11	0.02	0.12	0.13	0.06	0.12	0.02	0.13	0.12	0.05

Note: Figures in parentheses are square root transformed value

• **Field evaluation of various provenances of *Jatropha curcas* against leaf webber cum fruit borer, *Pempelia morosalis*.**

Pooled analysis of the fortnightly population of leaf webber cum fruit borer, *P. morosalis* was computed and presented in table no. 2. Data revealed that the mean number of larvae showed significant differences among various provenances. Provenances Jagdalpur and PKVJ-DHW-1 recorded (0.00) number of larvae and can be considered as provenances showing

tolerance against *P. morosalis* where as Sagar -1 and Pant J&K set - I with 0.59 and 0.46 larvae / plant can be regarded as susceptible. Screening of 47 provenances of *Jatropha curcas* against one of its major pests, webber, *P. morosalis* (Saalm Uller) (Lepidoptera: Pyralidae) conducted by Tamrakar, *et al.*, (2007)^[7], also revealed that provenance Sagar-1 as susceptible, but contradicts with the statement that provenance Jagdalpur and PKVJ-DHW-1 showing tolerance in the present finding was reported as moderately susceptible

Table 2: Population of leaf webber cum fruit borer, *Pempelia morosalis* recorded fortnightly on various provenances of *J. curcas*.

S. No.	Name of the provenances	Dates					
		05/03/12	20/03/12	05/04/12	20/04/12	05/05/12	20/05/12
1.	Sagar-1	0.00	0.00	0.00	0.22	0.66	0.00
		(0.71)	(0.71)	(0.71)	(0.84)	(0.91)	(0.71)
2.	RJ 117 (A)	0.00	0.00	0.00	0.33	0.77	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(1.13)	(0.71)
3.	Dehradoon	0.00	0.00	0.00	0.88	0.00	0.33
		(0.71)	(0.71)	(0.71)	(1.17)	(0.71)	(0.91)
4.	Barbuspur	0.00	0.00	0.00	0.55	0.00	0.00
		(0.71)	(0.71)	(0.71)	(1.02)	(0.71)	(0.71)
5.	Pant J&K Set 2	0.00	0.00	0.00	0.88	0.00	0.00
		(0.71)	(0.71)	(0.71)	(1.17)	(0.71)	(0.71)
6.	J&K Set 1	0.00	0.00	0.00	0.00	0.88	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.17)	(0.71)
7.	Jabalpur	0.00	0.00	0.00	0.00	0.77	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.13)	(0.71)
8.	J&K Set 1	0.00	0.00	0.00	0.77	0.33	0.00
		(0.71)	(0.71)	(0.71)	(1.13)	(0.97)	(0.71)
9.	NRCFAF-13	0.00	0.00	0.00	0.00	0.77	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.13)	(0.71)
10.	Baikunthpur	0.00	0.00	0.00	0.00	0.77	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.13)	(0.71)
11.	TNMC-5	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
12.	Mandeshwar	0.00	0.00	0.00	0.44	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.97)	(0.71)	(0.71)
13.	Pant J&K Set 1	0.00	0.00	0.00	0.00	2.77	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.81)	(0.71)
14.	PKVJ-MKV-1	0.00	0.00	0.00	0.00	0.88	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.17)	(0.71)
15.	AMOS-201	0.00	0.00	0.00	0.00	1.33	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.35)	(0.71)
16.	Bawal	0.00	0.00	0.00	1.11	0.00	0.88
		(0.71)	(0.71)	(0.71)	(1.26)	(0.71)	(1.17)
17.	NRCFAF-15	0.00	0.00	0.00	0.00	1.22	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.31)	(0.71)
18.	PKVJ-AKT-1	0.00	0.00	0.00	0.33	1.55	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(1.43)	(0.71)
19.	Indore-I	0.00	0.00	0.00	0.33	1.88	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(1.55)	(0.71)
20.	Korba	0.00	0.00	0.00	0.11	0.66	0.66
		(0.71)	(0.71)	(0.71)	(0.78)	(1.08)	(1.08)

21.	Chandka	0.00	0.00	0.00	0.44	0.44	0.00
		(0.71)	(0.71)	(0.71)	(0.97)	(0.97)	(0.71)
22.	TFRI-1	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
23.	Barmunda	0.00	0.00	0.00	0.55	0.55	0.00
		(0.71)	(0.71)	(0.71)	(1.02)	(1.02)	(0.71)
24.	NRCAF-18	0.00	0.00	0.00	0.00	1.22	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.31)	(0.71)
25.	J&K Set 2	0.00	0.00	0.00	0.55	0.00	0.00
		(0.71)	(0.71)	(0.71)	(1.02)	(0.71)	(0.71)
26.	Jagdapur	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
27.	Kalyanpur	0.00	0.00	0.00	0.77	0.00	0.00
		(0.71)	(0.71)	(0.71)	(1.13)	(0.71)	(0.71)
28.	APOS-2001	0.00	0.00	0.00	0.44	0.77	0.00
		(0.71)	(0.71)	(0.71)	(0.97)	(1.13)	(0.71)
29.	RJ 117 (B)	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
30.	TNMC-7	0.00	0.00	0.00	0.00	0.44	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.97)	(0.71)
31.	ANOS-201	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
32.	PKVJ-SJ-1	0.00	0.00	0.00	0.44	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.97)	(0.71)	(0.71)
33.	Pendra Road	0.00	0.00	0.00	0.88	0.77	0.00
		(0.71)	(0.71)	(0.71)	(1.17)	(1.13)	(0.71)
34.	PKVJ-DHW-1	0.00	0.00	0.00	0.33	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(0.71)	(0.71)
35.	NRCAF-14	0.00	0.00	0.00	0.33	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(0.71)	(0.71)
36.	Balodabazar	0.00	0.00	0.00	0.66	2.88	0.33
		(0.71)	(0.71)	(0.71)	(1.08)	(1.84)	(0.91)
37.	Kot	0.00	0.00	0.00	0.33	0.44	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(0.97)	(0.71)
38.	Tukupoms	0.00	0.00	0.00	0.00	1.55	0.22
		(0.71)	(0.71)	(0.71)	(0.71)	(1.43)	(0.85)
39.	Taraipur	0.00	0.00	0.00	0.00	0.44	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.97)	(0.71)
40.	Kilkila	0.00	0.00	0.00	0.66	0.11	0.00
		(0.71)	(0.71)	(0.71)	(1.08)	(0.78)	(0.71)
41.	Chandrapur	0.00	0.00	0.00	0.00	1.33	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.35)	(0.71)
42.	Mahanrpur	0.00	0.00	0.00	1.33	0.00	0.00
		(0.71)	(0.71)	(0.71)	(1.35)	(0.71)	(0.71)
43.	Surajpur	0.00	0.00	0.00	0.00	1.33	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(1.35)	(0.71)
44.	Sonhat	0.00	0.00	0.00	2.88	3.22	0.77
		(0.71)	(0.71)	(0.71)	(1.84)	(1.93)	(1.13)
45.	Saheltarai	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
46.	Churmundra	0.00	0.00	0.00	0.33	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.91)	(0.71)	(0.71)
47.	Keshipur	0.00	0.00	0.00	0.00	0.00	0.00
		(0.71)	(0.71)	(0.71)	(0.71)	(0.71)	(0.71)
	SEm±	0.00	0.00	0.00	0.01	0.01	0.02
	CD (5%)	0.00	0.00	0.00	0.02	0.04	0.07

Note: Figures in parentheses are square root transformed value

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