

# MOTHS (LEPIDOPETRA: HETEROCERA) DIVERSITY OF SANJAY-DUBRI NATIONAL PARK AND TIGER RESERVE, SIDHI, (M.P.)

**S. Sambath\* and Akhil Nair**

Central Zone Regional Centre,

Zoological Survey of India, Jabalpur-482002, Madhya Pradesh, India

E-mail : sambath63@gmail.com and akhil\_2919@yahoo.com

Received : 25.01.2023

**ABSTRACT:**

Accepted : 27.02.2023

The present study was conducted at Sanjay-Dubri National Park and Tiger Reserve, & its surrounding area in Sidhi district of Madhya Pradesh, India to evaluate the biodiversity of moths. A total of 953 moth specimens were recorded from the study area which represented 110 species from 16 families and seven super families. The highest species richness was shown by the family Erebidae followed by the families Bombycidae, Nolidae, Thyrididae, Pyralidae, Drepanidae, Lacturidae, Eutellidae and Eupterotidae comprising of one species each. The results of this study are promising; it sheds light on the unknown moth biodiversity of Sanjay-Dubri National Park and Tiger Reserve which needs to be strengthened through comprehensive future surveys. All 110 moths species reported for the first time from this area.

**Keywords :** *Moth diversity, sanjay-dubri national park and species richness*

## INTRODUCTION

Phylum Arthropoda being the largest animal group consists of two third of all animals of the planet. Lepidoptera, meaning “Scaled wings” in Greek, is the second largest order of class Insecta, comprising Moths & Butterflies. Moths constitute the sub-order Heterocera of order Lepidoptera that has important roles in the forest ecosystem as herbivores and as food for predatory and parasitic species (Sivasanakaran K. *et al.* 2011). Moths being an indicator group are frequently selected as subject of study; it is taxonomically well-known and relatively rapid to identify (Holloway, 1985). Moths play an important role in the natural ecosystem as pollinators, food in the food chain and also with the saproxylic nature of larvae of many species (Srinivasan *et al.* 2014). The dominance of the Moth diversity over the Butterflies could be understood by considering the fact that there are 140 families of Moths comprising about 1,40,000 known species

worldwide, whereas the number of species of butterflies known is around 15,000 only, which have been classified into five families (Sidhu *et al.* 2019). Moths (Heterocera) represent one of the most heterogeneous groups among insects. But, studies on moths are highly neglected because of nocturnal in nature and encounter with the human in the presence of light sources. The only compilation of moth diversity from Central India including Madhya Pradesh & Chhattisgarh includes 313 species/subspecies of moths belonging to 221 genera and 25 families (Chandra and Nema, 2007). Further, additions in the moth fauna of Central India has happened through various scattered research papers & regional studies (Chandra and Sambath, 2016; Sambath, 2017a; 2017b; 2018a; 2018b; 2020; Roshni *et al.*, 2020a; 2020b).

## STUDY AREA

Sanjay-Dubri National Park was declared a protected area in 1981, is located in Madhya

Pradesh, Central India and has been brought under Tiger Reserve Project during 2008-2009. It is spread over an area of 1674.511 sq. km. lies between 23°48' 57" to 23°49' 06" N latitudes and 82°10' 48" to 82°14' 06" E longitudes. It is situated on the north-eastern part of Madhya Pradesh and is bordered by Guru Ghasidas National Park, Chhattisgarh in south (Fig. 1). The terrain of Dubri sanctuary is almost plain while that of Sanjay National Park is hilly. Various perennial rivers flow through the reserve viz. Gopad, Banas, Mawai, Mohan, Kodmar, Umrari etc. The main soil type of the area is sandy in nature and the annual average rainfall is 1493.2 mm. May is the

hottest month with a maximum temperature of 42°C and January is the coldest month with minimum temperature of 8.6°C. Kushmi and Majhauli ranges are two main forests ranges in the reserve. The vegetation in the reserve is mixed and dominated by dry and moist deciduous sal forests. A few patches of montane subtropical forests are also found in the southern-most part of the reserve. In the present studies, the moth diversity of Sanjay-Dubri National Park and Tiger Reserve, district Sidhi was studied for the first time by surveying various localities in and around the National Park and Tiger Reserve (Table 1 & Fig.2).

**Table - 1 : Geo-coordinates of survey localities of Sanjay Dubri National Park and Tiger Reserve, Sidhi, Madhya Pradesh.**

S.No.	Localities Surveyed	Latitude (in degree)	Longitude (in degree)
1.	Dhudhmaniya Bijura (Riverside), Bastua	24.18694444	81.88916667
2.	Dubri Kallan village (Railway crossing), Dubri	24.24888889	81.61472222
3.	FRH Bastua	24.13277778	81.74166667
4.	FRH Dubri	24.3956	81.8825
5.	FRH Kusmi	24.08666667	82.17305556
6.	Ghad, Bastua	24.13426545	81.74236592
7.	Ghajira Jheel	24.27138889	81.62194444
8.	Gidh Pahadi, Bastua	24.396	81.8827
9.	Kusmi Barrier	24.08666667	82.17305556
10.	Ladakheri, Kusmi range	23.9271	81.8988
11.	Madaki Bastua	24.3961	81.884
12.	Pipartolna, Mohan Range	24.0923649	82.19364645
13.	Podrathal near Ben river, Dubri	24.08250000	81.66694444



**Figure - 1 : Map depicting the position of Sanjay Dubri National Park in India.**



**Figure - 2 : Map depicting the localities surveyed in and around Sanjay Dubri National Park and Tiger Reserve, Disrict Sidhi, Madhya Pradesh.**



## MATERIALS AND METHODS

In order to collect moth specimens to prepare the partial checklist of moths, various localities of Sanjay Dubri National Park and Tiger reserve and surrounding localities were systematically surveyed during 2019 to 2021. The specimens were collected using light trap method by spreading a screen of white cloth (12"x6") and illuminated by white light emitting from 160 watt mercury lamp. The specimens resting on the wall under the wall lights were collected using small plastic containers and vials which were then administered with cotton soaked in ethyl acetate that was used as the insect killing poison. The collected specimens were soon labelled at the field itself and stretched as per standard techniques in Lepidopterology for identification in the laboratories. Identification of moths was confirmed using various literatures like the fauna of British India (Hampson, 1894), The moths of Borneo (Holloway, 1985), The fauna of British India, including Ceylon and Burma (Bell and Scot, 1937)

and other publications. Web resources dedicated to lepidopteran diversity were also utilized to confirm or to check the species names. The collection is registered and included in the National Zoological Collection of Zoological Survey of India at Central Zone Regional Centre, Jabalpur (MP).

## RESULTS AND DISCUSSION

During the present study, a total of 953 moth specimens were recorded from the study area which represented 110 species of 96 genera from 16 families and seven super families (Table 2). The highest species richness was shown by the family Erebididae with 42 species belonging to 34 genera, followed by Crambidae with 18 species belonging to 16 genera and Noctuidae with 13 species belonging to 11 genera. The other families Bombycidae, Nolidae, Thyrididae, Pyralidae, Drepanidae, Lacturidae, Eutellidae and Eupterotidae represent by one species each. The present checklist is first of its kind from the study area and also for the district Sidhi of the state Madhya Pradesh.

**Table - 2 : Moth fauna of Sanjay Dubri National Park, district Sidhi, Madhya Pradesh.**

Species	Family	Subfamily
Superfamily: <b>Zygaenoidea</b> Latreille, 1809		
1. <i>Anticrates eulimna</i> Meyrick, 1913	Lacturidae	--
2. <i>Birhamoides junctura</i> (Walker, 1865)	Limacodidae	Limacodinae
3. <i>Miresa albipuncta</i> Herrich-Schäffer, 1854	Limacodidae	Limacodinae
4. <i>Parasa pastoralis</i> Butler, 1885	Limacodidae	Limacodinae
5. <i>Thosea tripartita</i> Moore, 1884	Limacodidae	Limacodinae
Superfamily: <b>Thyridoidea</b> Herrich-Schäffer, 1867		
6. <i>Banisia cf. myrtaea</i> (Drury, 1773)	Thyrididae	Striglininae
Superfamily: <b>Pyraloidea</b> Latreille, 1809		
7. <i>Hypsopygia mauritalis</i> (Boisduval, 1833)	Pyralidae	Pyralinae
8. <i>Chilo suppressalis</i> Walker, 1863	Crambidae	Crambinae
9. <i>Chilo partellus</i> Swinhoe, 1885	Crambidae	Crambinae
10. <i>Agroteria scissalis</i> (Walker, 1866)	Crambidae	Spilomelinae
11. <i>Cnaphalocrocis medinalis</i> Guenee, 1854	Crambidae	Spilomelinae
12. <i>Cydalima conchylalis</i> Guenee, 1854	Crambidae	Spilomelinae
13. <i>Cydalima laticostalis</i> Guenee, 1854	Crambidae	Spilomelinae
14. <i>Diaphania indica</i> Saunders, 1851	Crambidae	Spilomelinae

Species	Family	Subfamily
15. <i>Rehimena phyrnealis</i> (Walker, 1859)	Crambidae	Spilomelinae
16. <i>Sameodes cancellalis</i> (Zeller, 1852)	Crambidae	Spilomelinae
17. <i>Spoladea recurralis</i> Fabricius, 1787	Crambidae	Spilomelinae
18. <i>Eoophyla peribocalis</i> (Walker, 1859)	Crambidae	Acentropinae
19. <i>Herpetogramma licarsisalis</i> Walker, 1859	Crambidae	Acentropinae
20. <i>Lamprophaia ablactalis</i> (Walker, 1859)	Crambidae	Pyraustinae
21. <i>Omiodes analis</i> Snellen, 1880	Crambidae	Pyraustinae
22. <i>Pleuroptya balteata</i> (Fabricius, 1798)	Crambidae	Pyraustinae
23. <i>Pycnarmon cribrata</i> Fabricius, 1794	Crambidae	Pyraustinae
24. <i>Pyrausta panopealis</i> (Walker, 1859)	Crambidae	Pyraustinae
25. <i>Scirpophaga incertulus</i> Walker, 1863	Crambidae	Schoenobiinae
Superfamily: <b>Drepanoidea</b> Boisduval, 1828 26. <i>Tridrepana albonotata</i> Moore, 1879	Drepanidae	Drepaninae
Superfamily: <b>Lasiocampoidea</b> Harris, 1841 27. <i>Metanastria hyrtaea</i> (Cramer, 1782) 28. <i>Trabala vishnou</i> Lefebvre, 1827	Lasiocampidae Lasiocampidae	Lasiocampinae Lasiocampinae
Superfamily: <b>Bombycoidea</b> Latreille, 1802 29. <i>Eupterote gardneri</i> Bryk, 1950 30. <i>Trilocha varians</i> Walker, 1854 31. <i>Ambulyx sericeipennis</i> Butler, 1875 32. <i>Ambulyx substrigilis</i> Hampson, 1898 33. <i>Hippotion boerhaviae</i> (Fabricius, 1775) 34. <i>Theretra oldenlandiae</i> (Fabricius, 1775) 35. <i>Theretra alecto</i> Linnaeus, 1758 36. <i>Pergesa acteus</i> Cramer, 1779	Eupterotidae Bombycidae Sphingidae Sphingidae Sphingidae Sphingidae Sphingidae Sphingidae	Eupterotinae Bombycinae Smerinthinae Smerinthinae Macroglossinae Macroglossinae Macroglossinae Macroglossinae
Superfamily: <b>Geometroidea</b> Leach, 1815 37. <i>Ascotis selenaria</i> (Denis-Schiffermüller, [1865]) 38. <i>Biston suppressania</i> Guenee, 1854 39. <i>Chiasmia fidoniata</i> Guenee, 1858 40. <i>Zamarada excisa</i> Hampson, 1891 41. <i>Ectropidia shoreae</i> Prout, 1934 42. <i>Hyperythra lutea</i> Stoll, 1781 43. <i>Hyposidra talaca</i> (Walker, 1860) 44. <i>Hypomecis infixaria</i> Walker, 1860 45. <i>Petelia medardaria</i> Herrich-Schäffer, [1865] 46. <i>Pelagodes falsaria</i> Prout, 1912 47. <i>Thalassodes quadraria</i> Guenee, (1857) 48. <i>Chrysocraspeda fagnaria</i> (Guenee, 1858) 49. <i>Rhodometra sacraria</i> (Linnaeus, 1767)	Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae Geometridae	Ennominae Ennominae Ennominae Ennominae Ennominae Ennominae Ennominae Ennominae Ennominae Geometrinae Geometrinae Sterrhinae Sterrhinae

Species	Family	Subfamily
Superfamily: <b>Noctuoidea</b> Latreille, 1809		
50. <i>Allata argentifera</i> Walker, 1862	Notodontidae	Spataliinae
51. <i>Antheua servula</i> Drury, 1773	Notodontidae	Phalerinae
52. <i>Netria viridescens</i> Walker, 1855	Notodontidae	Dicranurinae
53. <i>Spatalia argentifera</i> Walker, 1862	Notodontidae	Pygaerinae
54. <i>Asota ficus</i> Fabricius, 1775	Erebidae	Aganainae
55. <i>Asota caricae</i> Fabricius, 1775	Erebidae	Aganainae
56. <i>Acantholipes miser</i> Butler, 1883	Erebidae	Arctiinae
57. <i>Aemene taproboris</i> Walker, 1854	Erebidae	Arctiinae
58. <i>Aloa lactinea</i> (Cramer, 1777)	Erebidae	Arctiinae
59. <i>Amata cyssea</i> Stoll, 1782	Erebidae	Arctiinae
60. <i>Arctelene uncodex</i> Kirti & Gill, 2008	Erebidae	Arctiinae
61. <i>Argina astrea</i> Drury, 1773	Erebidae	Arctiinae
62. <i>Brunia antica</i> Walker, 1854	Erebidae	Arctiinae
63. <i>Creatonotos gangis</i> Linnaeus, 1758	Erebidae	Arctiinae
64. <i>Creatonotos transiens</i> (Walker, 1855)	Erebidae	Arctiinae
65. <i>Eressa confinis</i> Walker, 1854	Erebidae	Arctiinae
66. <i>Estigmene perrotteti</i> Guerin-Meneville, 1844	Erebidae	Arctiinae
67. <i>Mangina astrea</i> Drury, 1773	Erebidae	Arctiinae
68. <i>Rajendra biguttata</i> (Walker, 1855)	Erebidae	Arctiinae
69. <i>Spilarctia obliqua</i> Walker, 1855	Erebidae	Arctiinae
70. <i>Syntomoides imaon</i> (Cramer, 1779)	Erebidae	Arctiinae
71. <i>Utetheisa lotrix</i> (Cramer, 1779)	Erebidae	Arctiinae
72. <i>Utetheisa pulchelloides</i> Hampson, 1907	Erebidae	Arctiinae
73. <i>Hypocala restrata</i> (Fabricius, 1794)	Erebidae	Calpinae
74. <i>Trigonodes hyppasia</i> Cramer, (1779)	Erebidae	Erebinae
75. <i>Cyana puella</i> Drury, 1773	Erebidae	Erebinae
76. <i>Attatha regalius</i> Moore, 1872	Erebidae	Erebinae
77. <i>Bastilla algira</i> Linnaeus, 1767	Erebidae	Erebinae
78. <i>Bastilla conficiens</i> Walker, 1858	Erebidae	Erebinae
79. <i>Chalciope mygdon</i> Cramer, 1777	Erebidae	Erebinae
80. <i>Disgonia algira</i> Linnaeus, 1767	Erebidae	Erebinae
81. <i>Fodina cuneigera</i> Butler, 1889	Erebidae	Erebinae
82. <i>Mocis frugalis</i> Fabricius, 1775	Erebidae	Erebinae
83. <i>Mocis undata</i> Fabricius, 1775	Erebidae	Erebinae
84. <i>Spirama retorta</i> (Clerck, 1764)	Erebidae	Erebinae
85. <i>Hypena abysisinialis</i> Gueree, 1854	Erebidae	Lymantriinae
86. <i>Arctornis lactea</i> Moore, 1879	Erebidae	Lymantriinae
87. <i>Artaxa digramma</i> Boisduval, 1844	Erebidae	Lymantriinae
88. <i>Artaxa guttara</i> Walker, 1855	Erebidae	Lymantriinae
89. <i>Euproctis bipunctapex</i> Hampson, 1891	Erebidae	Lymantriinae
90. <i>Euproctis lunata</i> Walker, 1855	Erebidae	Lymantriinae
91. <i>Lymantria marginata</i> (Walker, 1855)	Erebidae	Lymantriinae

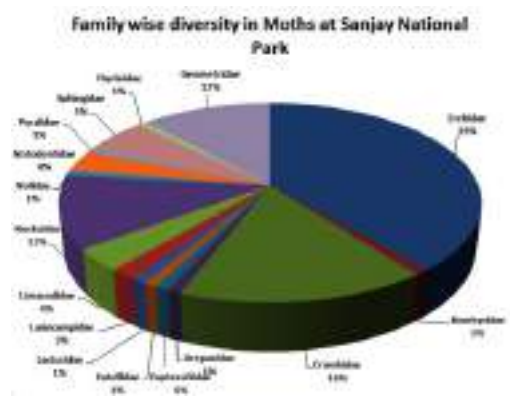
Species	Family	Subfamily
92. <i>Lymantria serva</i> Fabricius, 1793	Erebidae	Lymantriinae
93. <i>Perina nuda</i> Fabricius,1787	Erebidae	Lymantriinae
94. <i>Episparis liturata</i> Fabricius, 1787	Erebidae	Pangraptinae
95. <i>Anomis flava</i> Fabricius, 1775	Erebidae	Scoliopteryginae
96. <i>Lophoptera illucida</i> (Walker, 1865)	Eutellidae	
97. <i>Acontia marmoralis</i> (Fabricius, 1794)	Noctuidae	Stictoperinae
98. <i>Carea angulata</i> Fabricius, 1793	Noctuidae	Acontiinae
99. <i>Condica illecta</i> Walker,1865	Noctuidae	Chlophorinae
100. <i>Callopietria maillardi</i> Gueree,1854	Noctuidae	Condicinae
101. <i>Helicoverpa armigera</i> Hubner, 1805	Noctuidae	Eriopinae
102. <i>Mythimna separata</i> Walker, 1865	Noctuidae	Heliothinae
103. <i>Mythimna unipuncta</i> Haworth, 1809	Noctuidae	Noctuinae
104. <i>Spodoptera exigua</i> (Hubner,1808)	Noctuidae	Noctuinae
105. <i>Agrotis biconica</i> Kollar, 1844	Noctuidae	Noctuinae
106. <i>Agrotis segetum</i> (Denis & Schiffermuller,1775)	Noctuidae	Noctuinae
107. <i>Chrysodeixis acuta</i> (Walker,1858)	Noctuidae	Noctuinae
108. <i>Ctenoplusia agnata</i> (Staudinger, 1892)	Noctuidae	Plusiinae
109. <i>Thysanoplusia orichalcea</i> Fabricius,1775	Noctuidae	Plusiinae
110. <i>Xanthodes transversa</i> Guenée, 1857	Nolidae	Plusiinae
		Bagisarinae

### CONCLUSION

The results of this study are promising; it sheds light on the unknown moth biodiversity of Sanjay National Park which needs to be strengthened through comprehensive future surveys. The abundance of moth diversity found during this preliminary study assures that the diversity of moths in this area is huge. The relative species abundance for the 8 super-families is shown in Table 1 and the same is presented with the help of pie diagram (Fig. 3). The family Erebidae constitute 39 % of total Moth diversity, followed by Crambidae 16%, Geometridae & Noctuidae 12% each, Sphingidae 5%, Notodontidae & Limacodidae 4% each whereas rest of the families having 1% each. The biodiversity and occurrence of widespread moth fauna is mainly due to the rich vegetation in this area as vegetation plays an important role for the existence of insect fauna in a community as it provides the main source

of food etc. Further, future study will help to understand overall species diversity as well as seasonal variations in moth abundance and underlying biotic interactions. Despite extensive surveys, the sampling is still incomplete and more survey effort is required to assess the complete moth diversity of the study area, Dubey , Shivam et. al. ( 2021).

**Figure - 3 : Family wise diversity of moths at Sanjay-Dubri National Park and Tiger Resrve, District Sidhi, Madhya Pradesh**



## ACKNOWLEDGEMENTS

The authors are grateful to Dr. Dhriti Banrejee, Director, Zoological Survey of India, Kolkata for providing necessary facilities and encouragements. Sincere thanks are also due to the Principal Chief Conservator of Forests (WL), Bhopal, Madhya Pradesh, Divisional Forest Officer, Sanjay Dubri National Park and Forest Guards for extending field support during the surveys.

## REFERENCES

1. Barlow, H. S. 1982. *An introduction to the moths of South East Asia*. Kuala Lumpur, Malayan Nature Society. 305 pp. + 50 pls.
2. Bell, T. R. D., Scott, F. B. 1937. *Fauna of British India, including Ceylon and Burma. Moths—Volume 5, Sphingidae*. London, Taylor and Francis. 537 pp. + 15 pls.
3. Cerny, K., Pinratana, A. 2009. *Moths of Thailand. Volume 6, Arctiidae*. Bangkok, Brothers of St Gabriel in Thailand. 283 pp. + 56 pls.
4. Chandra, K., Nema, DK. Insecta : Lepidoptera : Heterocera (Moths). *In, Zool. Surv. India Fauna of Madhya Pradesh (including Chhattisgarh), State Fauna Series. Part-1*. 2007, 15 : 347-418.
5. Chandra, K. and Sambath, S. 2016. Insecta: Lepidoptera: Heterocera: *In: Faunal Diversity of Veerangana Durgawati Wildlife Sanctuary, District Damoh, Madhya Pradesh, Conservation Area Series*, 56 : 173-213 (Published by the Director, Zool. Surv. India, Kolkata).
6. Chandra, K. and Sambath, S. 2016. Insecta: Lepidoptera: Heterocera: *In: Faunal Diversity of Singhori Wildlife Sanctuary, District Raisen, Madhya Pradesh, Conservation Area Series*, 57 : 185-215 (Published by the Director, Zool. Surv. India, Kolkata).
7. Hampson, G. F. 1891. *Illustrations of typical specimens of Lepidoptera Heterocera in the collection of the British Museum. Part VIII-The Lepidoptera Heterocera of the Nilgiri District*. London, Taylor & Francis, Order of Trustees. 144 pp. + 18 pls.
8. Hampson, G. F. 1892. *The Fauna of British India including Ceylon and Burma. Moths, Vol. 1, Saturniidae to Hypsiidae*. London, Taylor & Francis. 627 pp. + 333 figs.
9. Hampson, G. F. 1894. *The Fauna of British India including Ceylon and Burma. Moths, Vol. 2, Arctiidae, Agrastidae, Noctuidae*. London, Taylor & Francis. 609 pp. + 325 figs.
10. Hampson, G. F. 1895. *The Fauna of British India including Ceylon and Burma. Moths, Vol. 3, Noctuidae (cont.) to Geometridae*. London, Taylor & Francis. 546 pp. + 226 figs.
11. Hampson, G. F. 1896. *The Fauna of British India including Ceylon and Burma. Moths, Vol. 4, Pyralidae*. London, Taylor & Francis. 594 pp. + 287 figs.
12. Holloway, J. D. 1983. The moths of Borneo (part 4) Family Notodontidae. *Malayan Nature Journal* 37: 1–107.
13. Holloway, J. D. 1985. The moths of Borneo (part 14) Family Noctuidae: subfamilies Euteliinae, Stictopterinae, Plusiinae, Pantheinae. *Malayan Nature Journal* 38: 157–317.
14. Holloway, J. D. 1986. The moths of Borneo. (part 1). Key to families; Families Cossidae, Metarbelidae, Ratardidae, Dudgeoneidae, Epipyropidae, and Limacodidae. *Malayan Nature Journal* 40: 1–165.
15. Holloway, J. D. 1987. *The Moths of Borneo (part 3); Families Lasiocampidae, Eupterotidae, Bombycidae, Brahmaeidae, Saturniidae, Sphingidae*. Kuala Lumpur, Southdene Sdn. Bhd. 199 pp. + 163 figs., 20 pls.
16. Holloway, J. D. 1988. *The Moths of Borneo*



(part 6); Family Arctiidae: Subfamilies Arctiinae, Syntominae, Aganainae (to Noctuidae). Kuala Lumpur, Southdene Sdn. Bhd. 101 pp. + 168 figs., 6 pls.

17. Holloway, J. D. 1989. The moths of Borneo (part 12); Family Noctuidae: Subfamilies Noctuinae, Heliiothinae, Hadeninae, Acronictinae, Amphipyrrinae, Agaristinae. *Malayan Nature Journal* 43: 57–226.

18. Holloway, J. D. 1993. The moths of Borneo (part 11); Family Geometridae: Subfamilies Ennominae. *Malayan Nature Journal* 47: 1–309.

19. Holloway, J. D. 1996. The moths of Borneo (part 9); Family Geometridae: Subfamilies Oenochrominae, Desmobathrinae, Geometrinae. *Malayan Nature Journal* 49: 147–326.

20. Holloway, J. D. 1997. The moths of Borneo (part 10); Family Geometridae: Subfamilies Sterrhinae, Larentiinae, Addenda to other subfamilies. *Malayan Nature Journal* 51: 1–242.

21. Holloway, J. D. 1999. The moths of Borneo (part 5); Family Lymantriidae. *Malayan Nature Journal* 53: 1–188.

22. Holloway, J. D. 2003. *The Moths of Borneo (Part 18): Family Nolidae*. Kuala Lumpur, Southdene Sdn Bhd. 279 pp. + 611 figs., 10pls.

23. Kirti, J. S., Goyal, T., Kaur, M. 2012. An inventory of family Geometridae (Lepidoptera) from Western Ghats of India. *Journal of Entomological Research* 36(1): 83–94.

24. Kirti, J. S., Singh, N. 2015. *Arctiid Moths of India, Volume 1*. New Delhi, Nature Books India. 205 pp.

25. Kirti, J. S., Singh, N. 2016. *Arctiid Moths of India, Volume 2*. New Delhi, Nature Books India. 214 pp.

26. Mathew, G. 2006. An inventory of Indian pyralids (Lepidoptera: Pyralidae). *Zoo's*

*Print Journal* 21(5): 2245–2258.

27. Roshni Pandey, S. Sambath and Rita Bhandari. 2020a. Diversity & Species richness of Family Geometridae (Lepidoptera: Insecta) in Veerangana Durgavati Wildlife Sanctuary, Damoh, Madhya-Pradesh. *International Journal of Global Science Research*, 7: 1284-1290.

28. Roshni Pandey, S. Sambath and Rita Bhandari. 2020b. Species Diversity of Family Crambidae (Moth) in Veerangana Durgavati Wildlife Sanctuary, Damoh (M.P.). *International Journal of Current Advanced Research*, 9: 22037-22039.

29. Sambath, S. 2017a. A Report on the Moths of Ghatigaon Wildlife Sanctuary, Madhya Pradesh. *Bionotes*, 19(1): 21-23.

30. Sambath, S. and Farooqui, S.A. 2017b. Additions to the moth fauna (Lepidoptera) of district Jabalpur, Madhya Pradesh. *Bionotes*, 19(4): 152-153.

31. Sambath, S. 2018a. On a Collection of moths (Lepidoptera) from Narsingharh Wildlife Sanctuary, district Rajgarh, Madhya Pradesh. *Bionotes*, 20(4): 121-123.

32. Sambath, S. 2018b. Moth Fauna of Kheoni Wildlife Sanctuary district Dewas, Madhya Pradesh. *Bionotes*, 20(127-129).

33. Sambath, S. 2020. Insecta: Lepidoptera: Heterocera. In: Faunal Diversity of Bhoj Wetland, Bhopal, Madhya Pradesh, India (A Ramsar Site) *Wetland Ecosystem Series*, 22: 141-152. Published by the Director, *Zool.Sur. India*.

34. Sivasankaran K, Gnanasekaran S, Paradhaman D, Ignacimuthu S. *Diversity of Noctuid moths (Lepidoptera: noctuidae) in Tamil Nadu part of Western Ghats (Nilgiri Biosphere and Kodaikanal hills), India*. *Elixir Bio Diversity*. 2011; 38:4131-4134.

35. S r i n i v a s a n B a l a k r i s h n a n , Muthukumarasamy Srinivasan, Jeyaraj

Mohanraj. *Diversity of some insect fauna in different coastal habitats of Tamil Nadu, southeast coast of India. Journal of Asia-Pacific Biodiversity*. 2014; 7(4):408-414.

36. van Nieukerken E. J., Kaila, L., Kitching, I. J., Kristensen, N. P., Lees, D. C., Minet, J., Mitter, C., Mutanen, M., Regier, J. C., Simonsen, T.J., Wahlberg, N., Yen, S.-H., Zahiri, R., Adamski, D., Baixeras, J., Bartsch, D., Bengtsson, B.A., Brown, J. W., Bucheli, S. R., Davis, D. R., Prins, J. D., Prins, W.D., Epstein, M.E., Gentili-Poole, P., Gielis, C., Hättenschwiler, P., Hausmann, A. Holloway, J.D., Kallies, A., Karsholt, O., Kawahara, A. Y., Koster, S., Kozlov, M.V., Lafontaine, J. D., Lamas, G., Landry, J. F., Lee, S., Nuss, M., Park, K.-T., Penz, C., Rota, J., Schintlmeister, A., Schmidt, B. C., Sohn, J. -C., Solis, M. A., Tarmann, G. M., Warren, A. D., Weller, S., Yakovlev, R.V., Zolotuhin, V. V. & A. Zwick. 2011. Order Lepidoptera, pp. 212–221. *In*: Zhang, Z.-Q. (Ed.), *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa* 3148: 212–221.
37. Dubey, Shivam, Pant, Hemlata and Shiv Ji Malviya (2021) : Moth (Insecta: Lepidoptera diversity at Dumna Nature Reserve, Jabalpur, M.P., JNRD, Vol 16(1), Page No 118-122.

# PREVALENCE OF MALNUTRITION AMONG PRESCHOOL CHILDREN: AN ANTHROPOMETRIC-BASED STUDY

**Shriya Singh, N. K. Mishra and Pradeep Kumar Yadav**

Department of Agricultural Extension

T. D. P.G. College, Jaunpur, (U.P.), India

Corresponding email : singhshriya211@gmail.com

Received : 21.01.2023

**ABSTRACT**

Accepted : 26.02.2023

**This anthropometric-based study aimed to determine the prevalence of malnutrition among preschool children. A total of 120 children aged 0 to 6 years were included in the study. Anthropometric measurements were taken and clinical examinations were conducted to assess the nutritional status of the children. The findings revealed that 45.8% of the respondents belonged to the height group of 83 to 99 cm, while more than 63% of the respondents belonged to the weight group of 11.5 to 17.5 kg. Moreover, 52.5% of the respondents were in the high category group of clinical examination. The results also showed that 43.33% of the children started weaning from 6 to 12 months, and most of the children (40.83%) started solid food at the age of 6 to 12 months. In addition, the majority of the respondents (60.00%) were taking meals thrice a day.**

***Keywords :*** Anthropometric, malnutrition, clinical examinations, weaning

## INTRODUCTION

Integrated Child Development Services (ICDS) is a government programme in India which provides food, preschool education, primary healthcare, immunization, health check-up and referral services to children under 6 years of age and their mothers. The scheme was launched in 1975, discontinued in 1978 by the government of Morarji Desai, and then relaunched by the Tenth Five Year Plan. The scheme is centrally sponsored with the state governments contributing up to Rs.1.00 per day per child. Furthermore, in 2008, the GOI adopted the World Health Organization standards for measuring and monitoring the child growth and development, both for the ICDS and the National Rural Health Mission (NRHM). Tenth five-year plan also linked ICDS to Anganwadi centres established mainly in rural areas and staffed with frontline

workers. In addition to fighting malnutrition and ill health, the programme is also intended to combat gender inequality by providing girls the same resources as boys. A 2005 study found that the ICDS programme was not particularly effective in reducing malnutrition, largely because of implementation problems and because the poorest states had received the least coverage and funding. During the 2018–19 fiscal years, the Indian central government allocated 16,335 crores to the programme. The widespread network of ICDS has an important role in combating malnutrition especially for children of weaker groups.

The Integrated Child Development Services (ICDS) in India comprises health, nutrition, and education human resource development in 1745 rural, 716 tribal, and 235 urban projects in about 45 per cent of community development blocks of the

country. Research studies have found that in ICDS areas there were fewer children suffering from Grades S II and IV malnutrition compared with non ICDS areas and the percentage of normal children has increased 6.8 per cent of children aged 0-3 years and 4.0 per cent of children aged 3-6 years in ICDS areas were in Grades III and IV of malnutrition. The ICDS treatment for malnutrition is administration of 16-20 gm. of protein and about 600 calories and monitoring monthly; there are 13.9 million children presently receiving supplementary nutrition in the ICDS program. The nutrition program in general aims to provide health and nutrition inputs to expectant mothers throughout the gestation period in order to prevent low birth weight babies; the nutrition supplement distribution has improved, but chronic malnutrition among pregnant mothers persists. The ICDS program provides regular health checkups, immunization, detection of malnutrition, treatment of diarrhea, and deworming of and for children. These services have contributed to improved health among children in ICDS areas. The infant mortality rate (IMR) of 71.3 out of 1000 live births in 1992 in ICDS areas was found to be lower than national estimates in 1989. In ICDS projects more than 3 years old, IMR was found to be 84.5; further decline in IMR in 1990 were found in projects older than 5 years. Morbidity and mortality have been found to be higher in non-ICDS areas and declines have been observed in ICDS areas. The incidence of vaccine preventable diseases was not found to have declined in ICDS areas, in spite of increased immunization. ICDS provides Anganwadi community workers (AWWs) and services through a network of Primary Health Centers and sub centers, which are not optimally used. However, when compared with non-ICDS areas, prenatal services are used by 71.9 per cent of the pregnant population compared with 40 per cent in a non-ICDS control group. In 1992, there was 90 per cent coverage of children aged 0-6 years with health checkups; this level of usage may be due to the availability of medicine kits through AWWs.

ICDS provides potential for enhancing the survival of children.

## **MATERIALS AND METHODS**

The study was conducted in the Baksha block of Jaunpur district, Uttar Pradesh. The sample of respondents was selected using a convenience sampling technique. Due to the lack of time and resources, it was not possible to cover a large area in the study. Therefore, the sample was limited to the Baksha block. The inclusion criteria for the study were children aged between 0 to 12 months, residing in the Baksha block, and whose parents/guardians agreed to participate in the study.

Data was collected using a structured questionnaire that included questions related to age, education, castes, occupation, annual income, family type, and Anganwadi participation. Anthropometric measurements were taken to determine the nutritional status of the children. The measurements included height, weight, and BMI. Clinical examinations were conducted to assess the physical and clinical signs of malnutrition.

Data analysis will be performed using appropriate statistical software. Descriptive statistics will be used to summarize the demographic and anthropometric data. The prevalence of malnutrition will be calculated based on the anthropometric measurements and clinical examinations.

## **RESULTS AND DISCUSSION**

### **Anthropometric assessment**

#### **Height**

Anthropometric measurement is considered to be the most sensitive parameter for assessing the nutritional status of children.

**Table - 1 : Height-wise distribution of child**

<b>Height</b>	<b>Frequency</b>	<b>Percent</b>
Below 83 cm.	20	16.7
83-99 cm.	55	45.8
Above 99 cm.	45	37.5
Total	120	100.0

From the table 1, it is evident that from 120 respondents, there are 45.8 per cent respondent belong to 83 to 99 cm. and 37.5 per cent respondent were above 99 cm. height. There are only 16.7 per cent respondents who were belonged to 16.7 per cent of total respondents.

The majority of respondents belong to medium level of height group (45.8 per cent). This finding was found similar to that of Stanely *et al.* (1999).

Weight

Table - 2 : Weight-wise distribution of child

Weight	Frequency	Percent
Below 11.5 kg.	19	15.8
11.5 -17.5 kg.	76	63.3
Above 17.5 kg.	25	20.8
Total	120	100.0

Weight for age is commonly used indicator of body size and it reflects the level of food intake. Weight deficiency appears to the best indicator of protein energy malnutrition (PEM) in the children of all age-group.

From the table 2, there are more than 63 per cent of respondents belongs to 11.5 to 17.5 kg. weight group and 20.8 per cent children are above 17.5 kg. . Only 15.8 per cent from 120 respondent belonged below 11.5 kg. of weight-group. This finding finds support with the work of Rao and Vijaraghavan (1996).

Clinical Assessment

Table - 3 : Overall clinical symptoms of child

Category	Frequency	Percent
Low (Below 30)	9	7.5
Medium (30 -33)	48	40.0
High (Above 33)	63	52.5
Total	120	100.0

From the table 3, there are 52.5 per cent respondents are belongs to high category group and

7.5 per cent respondents belongs to low category.  
Supplementary Nutrition

Table - 4 : Distribution of children on the basis of age at the time of weaning

Weaning age	Frequency	Percent
Up to 6 months	11	9.16
6 to 12 months	52	43.33
12 to 18 months	36	30.00
18 to 24 months	18	15.00
2 years and above	3	2.50
Total	120	100.0

Table 4 shows that 43.33 per cent children started weaning from 6 to 12 months followed by 30.00 per cent children started weaning during 12 to 18 months. 9.16 per cent children started weaning below 6 months and 2.50 per cent children started weaning above 2 years.

Table - 5 : Distribution of children on the basis of age at the starting of solid foods

Age	Frequency	Percent
Up to 6 months	2	1.66
6 to 12 months	49	40.83
12 to 18 months	38	31.66
18 to 24 months	27	22.50
2 years and above	4	3.33
Total	120	100.0

Table 5 depicts that distribution of children on the basis of age at starting of solid food. 40.83 per cent children have started solid food at the age of 6 to 12 months followed by 31.66 per cent children have started food in 12 to 18 months. 22.50 per cent children have started solid food during 18 to 24 months age and 3.33 per cent children found starting solid food assuming 24 months age.



**Table - 6 : Distribution of children on the basis of number of meal per day**

Particulars	Frequency	Percent
Twice	48	40.00
Thrice	72	60.00
Total	120	100.0

Table 6 shows that distribution of children on the basis of number of meal per day, 60.00 per cent children were taking meal thrice a day whereas 40.00 per cent children were taking meal twice a day.

### CONCLUSION

In conclusion, this study aimed to determine the prevalence of malnutrition among preschool children in the Baksha block of Jaunpur district, Uttar Pradesh. Anthropometric measurements and clinical examinations were used to assess the nutritional status of the children. The findings revealed that 45.8% of the respondents belonged to the height group of 83 to 99 cm, while more than 63% of the respondents belonged to the weight group of 11.5 to 17.5 kg. Moreover, 52.5% of the respondents were in the high category group of clinical examination. The results also showed that 43.33% of the children started weaning from 6 to 12 months, and most of the children (40.83%) started solid food at the age of 6 to 12 months. In addition, the majority of the respondents (60.00%) were taking meals thrice a day. Based on the findings, the prevalence of malnutrition among preschool children in the Baksha block was found to be at 'prevalence rate'. These findings underscore the importance of interventions to improve the nutritional status of preschool children and promote

healthy eating habits. The results of this study can serve as a baseline for future research aimed at reducing the prevalence of malnutrition among preschool children in the Baksha block and other similar regions.

### REFERENCES

1. Agnihotri, S.B. (1999) Eliminating severe malnutrition in Orissa: Profile of a Campaign. *Econ. And Political Weekly*, 34(51): 3616-3621.
2. Bapat, M.M. and Aspatwar, A.P. (1993) Nutritional status of preschool and school children in slums of Bombay suburbs. *Ind. J. Nutr. Diet.*, 30 : 127.
3. Dixit, P.; Gupta, A.; Dwivedi, L.K. and Coomar, D. (2018) Impact Evaluation of Integrated Child Development Services in Rural India: Propensity Score Matching Analysis. *Sage open*. 1-7.
4. Rao, D.H. and Vijayaraghavan, K. (1996) Anthropometric assessment of nutritional status. In Bamji, M.S.; Rao, N.P.; Reddy, V. ed. Text book of Human Nutrition, New Delhi, Oxford and IBH Publishing Company Pvt. Ltd. : 148-160.
5. Stanley, J.; Ulijaszex and Deborah, A.K. (1999) Anthropometric measurement, error and the assessment of nutritional status. *British Journal of Nutrition*, 82 : 162-177.

# USE OF BOTANICAL PESTICIDES IN SUSTAINABLE AGRICULTURE : PROSPECTS AND PROMISES

**Preeti Maurya and Sanjay Singh**

Department of Botany, CMP Degree College,

University of Allahabad, Prayagraj - 211002, (U.P.), India

E-mail : cmpsanjay@gmail.com

Received : 18.02.2023

**ABSTRACT**

Accepted : 28.03.2023

Conventional pesticides contributed to several environmental problems, including ecosystem imbalances, decreased soil fertility, and worsening conditions for marine life. These synthetic pesticides' non-target toxicity, persistent effects, and difficult biodegradability have grown to be a severe concern, necessitating the urgent adoption of environmentally friendly and cost-effective pest management alternatives. Growing concern over environmental safety has sparked interest in pest control strategies using environmentally benign plant-based insecticides. Farmers' attitudes toward the usage of pesticides for crop protection and crop production have significantly changed.

**Keywords :** *Environmental worsening, pest management, crop protection, pesticides, biodegradability.*

## INTRODUCTION

In the 1950s and 1960s, the era of the Green Revolution, crop output was increased to fulfil the need for food in low-income countries by heavily relying on inputs like inorganic fertilizers, synthetic insecticides, and genetically engineered organisms (Grassini P. et al 2013; Singh A. et al 2014; Patrick MaadaNgegba et al 2022). The biological functions of botanical pesticides, which can be solitary compounds or complex combinations, include functioning as deterrents, insecticides, fungicides, nematocides, and bactericides. (Isman, 2006). According to studies, botanical pesticides prevent certain mosquito species, including species important to agriculture, from ingesting food, growing at different phases of development, and laying eggs. (Aharoni et al., 2005; Nagegowda, 2010; Pavela, 2011; Regnault-Roger et al., 2012). Evidence suggests that botanical pesticides can

exert their effects through a variety of pathways in insects and mammals, operating particularly on the nervous system and potentially influencing sodium channels, acetylcholinesterase, nicotinic acetylcholine receptors (nAChR), octopamine and tyramine receptors, acetylcholinesterase, and GABA-gated chloride channels. (Pavela and Benelli, 2016; Regnault-Roger et al., 2012; E.V.R. Campos et al. 2018). It is recognised that pathogenic microbes such as viruses, bacteria, fungi, protozoa, and nematodes are the culprits behind plant disease. Plants are frequently harmed by insect assaults and compete with weeds, which is another source of stress. It is tentatively estimated that between 31 and 42% of all crops produced globally are affected by, or destroyed by, diseases, insects, and weeds each year. Diseases, insects, and weeds account for 14%, 10.2%, and 12.2%, respectively, of the average 36.5% total losses. According to Oerke and Dehne

(2004), the factual losses for the 1996–1998 period were estimated at 26–30% for sugar beet, barley, soybean, wheat, and cotton, and 35%, 39%, and 40% for maize, potatoes, and rice. Plant diseases cause roughly \$ 220 billion worth of agricultural losses worldwide each year (Agrios, G. N. 2005; Quang Le Dang, et al 2012). Arthropod-related, disease-related, and weed-related yield losses are thought to account for around 35% of major crop losses globally. In underdeveloped countries with few pest control alternatives, losses could surpass 50% (Oerke 2006). In some circumstances, crop failure or even larger losses can result from pest damage, specifically arthropod damage (Abate et al. 2000; Grzywacz et al. 2014; Lingappa et al. 2004; Dougoud J. et al 2019).

Agrochemicals can enter the soil by direct applications, including weed control and seed treatment, as well as indirectly through plant aerial

portions being sprayed, treated foliage or fruits dropping to the ground, and polluted water moving across the soil's surface and into the soil profile (Chaplain et al., 2011; Chowdhury et al., 2008; Cycon et al., 2017; Gevao et al., 2000). These chemicals can interact with the living portion of the soil (the microbiota) and be biodegraded once they have accumulated in the soil. Once in the soil, they can be transported by leaching and surface runoff, go through chemical processes like hydrolysis, photolysis, and chemical degradation, as well as undergo chemical processes like hydrolysis, photolysis, and chemical degradation (Arias-Estévez et al., 2008; Chaplain et al., 2011; Kookana et al., 1998; Meite et al., 2018; Salazar-Ledesma et al., 2018; Shaheen et al., 2017). Numerous bioactive substances provided by plants are essential for the interaction between plants and their surroundings.

**Table - 1 : Botanical Plants with Target Pest.**

Scientific Name	Family	Part Utilized	Target Pest	References
<i>Acorus calamus</i>	Acoraceae	Leaf, Rhizome, Stem	<i>Microsporiumgypseum</i> , <i>Penicillium marneffeii</i> , <i>Trichophyton rubrum</i> , <i>Sitophilus zeamais</i>	Yao, Y. et al 2012
<i>Adhatodavasica</i>	Acanthaceae	Leaf, Root, Bark, Fruit, Flower	<i>Xanthomonas oryzae</i>	Madhiazhagan, K. et al 2002
<i>Allium cepa</i>	Alliaceae	Seed	<i>Alternaria solani</i> , <i>Cochliobolusheterostrophus</i> , <i>Phytophthora infestans</i> , <i>Ramularia areola</i>	Ponnanna, K.M. et al 2001; Jha, M.M. et al 2004; Abd-El-Khair, H. et al 2007
<i>Allium sativum</i>	Alliaceae	Bulb, Leaf	<i>Bemisiatabaci</i> , <i>Curvularialunata</i> , <i>Fusarium guttiforme</i> , <i>Helicoverpaarmigera</i> , <i>Pseudomonas syringae</i>	Sumitra, A. et al 2014; Sales, M.D.C. et al 2016; Muthomi, J. et al 2017; Mougou, I. et al 2018
<i>Annona squamosa</i>	Annonaceae	Seed	<i>Fusarium wilt</i> , <i>Phytophthora blight</i> , <i>Rhizoctonia solani</i>	Suryawanshi, A.P et al 2007
<i>A. indica</i>	Meliaceae	Leaf, Bark, Root, Seed, Fruit	<i>Aphis spp.</i> , <i>Aspergillus niger</i> , <i>B. tabaci</i> , <i>Colletotrichum spp</i> , <i>Echinochloacrusgalli</i> , <i>Fusarium oxysporum</i> , <i>Geotrichumcandidium</i> , <i>H. armigera</i> , <i>Meloidogyne incognita</i> , <i>Meloidogyne javanica</i> , <i>Rhizopus stolonifer</i> , <i>Sitophilus zeamais</i>	Okwute, S.K. 2012; Chougule, P.M. et al 2016; Ngegba, P.M. et al 2018; Ntalli, N. et al 2020
<i>Camellia oleifera</i>	Theaceae	Stem, Leaf		Liu, X.L. et al 2017
<i>Capsicum frutescens</i>	Solanaceae	Fruit	<i>A. solani</i> , <i>Bacillus subtilis</i> , <i>Escherichia coli</i> , <i>F. oxysporum</i> , <i>Phytophthrainfestans</i> , <i>Pseudomonas aerugionsa</i> , <i>Staphylococcus aureus</i>	Abd-El-Khair, H. et al 2007; Bowers, J.H. et al 2000; Izah, S.C. et al 2019
<i>Chromolaena odorata</i>	Asteraceae	Leaf, Stem, Root	<i>A. niger</i> , <i>Dolichodorus sp.</i> , <i>F. oxysporum</i> , <i>G. candidium</i> , <i>Helicotylenchus sp.</i> , <i>M. incognita</i> , <i>R. stolonifera</i>	Ngegba, P.M. et al 2018; Ogundele, R.A. et al 2018
<i>Chrysanthemum cinerariaefolium</i>	Compositae	Flower	<i>Blattaorientalis</i> , <i>Isoptera spp.</i> , <i>Lasiusniger</i> , <i>Myrmeciaagulosa</i>	Okwute, S.K. 2012
<i>Citrus hystrix</i>	Rutaceae	Leaf	<i>Acarina spp.</i> , <i>Acheta domesticus</i> , <i>Aphis spp.</i> , <i>Botrytis cinerea</i> , <i>Siphonaptera spp.</i> , <i>Uromyces appendiculatus</i> ,	Muthomi, J. et al 2017; Jing, L. et al 2014
<i>Coriandrum sativum</i>	Apiaceae	Seed, Fruit	<i>Alternaria alternata</i> , <i>F. oxysporum</i> , <i>Pyriculariaaoryzae</i> , <i>Trichoconiellapadwickii</i> , <i>X. oryzae</i>	Mandal, S. et al 2015
<i>Croton chichenensis</i>	Euphorbiaceae	Root	<i>Alternaria tagetica</i> , <i>Colletotrichum gloeosporioidese</i> , <i>F. oxysporium</i> , <i>Rhizopus sp.</i>	Gamboa-Angulo, M.M. et al 2008
<i>Cymbopogon citratus</i>	Gramineae	Leaf	<i>A. solani</i> , <i>Alternaria brassicae</i> , <i>P. infestans</i> , <i>Pectobacteriumcarotovorum</i>	Acedo, A.L et al 1999
<i>Curcuma longa</i>	Zingiberaceae	Root stem	<i>Spodoptera frugiperda</i> , <i>Spodoptera litura</i>	Cui, G.F. et al 2022; Veeran, S. et al 2019; Veeran, S. et al 2017
<i>Datura stramonium</i>	Solanaceae	Leaf, Fruit	<i>A. alternata</i> , <i>Aspergillus flavus</i> , <i>Aspergillus fumigatus</i> , <i>A. niger</i>	Dabur, R. et al 2005; Pande, P.C. et al 2011
<i>Eucalyptus globules</i>	Myrtaceae	Leaf, Bark	<i>A. brassicae</i> , <i>Alternaria trititcina</i> , <i>A. solani</i> , <i>F. oxysporum</i> , <i>P. infestans</i> , <i>Pythium ultimum</i> <i>R. solani</i>	Patil, V.S. et al 2002; Prasad, C.S. et al 2003; Patni, C.S et al 2005
<i>Gossypium herbaceum</i>	Malvaceae	Leaf	Rice stripe virus, Southern rice black-streaked dwarf virus, Tobacco mosaic virus	Alabi, D.A. et al 2005

Scientific Name	Family	Part Utilized	Target Pest	References
<i>Hydnocarpusant helminthicus</i>	Achariaceae	Leaf, Fruit	<i>Colletotrichum falcatum</i> , <i>Colletotrichum higginsianum</i> , <i>Phytophthora palmivora</i> , <i>P. oryzae</i> , <i>R. solani</i>	Katooli, N. et al 2011; Zhao, L. et al 2015
<i>Lantana camara</i>	Verbenaceae	Leaf, Stem, Fruit	<i>A. flavus</i> , <i>A. niger</i>	Jantasorn, A. et al 2016; Hsieh, T.F. 2018
<i>Derris elliptical</i>	Fabaceae	Root	<i>Aphis spp.</i> , <i>Ceratomyrifurcata</i> , <i>Diabroticaundecimpunctata</i> , <i>Erythroneura variabilis</i> , <i>Tetranychusurticae</i>	Okwute, S.K. 2012
<i>Mentha piperita</i>	Lamiaceae	Shoot	<i>A. alternata</i> , <i>B. cinerea</i>	Fayaz, M. et al 2017; Sreeramulu, A. et al 2017
<i>N. tabacum</i>	Solanaceae	Leaf	<i>Aphis sp.</i> , <i>Acarina sp.</i> , <i>Bradysia sp.</i> , <i>Circulifer tenellus</i> , <i>F.</i> <i>oxysporum</i> , <i>Penicillium digitatum</i> , <i>Rhizopus sp.</i>	Okwute, S.K. 2012; Feng, W. et al 2007
<i>Ocimum basilicu m</i>	Labiatae	Leaf	<i>A. solani</i> , <i>Alternaria heveae</i> , <i>P. infestans</i>	Abd-El-Khair, H. et al 2007; Mermer -Do ̃gu, D. et al 2014
<i>Ocimum sanctum</i>	Malvaceae	Leaf	<i>F. oxysporum</i> , <i>Macrophominaphaseolina</i> , <i>Sarocladiumoryzae</i>	Suleiman, M.N. et al 2011; Ogbabor, N. et al 2005; Ushamali, C. et al 1997
<i>Ocimumtenuflo rum</i>	Lamiaceae	Leaf	<i>Phyllostictazingiberi</i>	Pramanick, T.C. et al 1998
<i>Origanum vulgare</i>	Lamiaceae	Leaf, flower	<i>Bacillus spp.</i> , <i>Serratia marcescens</i>	Tomar, M. et al 2006
<i>Peganum harmala</i>	Zygophyllaceae	Leaf, Stem	<i>Bursaphelenchus xylophilus</i>	Weng, Q.F. et al 2005
<i>Prosopis juliflora</i>	Fabaceae	Leaf, Fruit	<i>A. alternata</i> , <i>A. solani</i> , <i>B. cinerea</i> , <i>B. subtilis</i> , <i>Candida albican</i> , <i>Geotrichumcandidum</i> , <i>P. infestans</i> , <i>S. aureus</i> , <i>Xanthomonas campestris</i>	Sharoba, A.M. et al 2015
<i>Psidium guajava</i>	Myrtaceae	Leaf	<i>Chromobacterium violaceum</i> , <i>P. ca rotovorum</i> , <i>Pseudomonas aeruginosa</i> , <i>S. aureus</i> , <i>S. marcescens</i>	Acedo, A.L. et al 1999; Jnaid, Y. et al 2016
<i>Reynoutriasach alinensis</i>	Polygonaceae.	Leaf, Stem, Flower	<i>Leveillulataurica</i>	Satish, S. et al 1999; Patel, P. et al 2019
<i>Ricinus communis</i>	Euphorbiaceae	Leaf	<i>R.solani</i> , <i>Fusarium wilt</i>	Suryawanshi, A.P et al 2007
<i>Rhododendron molle</i>	Ericaceae	Flower	<i>Pieris rapae</i>	Zhong, G.H. et al 2001
<i>Rosmarinus officinalis</i>	Lamiaceae	Leaf, Seed	<i>A. flavus</i> , <i>Phytophthora capsici</i> , <i>P. megakarya</i> , <i>P. palmivora</i>	Doltsinis, S.K. et al 2006
<i>Salvia officinalis</i>	Lamiaceae	Shoot	<i>Penicillium aurantiogriseum</i> , <i>Verticillium dahlia</i>	Widmer, T.L. et al 2006
<i>Tithonia diversifolia</i>	Asteraceae	Leaf	<i>A. niger</i> , <i>F. oxysporum</i> , <i>G. candidum</i> , <i>R. stolonifer</i>	Veeran, S. et al 2019
<i>T. diversifolia</i>	Asteraceae	Leaf	<i>Cercosporaarachidicola</i> , <i>Cercosporidiumpersonatum</i>	Ngegba, P.M. et al 2017
<i>Tridax procumbens</i>	Asteaceae	Leaf	<i>C. arachidicola</i> , <i>C. personatum</i>	Ngegba, P.M. et al 2017
<i>Thuja orientalis</i>	Cupressaceae	Leaf	<i>Watermelon mosaic virus</i>	Elbeshehy, E.K.F. et al 2015
<i>Thymus citriodorus</i>	Lamiaceae	Leaf	<i>M.incognita</i> , <i>M.javanica</i>	Bowers, J.H. et al 2000
<i>Trigonella foenumgraceum</i>	Fabaceae	Leaf, Seed	<i>P. capsici</i>	Mathur, K. et al 2002
<i>Vernonia amygdalina</i>	Asteraceae	Leaf	<i>F. oxysporum</i>	Prasad, C.S. et al 2003
<i>Withaniasomnif era</i>	Solanaceae	Leaf	<i>Trichotheciumroseum</i>	Purnima, D. et al 2002
<i>Zingiber officinale</i>	Zingiberaceae	Rhizome	<i>B.tabaci</i> , <i>Caliothrips fasciatus</i> , <i>Colletotrichum lindemuthianum</i> , <i>Fusarium lycopersici</i> , <i>F. oxysporium</i> , <i>F. solani</i> , <i>Phaeoisariopsis</i> , <i>griseola</i> , <i>P.infestans</i> , <i>P. oryzae</i> , <i>P. digitatum</i>	Muthomi, J. et al 2017; Al -Samarrai, G. et al 2012; Rawal, P. et al 2016

Bioactive compounds from botanicals:

species because of their varied mechanisms of

Botanical pesticidal compounds have

action(Patrick MaadaNgegba et al 2022).

noticeable effects against various agricultural pest

Table - 2 : Bioactive compounds released by botanical plants with their Trade Name as well as biological effects (Patrick MaadaNgegba et al 2022).

Product name	Botanical name	Trade name	Main Bioactive Compound(s)	Biological Effects
Capsicum oleoresin	<i>Capsicum spp. (C. frutescens)</i>	Hot Pepper Wax Insect Repellent	Capsaicin	Repellent, Fungicide, Nematicide, Bactericide
Cinnamaldehyde	<i>Cassia tora L., Cassia obtusifolia L.</i>	VertigoTM, CinnacureTM	Cinnamaldehyde	Fungicide, Insect Attractant
Cinnamon essential oil	<i>Cinnamomum zeylanicum</i>	Weed ZapTM, Repellex,	Cinnamaldehyde	Insecticide, Herbicide
Clove essential oil	<i>Syzygiumaromaticum L. Eugenia caryophyllusSpreng</i>	Matran EC, Burnout II, Bioorganic Lawn	Eugenol (mixture of several predominantly terpenoid compounds)	Insecticide, Herbicide
Extract of giant Knotweed	<i>R. sachalinensis</i>	Milsana®, RegaliaTM	Physcion, Emodin	Fungicide, Bactericide
Jjoba essential oil	<i>Simmondsia californica Nutt.,S. chinensis</i>	Detur, E -Rasem, Eco E -Rase, Permatrol, ERaseTM	Straight-chain wax esters	Fungicide, Insecticide

Product name	Botanical name	Trade name	Main Bioactive Compound(s)	Biological Effects
Karanjin	<i>Derris indica</i> (Lam.) Bennet	Derisom	Karanjin	Insecticide, Acaricide
Lemongrass essential oil	<i>Cymbopogon nardus</i> , <i>C. citratus</i> , <i>Cymbopogon flexuosus</i> D.C	GreenMatch EXTM	Citronellal, Citral	Insecticide, Herbicide
Neem (neem oil)	<i>A. indica</i>	Ecozin, Azatrol EC, Agroneem, TrilogyTM	Azadirachtin, Dihydroazadirachtin, Triterpenoids (Nimbin, Salannin	Insecticide, Acaricide, Fungicide
Nicotine	<i>Nicotiana spp.</i>	Stalwart, No -Fid, XL -All Nicotine, Tobacco Dust	(S)-isomer, (RS) -isomers, and (S)-isomer of nicotine sulfate.	Insecticide
Phenethyl propionate	Component of peppermint oil ( <i>M. piperita</i> ) and peanut oil	EcoSmart HC, EcoExempt HC, EcopcoAcu	Phenethyl propionate	Insecticide, Insect Repellent, Herbicide
Pink plume poppy extract	<i>Macleaya cordata</i> R. Br.	Qwel®	Alkaloids, Anguinarine Chloride, Chelerythrine Chloride	Fungicide
Pyrethrum	<i>Tanacetum cinerariaefolium</i> (Trevisan) Schultz-Bip.	Pyganic, Diatect	Esters of chrysanthemic acid and pyrethric acid (pyrethrins I and II, cinerins I and II, jasmolin s I and II)	Insecticide, Acaricide
Rosemary essential oil	<i>R. officinalis</i>	EcotrolTM, SporanTM	1,8-cineole (borneol, camphor, monoterpenoids)	Insecticide, Acaricide, Fungicide
Rotenone	<i>Derris spp.</i> , <i>Lonchocarpus spp.</i> , and <i>Tephrosia spp.</i>	Bonide, Rotenone	Rotenone, Deguelin, (isoflavonoids)	Insecticide, Acaricide
Ryania	<i>Ryania spp.</i> ( <i>Ryania speciosa Vahl</i> )	Natur -Gro R -50, Natur -Gro Triple Plus, Ryan 50	Ryanodine, Ryania, 9,21 -didehydroryanodine (alkaloids)	Insecticide
Sabadilla	<i>Schoenocaulon spp.</i> ( <i>S. officinale</i> )	Veratran, Red Devil, Natural Guard	Mixture of alkaloids (cevadine, veratridine)	Insecticide
Thyme essential oil	<i>Thymus vulgaris</i> L. <i>Thymus spp.</i>	Proud 3, Organic Yard Insect Killer, PromaxTM	Thymol, Carvacrol	Insecticide, Fungicide, Herbicide

Table - 3 : Mechanism of Action of Some Bioactive Compounds

PlantSource	Active Compounds	Target site	Mechanism of Action	References
<i>Haloxylon salicornicum</i> , <i>N. tabacum</i> , <i>Stemona japonicum</i>	Nicotine	Nervous system	It competes with the neurotransmitter by attaching to acetylcholine receptors (nAChRs) at neuron synapses, producing unregulated nerve firing. The disturbance of normal nerve impulse performance caused physiological system malfunctions of the neurons	Akaike, A. et al 2018; Blotnick -Rubin, E. et al 2018; Chowa ´nski, S. et al 2016
<i>Chrysanthemum cinerariaefolium</i>	Pyrethrin I & II, Cinerin I & II, Jasmolin I & II	Nerve (Axon)	Interfering with Na and K ion conversion inhibited the normal transmittal of nerve impulses, triggering paralysis in insects.	Sola, P. et al 2014; Isman, M.B. 2006; Rattan, R.S. 2010
<i>Lonchocarpus spp.</i> , <i>Derris spp.</i>	Rotenone	Mitochondria	Cell respiratory enzyme inhibitor disrupts cellular metabolism, and reduces ATP output. Nerve and muscle cell malfunctions lead to low feeding rates.	Ware, G.W. 2000; Ware, G.W. et al 2004; Casida, J. et al 2013
<i>Ryania spp.</i>	Byanodine	Muscles	Activation of sarcoplasmic reticulum. Affect calcium development and causes improper function of muscles.	Shivanandappa, T. et al 2014
<i>S. officinale</i>	Sabadilla	Nerve (Axon)	Obstruct the movement of neurons and potassium ions in nerve axons.	Hare, J. et al 1997; Rattan, R.S. 2010
<i>Cedrus spp.</i> , <i>Citronella spp.</i> , <i>Eucalyptus spp.</i> , <i>Pinus spp.</i>	Essential oils	Octopaminergic system	Increase the level of intracellular messenger and effectively inhibit cyclic AMP of abdominal epidermal tissue.	Rattan, R.S. 2010; Kostyukovsky, M. et al 2002
<i>Monarda spp.</i> , <i>O. vulgare</i> , <i>T. vulgaris</i>	Thymol	Octopaminergic system	Prevent octopamine receptors via tyramine receptors cascade	Rattan, R.S. 2010; Park, J.H. et al 2017
<i>A. indica</i>	Azadirachtin, Nimbin, Salannin, Melandriol	Endocrine system	Inhibit Prothoracicotropic hormone (PTTH); distort phagostimulant disruptor by cholinergic transmission	Rattan, R.S. 2010; Mordue, A.J. et al 2000; Chengala, L. et al 2018
<i>A. squamosa</i>	Squamocin (annonin), Debitterizedannonna oil	Mitochondria	Dunnione acts as an insecticide and fungicide, disrupting mitochondrial complex III.	Rattan, R.S. 2010; Pavela, R. 2016
<i>Capsicum annum</i>	Protoalkaloids Capsaicin	Nerve	Induced metabolism, impaired cell membrane, and nervous system. Acts as a physical repellent.	Pavela, R. 2016
<i>Citrus sinensis</i>	Limonene, Linalool	Nerve	Hyperactivity, and hyperexcitation leading to rapid knockdown and immobilization. Inhibitory effects on acetylcholinesterase.	Oboh, G. et al 2017
<i>Pongamia pinnata</i>	Karanjin, Debitterisedkaranjin oil		Serves as feeding restraint, repellent, reduced growth, oviposition suppressor, and low or no fertilization.	Rattan, R.S. 2010; Pavela, R. 2016
<i>S. officinale</i>	Cevadine, Veratridine	Mitochondria	Interrupt nerve cell membrane process, induced nerve cell membrane, paralysis, and mortality.	Rattan, R.S. 2010; Pavela, R. 2016



Applications of botanical pesticides:

Research has been done on the use of botanicals as pesticides and their efficacy as an alternative to traditional pest control in sustainable agriculture and related disciplines. The products are used as insecticides, growth inhibitors for insects, antifeedants, and insect repellents. Furthermore, nematocides, fungicides, bactericides, and virucides are all applications for these botanical bioactive compounds.

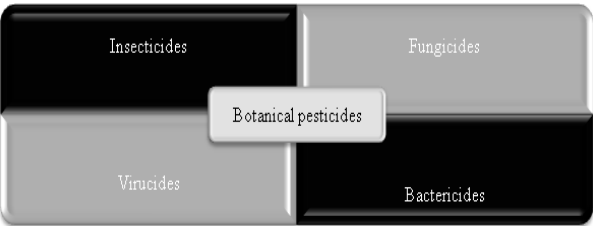


Figure - 1 : Applications of botanical pesticides

Table - 4 : An index of biologically active compounds used as nematocides (Shivkumara KT et al 2020):

Botanical Plants	Active Compounds	Activity
<i>Abiesbalsamea</i>	Juvabione	JH agonist
<i>Acoruscalamus</i>	Asarone	Antifeedant
<i>Ageratum houstonianum</i>	Precocene, Anacylin	Anti-JH
<i>Ajugaremota</i>	Ajygarin	Feeding deterrent
<i>Allium sativum</i>	Diallyl sulfide	Repellent
<i>Atlantiaracemosa</i>	Luvangetin	Antifeedant
<i>Citrulluscolocynthis</i>	Cucurbitacin-B	Antifeedant
<i>Citrus paradisi</i>	Isolimonic acid	Oviposition deterrent
<i>Clerodendroninfotunatum</i>	Clerodin	Antifeedant
<i>Curcuma longa</i>	Termeron	Growth inhibitor
<i>Glycine max</i>	Glyceollin	Antifeedant activity
<i>Tagetes minuta</i>	E-Ocimenone	Repellent
<i>Ricinus communis</i>	Ricinine	Oviposition deterrent
<i>Medicago sativa</i>	Butyric acid	Repellent
<i>Ocimumbasillicum</i>	Juvocimene	JHA
<i>Parthenium hysterophorus</i>	Parthenin	Growth inhibitor
<i>Piper nigrum</i>	Piperin	Oviposition deterrent
<i>Quassiaamara</i>	Quassin	JHA
<i>Pongamiapinnata</i>	Karanjin	Antifeedant, JHA

Conclusion and Future prospects:

In contrast to synthetic pesticides, the application of botanical pesticides is a crucial component of IPM programmes. Insects are affected by a variety of behavioral and physiological effects

caused by naturally occurring botanical pesticides, and it is challenging for insects to build resistance to these pesticides. Farmers won't need to spend a lot of money on pricey synthetic agrochemical purchases if village cooperatives take on the formulation of locally accessible plants. Fruits, vegetables, cotton, and beverages with no residue are in high demand on the global market. Most nations frequently take sustainable agricultural development into account to support the growing population. Currently, organic farming places a high priority on integrated crop management. These characteristics of plants encourage scientists to utilise them as a part of integrated pest control because they are the main natural alternatives to manmade pesticides. Botanical insecticides are organic substances with insecticidal qualities isolated from plants and utilised as a great substitute for synthetic or chemical pesticides for crop protection to prevent any side effects. Repellants, feeding deterrents/antifeedants, toxicants, growth retardants, chemosterilants, and attractants are only a few of the varied ways that botanical pesticides (such as pyrethrum, neem, nicotine, etc.) affect insects. Therefore, it is preferable to use botanical insecticides rather than synthetic ones, and organic crop growers in developed nations know these botanical pesticides' effectiveness. Therefore, we advised employing botanical insecticides, which are currently being promoted and new sources of botanical insecticides are being sought after.

REFERENCES

1. Isman, M.B., 2006. Botanical insecticides, deterrents, and repellents in modern agriculture and an increasingly regulated world. *Annu. Rev. Entomol.* 51, 45–66.

2. Aharoni, A., Jongsma, M., Bouwmeester, H., 2005. Volatile science? Metabolic engineering of terpenoids in plants. *Trends Plant Sci.* 10, 594–602. <https://dx.doi.org/10.1016/j.tplants.2005.10.005>.

3. Nagegowda, D.A., 2010. Plant volatile

terpenoid metabolism: biosynthetic genes, transcriptional regulation, and subcellular compartmentation. *FEBS Lett.* 584, 2965–2973. <https://dx.doi.org/10.1016/j.febslet.2010.05.045>.

5. Pavela, R., 2011. Antifeedant and larvicidal effects of some phenolic components of essential oils last lines of introduction against *Spodopteralittoralis* (Boisd.). *J. Essent. Oil Bear. Plants* 14, 266–273. <https://dx.doi.org/10.1080/0972060X.2011.10643932>.

6. Pavela, R., Benelli, G., 2016. Essential oils as eco-friendly biopesticides? Challenges and constraints. *Trends Plant Sci.* 21, 1000–1007. <https://dx.doi.org/10.1016/j.tplants.2016.10.005>.

7. Regnault-Roger, C., Vincent, C., Arnason, J.T., 2012. Essential oils in insect control: low-risk products in a high-stakes world. *Annu. Rev. Entomol.* 57, 405–424. <https://dx.doi.org/10.1146/annurev-ento-120710-100554>.

8. Abate T, van Huis A, Ampofo JK (2000) Pest management strategies in traditional agriculture: an African perspective. *Annu Rev Entomol* 45:631–659. <https://doi.org/10.1146/annurev.ento.45.1.631>.

9. Grzywacz D, Stevenson PC, Mushobozi WL, Belmain S, Wilson K (2014) The use of indigenous ecological resources for pest control in Africa. *Food Sec* 6(1):71. <https://doi.org/10.1007/s12571-013-0313-5>.

10. Lingappa S, Basavanagoud K, Kulkarni KA, Patil RS, Kambrekar DN (2004) Threat to vegetable production by diamondback moth and its management strategies. In: *Fruit and vegetable diseases*. Kluwer Academic, Dordrecht, pp 357–396.

11. Oerke EC (2006) Crop losses to pests. *J Agric Sci* 144(01):31. <https://doi.org/10.1017/S0021859605005708>.

12. Dougoud, J., Toepfer, S., Bateman, M., & Jenner, W. H. (2019). Efficacy of homemade botanical insecticides based on traditional knowledge. *A review. Agronomy for Sustainable Development*, 39(4). <https://doi.org/10.1007/s13593-019-0583-1>.

13. Campos, E. V., Proença, P. L., Oliveira, J. L., Bakshi, M., Abhilash, P., & Fraceto, L. F. (2019). Use of botanical insecticides for sustainable agriculture: Future perspectives. *Ecological Indicators*, 105, 483–495. <https://doi.org/10.1016/j.ecolind.2018.04.038>.

14. Chaplain, V., Mamy, L., Vieubl  , L., Mougin, C., Benoit, P., Barriuso, E., & N  lieu, S. (2011). The fate of pesticides in soils: Toward an integrated approach of influential factors.

15. Chowdhury, A., Pradhan, S., Saha, M., Sanyal, N., 2008. Impact of pesticides on soil microbiological parameters and possible bioremediation strategies. *Indian J. Microbiol.* 48, 114–127. <http://dx.doi.org/10.1007/s12088-008-0011-8>.

16. Cycon, M., Mrozi  , A., Piotrowska-Seget, Z., 2017. Bioaugmentation as a strategy for the remediation of pesticide-polluted soil: a review. *Chemosphere* 172, 52–71. <http://dx.doi.org/10.1016/j.chemosphere.2016.12.129>.

17. Geva  , B., Semple, K.T., Jones, K.C., 2000. Bound pesticide residues in soils: a review. *Environ. Pollut.* 108, 3–14. [http://dx.doi.org/10.1016/S0269-7491\(99\)00197-9](http://dx.doi.org/10.1016/S0269-7491(99)00197-9).

18. Arias-Est  vez, M., L  pez-Periago, E., Mart  nez-Carballo, E., Simal-G  ndara, J., Mejuto, J.- C., Garc  a-R  o, L., 2008. The mobility and degradation of pesticides in soils and the pollution of groundwater resources. *Agric. Ecosyst. Environ.* 123, 247–260. <https://dx.doi.org/10.1016/j.agee.2007.07.011>.

80	Preeti Maurya and Sanjay Singh	
19.	Kookana, R.S., Baskaran, S., Naidu, R., 1998. Pesticide fate and behavior in Australian soils in relation to contamination and management of soil and water: a review. <i>Aust. J. Soil Res.</i> 36, 715. <a href="http://dx.doi.org/10.1071/S97109">http://dx.doi.org/10.1071/S97109</a> .	crop production trends. <i>Nat. Commun.</i> 2013, 4, 2918. <a href="http://doi.org/10.1038/ncomms3918">http://doi.org/10.1038/ncomms3918</a> .
20.	Meite, F., Alvarez-Zaldívar, P., Crochet, A., Wiegert, C., Payraudeau, S., Imfeld, G., 2018. Impact of rainfall patterns and frequency on the export of pesticides and heavy metals from agricultural soils. <i>Sci. Total Environ.</i> 616–617, 500–509. <a href="https://dx.doi.org/10.1016/j.scitotenv.2017.10.297">https://dx.doi.org/10.1016/j.scitotenv.2017.10.297</a> .	27. Archana Singh, S. K. (2014). Biopesticides for Integrated Crop Management: Environmental and Regulatory Aspects. <i>Journal of Biofertilizers &amp; Biopesticides</i> , 5(1). <a href="https://doi.org/10.4172/2155-6202.1000e121">https://doi.org/10.4172/2155-6202.1000e121</a> .
21.	Salazar-Ledesma, M., Prado, B., Zamora, O., Siebe, C., 2018. Mobility of atrazine in soils of a wastewater-irrigated maize field. <i>Agric. Ecosyst. Environ.</i> 255, 73–83. <a href="https://dx.doi.org/10.1016/j.agee.2017.12.018">https://dx.doi.org/10.1016/j.agee.2017.12.018</a> .	28. Sola, P., Mvumi, B. M., Ogendo, J. O., Mponda, O., Kamanula, J. F., Nyirenda, S. P., Belmain, S. R., & Stevenson, P. C. (2014). Botanical pesticide production, trade, and regulatory mechanisms in sub-Saharan Africa: Making a case for plant-based pesticidal products. <i>Food Security</i> , 6(3), 369-384. <a href="https://doi.org/10.1007/s12571-014-0343-7">https://doi.org/10.1007/s12571-014-0343-7</a> .
22.	Shaheen, I., Ahmad, K.S., Zahra, T., 2017. Evaluating the fate of agrochemical through adsorption and desorption studies of chlorfluazuron in selected agricultural soils. <i>J. King Saud Univ. Sci.</i> <a href="http://dx.doi.org/10.1016/j.jksus.2017.12.005">http://dx.doi.org/10.1016/j.jksus.2017.12.005</a> .	29. Akaike, A., & Izumi, Y. (2018). Overview. <i>Nicotinic Acetylcholine Receptor Signaling in Neuroprotection</i> , 1-15. <a href="https://doi.org/10.1007/978-981-10-8488-1_1">https://doi.org/10.1007/978-981-10-8488-1_1</a> .
23.	Agrios, G. N. (2005). <i>Plant pathology</i> 5th edition: Elsevier academic press. <i>Burlington, Ma. USA</i> , 79-103.	30. Blotnick-Rubin, E., & Anglister, L. (2018). Fine Localization of Acetylcholinesterase in the Synaptic Cleft of the Vertebrate Neuromuscular Junction. <i>Frontiers in Molecular Neuroscience</i> , 11. <a href="https://doi.org/10.3389/fnmol.2018.00123">https://doi.org/10.3389/fnmol.2018.00123</a> .
24.	Dang Q. L., Lim, C. H. and Kim J. C. (2012). Current status of botanical pesticides for crop protection. <i>Research in Plant Disease</i> 18(3):175-185. <a href="https://dx.doi.org/10.5423/RPD.2012.18.3.175">https://dx.doi.org/10.5423/RPD.2012.18.3.175</a> .	31. Chowański, S., Adamski, Z., Marciniak, P., Rosiński, G., Büyükgüzel, E., Büyükgüzel, K., Falabella, P., Scrano, L., Ventrella, E., Lelario, F., & Bufo, S. (2016). A Review of Bioinsecticidal Activity of Solanaceae Alkaloids. <i>Toxins</i> , 8(3), 60. <a href="https://doi.org/10.3390/toxins8030060">https://doi.org/10.3390/toxins8030060</a> .
25.	Ngegba, P. M., Cui, G., Khalid, M. Z., & Zhong, G. (2022). Use of Botanical Pesticides in Agriculture as an Alternative to Synthetic Pesticides. <i>Agriculture</i> , 12(5), 600. <a href="https://doi.org/10.3390/agriculture12050600">https://doi.org/10.3390/agriculture12050600</a> .	32. Rattan, R. S. (2010). Mechanism of action of insecticidal secondary metabolites of plant origin. <i>Crop Protection</i> , 29(9), 913-920. <a href="https://doi.org/10.1016/j.cropro.2010.05.008">https://doi.org/10.1016/j.cropro.2010.05.008</a> .
26.	Grassini, P.; Eskridge, K.M.; Cassman, K.G. Distinguishing between yield advances and yield plateaus in historical	33. Ware, G.W. (2000). An introduction to insecticides. In <i>Radcliffe's IPM World Textbook</i> , 3rd ed.; Radcliffe, E.B.,

- Hutchison, W.D., Eds.; MeisterPro Information Resources: Willoughby, OH, USA.
34. Ware, G.W.; Whitacre, D.M. (2004). The Pesticide Book, 6th ed.; MeisterPro Information Resources: Willoughby, OH, USA. p.488.
  35. Casida, J. E., & Durkin, K. A. (2013). Neuroactive Insecticides: Targets, Selectivity, Resistance, and Secondary Effects. Annual Review of Entomology, 58(1), 99-117. <https://doi.org/10.1146/annurev-ento-120811-153645>.
  36. Shivanandappa, T., & Rajashekar, Y. (2014). Mode of Action of Plant-Derived Natural Insecticides. Advances in Plant Biopesticides, 323-345. [https://doi.org/10.1007/978-81-322-2006-0\\_16](https://doi.org/10.1007/978-81-322-2006-0_16).
  37. Hare, D. J., & Morse, J. G. (1997). Toxicity, Persistence, and Potency of Sabadilla Alkaloid Formulations to Citrus Thrips (Thysanoptera: Thripidae). Journal of Economic Entomology, 90(2), 326-332. <https://doi.org/10.1093/jee/90.2.326>.
  38. Kostyukovsky, M., Rafaeli, A., Gileadi, C., Demchenko, N., & Shaaya, E. (2002). Activation of octopaminergic receptors by essential oil constituents isolated from aromatic plants: Possible mode of action against insect pests. Pest Management Science, 58(11), 1101-1106. <https://doi.org/10.1002/ps.548>.
  39. Park, J.-H., Jeon, Y.-J., Lee, C.-H., Chung, N., & Lee, H.-S. (2017). Insecticidal toxicities of carvacrol and thymol derived from *Thymus vulgaris* Lin. against *Pochazia shantungensis* Chou & Lu., newly recorded pest. Scientific Reports, 7(1). <https://doi.org/10.1038/srep40902>.
  40. Mordue (Luntz), A. J., & Nisbet, A. J. (2000). Azadirachtin from the neem tree *Azadirachta indica*: Its action against insects. Anais Da Sociedade Entomológica Do Brasil, 29(4), 615-632. <https://doi.org/10.1590/s0301-80592000000400001>.
  41. Laxmishree, C., & Singh, N. (2018). Review of Mode of action of some major botanical pesticides. Int. Res. Journal of Science & Engineering, 6(2), 129-132.
  42. PAVELA, R. (2016). History, presence, and perspective of using plant extracts as commercial botanical insecticides and farm products for protection against insects - a review. Plant Protection Science, 52(4), 229-241. <https://doi.org/10.17221/31/2016-pps>.
  43. Oboh, G., Ademosun, A. O., Olumuyiwa, T. A., Olasehinde, T. A., Ademiluyi, A. O., & Adeyemo, A. C. (2017). Insecticidal activity of essential oil from orange peels (*Citrus sinensis*) against *Tribolium confusum*, *Callosobruchus maculatus* and *Sitophilus oryzae* and its inhibitory effects on acetylcholinesterase and Na<sup>+</sup>/K<sup>+</sup>-ATPase activities. Phytoparasitica, 45(4), 501-508. <https://doi.org/10.1007/s12600-017-0620-z>.
  44. Yao, Y., Cai, W., Yang, C., & Hua, H. (2012). Supercritical fluid CO<sub>2</sub> extraction of *Chorus calamus*. (Arales: Araceae) and its contact toxicity to *Sitophilus zeamais* Motschusky (Coleoptera: Curculionidae). Natural Product Research, 26(16), 1498-1503. <https://doi.org/10.1080/14786419.2011.562209>.
  45. Madhiahagan, K., Anuradha, R., & Ramadoss, N. (2002). Effect of botanicals on bacterial blight of rice. Journal of Mycology and Plant Pathology (India).
  46. Ponnanna, K. M., & Adiver, S. S. (2001). Fungicidal management of grey mildew of cotton. Plant Pathol. News, 19, 6-8.
  47. Jha, M. M., Kumar, S., & Hasan, S. (2004). Effects of botanicals on maydis leaf blight of maize in vitro. Annals of Biology (India).
  48. Abd-El-Khair, H., & Haggag, W. M. (2007).



Application of some Egyptian medicinal plant extracts against potato late and early blights. *Res. J. Agric. Biol. Sci.*, 3(3), 166-175.

49. Arora, S., Kanojia, A. K., Kumar, A., Mogha, N., & Sahu, V. (2012). Biopesticide formulation to control tomato lepidopteran pest menace. *Current science*, 1051-1057.
50. Sales, M. D. C., Costa, H. B., Fernandes, P. M. B., Ventura, J. A., & Meira, D. D. (2016). Antifungal activity of plant extracts with potential to control plant pathogens in pineapple. *Asian Pacific Journal of Tropical Biomedicine*, 6(1), 26-31. <https://doi.org/10.1016/j.apjtb.2015.09.026>.
51. Muthomi, J., Fulano, A. M., Wagacha, J. M., & Mwang'ombe, A. W. (2017). Management of Snap Bean Insect Pests and Diseases by Use of Antagonistic Fungi and Plant Extracts. *Sustainable Agriculture Research*, 6(3), 52. <https://doi.org/10.5539/sar.v6n3p52>.
52. Mougou, I., & Boughalleb-M'hamdi, N. (2018). Biocontrol of *Pseudomonas syringae* pv. *syringae* affecting citrus orchards in Tunisia by using indigenous *Bacillus* spp. and garlic extract. *Egyptian Journal of Biological Pest Control*, 28(1). <https://doi.org/10.1186/s41938-018-0061-0>.
53. Suryawanshi, A.P.; Ladkat, G.M.; Dhoke, P.K.; Surayawanshi, S.D.; Pensalwar, S.N. Evaluation of some plant extracts against *Sclerotium rolfsii* on pigeonpea. *J. Plant Dis. Sci.* (2007). 2, 32–33.
54. Koma, S. (2012). Plants as Potential Sources of Pesticidal Agents: A Review. *Pesticides - Advances in Chemical and Botanical Pesticides*. <https://doi.org/10.5772/46225>.
55. Chougule, P.M.; Andoji, Y.S. (2016). Antifungal activity of some common medicinal plant extracts against soil-borne phytopathogenic fungi *Fusarium oxysporum* causing wilt of tomato. *Int. J. Dev. Res.* 6, 7030–7033.
56. Ngegba, P. M., Kanneh, S. M., Bayon, M. S., Ndoko, E. J., & Musa, P. D. (2018). Fungicidal effect of three plant extracts in control of four phytopathogenic fungi of tomato (*Lycopersicon esculentum* L.) fruit rot. *International Journal of Environment, Agriculture and Biotechnology*, 3(1), 112-117. <https://doi.org/10.22161/ijeab.3.1.14>.
57. Ntalli, N., BratidouParlapani, A., Tzani, K., Samara, M., Boutsis, G., Dimou, M., Menkissoglu-Spiroudi, U., & Monokrousos, N. (2020). Thymus citriodorus (Schreb) Botanical Products as Ecofriendly Nematicides with Bio-Fertilizing Properties. *Plants*, 9(2), 202. <https://doi.org/10.3390/plants9020202>.
58. Bowers, J. H., & Locke, J. C. (2000). Effect of Botanical Extracts on the Population Density of *Fusarium oxysporum* in Soil and Control of *Fusarium* Wilt in the Greenhouse. *Plant Disease*, 84(3), 300-305. <https://doi.org/10.1094/pdis.2000.84.3.300>.
59. ChibuezeIzah, S., Godwin Etim, N., Ilerhunmwuwa, A. I., & Sila, G. luck. (2019). Evaluation of crude and ethanolic extracts of *Capsicum frutescens* var. *minima* fruit against some common bacterial pathogens. *International Journal of Complementary & Alternative Medicine*, 12(3), 105-108. <https://doi.org/10.15406/ijcam.2019.12.00457>.
60. Ogundele, R. A., Oyedele, D. J., & Adekunle, O. K. (2016). Management of *Meloidogyne incognita* and other phytonematodes infecting *Amaranthus cruentus* and *Telfairia occidentalis* with African marigold (*Tagetes erecta*) and Siam weed (*Chromolaena odorata*). *Australasian Plant Pathology*, 45(5), 537-545. <https://doi.org/10.1007/s13313-016-0438-z>.



61. Liu, X.L.; Li, L.; Sun, T.; Fu, S.J.; Hu, M.Y.; Zhong, G.H. (2017). Inhibition of *Echinochloa crus-galli* using bioactive components from the stems and leaves of *Camellia oleifera*. *International Journal of Agriculture and Biology*, 19(5), 1031-1038. <https://doi.org/10.17957/ijab/15.0380>.
62. Jing, L., Lei, Z., Li, L., Xie, R., Xi, W., Guan, Y., Sumner, L. W., & Zhou, Z. (2014). Antifungal Activity of Citrus Essential Oils. *Journal of Agricultural and Food Chemistry*, 62(14), 3011-3033. <https://doi.org/10.1021/jf5006148>.
63. Acedo Jr, A. L., Acedo, J. Z., & Evangelio, M. F. N. (1999). Postharvest biocontrol of bacterial soft rot in cabbage using botanicals. *Philippine Journal of Crop Science (Philippines)*.
64. Cui, G., Yuan, H., He, W., Deng, Y., Sun, R., & Zhong, G. (2022). Synergistic effects of botanical curcumin-induced programmed cell death on the management of *Spodoptera litura* Fabricius with avermectin. *Ecotoxicology and Environmental Safety*, 229, 113097. <https://doi.org/10.1016/j.ecoenv.2021.113097>.
65. Veeran, S., Cui, G., Shu, B., Yi, X., & Zhong, G. (2018). Curcumin induced autophagy and nucleophagy in *Spodoptera frugiperda* Sf9 insect cells occur via PI3K/AKT/TOR pathways. *Journal of Cellular Biochemistry*, 120(2), 2119-2137. <https://doi.org/10.1002/jcb.27520>.
66. Veeran, S., Shu, B., Cui, G., Fu, S., & Zhong, G. (2017). Curcumin induces autophagic cell death in *Spodoptera frugiperda* cells. *Pesticide Biochemistry and Physiology*, 139, 79-86. <https://doi.org/10.1016/j.pestbp.2017.05.004>.
67. Dabur, R., Chhillar, A. K., Yadav, V., Kamal, P. K., Gupta, J., & Sharma, G. L. (2005). In vitro antifungal activity of 2-(3,4-dimethyl-2,5-dihydro-1H-pyrrol-2-yl)-1-methylethyl pentanoate, a dihydropyrrole derivative. *Journal of Medical Microbiology*, 54(6), 549-552. <https://doi.org/10.1099/jmm.0.45968-0>.
68. Pande, P. C., & Chauhan, J. (2011). Screening of in vitro antifungal activity of plant extract of *Datura stramonium*, *Solanum nigrum* and *Withaniasomnifera*. *J. Plant Dev. Sci*, 3, 315-316.
69. Patil, V. S., & Kulkarni, S. (2002). Bio-efficacy of certain botanicals against colony growth and spore germination of *Exserohilum hawaiiensis* a causal agent of leaf blight of wheat. *Karnataka Journal of Agricultural Sciences*, 15(2), 391-396.
70. Prasad, C. S., Gupta, V., Tyagi, A., & Pathak, S. (2003). Biological Control of *Sclerotium rolfsii* Sacc, the Incitant of Cauliflower Collar Rot. *Annals of plant Protection Sciences*, 11(1), 61-63.
71. Patni, C. S., Kolte, S. J., & Awasthi, R. P. (2005). Cultural variability of *Alternaria brassicae*, causing *Alternaria* blight of mustard. *Annals of Plant Physiology*, 19(2), 231.
72. Alabi, D. A., Oyero, I. A., & Amusa, N. A. (2005). Fungitoxic and phytotoxic effect of *Vernonia amygdalina* (L.), *Bryophyllum pinnatum* Kurz *Ocimum gratissimum* (Closium) L. and *Eucalyptus globules* (Caliptos) Labill water extracts on cowpea and cowpea seedling pathogens in Ago-Iwoye, South Western Nigeria. *World Journal of Agricultural Sciences*.
73. Katooli, N.; Maghsodlo, R.; Razavi, S.E. (2011). Evaluation of eucalyptus essential oil against some plant pathogenic fungi. *J. Plant Breed. Crop Sci.* 3, 41-43.
74. Zhao, L., Feng, C., Hou, C., Hu, L., Wang, Q., & Wu, Y. (2015). First Discovery of Acetone Extract from Cottonseed Oil Sludge as a Novel Antiviral Agent against

Plant Viruses. PLOS ONE, 10(2). <https://doi.org/10.1371/journal.pone.0117496>.

75. Jantasorn, A., Moungrimsuangdee, B., & Dethoup, T. (2016). In vitro antifungal activity evaluation of five plant extracts against five plant pathogenic fungi causing rice and economic crop diseases. *Journal of Biopesticides*, 9(1), 01-07. <https://doi.org/10.57182/jbiopestic.9.1.01-07>.
76. Hsieh, T.F. (2018). Effect of leaf extract of *Hydnocarpus* on control of anthracnose of Chinese cabbage caused by *Colletotrichum higginsianum*. *Acad. J. Med. Plants* 6, 255–261.
77. Fayaz, M., Hussain Bh, M., Fayaz, M., Kumar, A., & Kumar Jain, A. (2017). Antifungal Activity of *Lantana camara* L. Leaf Extracts in Different Solvents Against Some Pathogenic Fungal Strains. *Pharmacologia*, 8(3), 105–112. <https://doi.org/10.5567/pharmacologia.2017.105.112>.
78. Sreeramulu, A.; Arunakumari, M.; Lakshmi, N.R.P. (2017). Antifungal Activity of Wild Sage (*Lantana camara*) against *Colletotrichum falcatum*. *Int. J. Curr. Microbiol. Appl. Sci.* 6, 1847–1852.
79. Feng, W., & Zheng, X. (2007). Essential oils to control *Alternaria alternata* in vitro and in vivo. *Food Control*, 18(9), 1126–1130. <https://doi.org/10.1016/j.foodcont.2006.05.017>. Mermer-Doğru, D.; Zobar, D. (2014). Effects of some plant essential oils against *Botrytis cinerea* and *Tetranychus urticae* on grapevine. *Turk. J. Agric. Nat. Sci.* 1, 1268–1273.
80. Suleiman, M.N. (2011). Antifungal properties of leaf extract of neem and tobacco on three fungal pathogens of tomato (*Lycopersicon esculentum* Mill). *Adv. Appl. Sci. Res.* 2, 217–220.
81. Ogbabor, N.; Adekunle, A.T. (2005). Inhibition of conidial germination and mycelial growth of *Corynesporacassiicola* (Berk and Curt) of rubber (*Hevea brasiliensis* Muell. Arg.) using extracts of some plants. *Afr. J. Biotechnol* 4, 996–1000.
82. Ushamalini, C.; Rajappan, K.; Gangadharan, K. (1997). Suppression of charcoal rot and wilt pathogens of cowpea by botanicals. *Plant Dis. Res.* 12, 113–117.
83. Pramanick, T.C.; Phookan, A.K. (1998). Effect of plant extracts in the management of sheath rot of rice. *J. Agric. Sci. Soc. North East India* 11, 85–87.
84. Tomar, M.; Chandel, S. (2006). Use of phytoextracts in the management of *Gladiolus* wilt. *J. Mycol. Plant Pathol.* 36, 142–144.
85. Weng, Q.F.; Zhong, G.H.; Hu, M.Y.; Luo, J.J.; Li, X.G. (2005). Bioactivities and physiological effects of extracts of *Peganum harmala* against *Bursaphelenchus xylophilus*. *Sci. Agric. Sin.* 38, 2014–2022.
86. Sharoba, A.M.; El Mansy, H.A.; El Tanahy, H.H.; El Waseif, K.H.; Ibrahim, M.A. (2015). Chemical composition, antioxidant and antimicrobial properties of the essential oils and extracts of some aromatic plants. *Middle East J. Appl. Sci.* 2, 344–352.
87. Jnaid, Y.; Yacoub, R.; Al-Biski, F. (2016). Antioxidant and antimicrobial activities of *Origanum vulgare* essential oil. *Int. Food Res. J.* 4, 1706–1710.
88. Satish, S.; Raveesha, K.A.; Janardhana, G.R. (1999). Antibacterial activity of plant extracts on phytopathogenic *Xanthomonas campestris* pathovars. *Lett. Appl. Microbiol.* 28, 145–147.
89. Patel, P.; Joshi, C.; Birdi, T.; Kothari, V. (2019). Anti-infective efficacy of *Psidium guajava* L. leaves against certain pathogenic bacteria. *F1000Research* 3, 8–12.
90. Zhong, G.H.; Hu, M.Y.; Weng, Q.F.; Ma,

- A.Q.; Xu, W.S. (2001). Laboratory and field evaluations of extracts from *Rhododendron molle* flowers as an insect growth regulator to imported cabbage worm, *Pieris rapae* L. (Lepidoptera:Pieridae). *J. Appl. Entomol.* 125, 563–569
91. Doltsinis, S.K.; Markellou, E.; Kasselaki, A.M.; Fanouraki, M.N.; Koumaki, C.; Schmitt, M.A.; Tsakalidis, A.L.; Malathrakis, N.E. (2006). Efficacy of Milsana, a Formulated Plant Extract from *Reynoutriasachalinensis*, against Powdery Mildew of Tomato (*Leveillulataurica*). *BioControl* 51, 375–392.
  92. Widmer, T.L.; Laurent, N. (2006). Plant extracts containing caffeic acid and rosmarinic acid inhibit zoospore germination of *Phytophthora* spp. pathogenic to *Theobroma cacao*. *Eur. J. Plant Pathol.* 115, 377–388.
  93. Ngegba, P.M.; Enikuomelin, O.A.; Afolabi, C.G.; Akintokun, A.K.; Egbontan, A.O.; Kanneh, S.M.; Samura, A.E. (2017). Evaluation of some Plant Extracts on Mycelial Growth and Sporulation Density of Fungal Pathogens of Groundnut (*Arachis hypogaea* L.) In-Vitro. *Int. J. Dev. Res.* 7, 13808–13814.
  94. Elbeshehy, E.K.F.; Metwali, E.M.R.; Almaghrabi, O.A. (2015). Antiviral activity of *Thujaorientalis* extracts against Watermelon Mosaic Virus (WMV) on *Citrulluslanatus*. *Saudi J. Biol. Sci.* 22, 211–219.
  95. Mathur, K.; Gurjar, R.B.S. (2002). Evaluation of different fungal antagonists, plant extracts and oilcakes against *Rhizoctonia solani*, causing stem rot of chilli. *Ann. Plant Prot. Sci.* 10, 319–322.
  96. Purnima, D.; Saxena, S.K. (2002). Effect of *Withaniasomnifera* on fruit rot of tomato caused by *Aspergillusniger* in presence of *Drosophilabusckii*. *Indian Phytopathol.* 55, 112–113.
  97. Al-Samarrai, G.; Singh, H.; Syarhabil, M. (2012). Evaluating eco-friendly botanicals (natural plant extracts) as alternatives to synthetic fungicides. *Ann. Agric. Environ. Med.* 19, 673–676.
  98. Rawal, P.; Adhikari, R.S. (2016). Evaluation of antifungal activity of *Zingiber officinale* against *Fusariumoxysporumf.sp. lycopersici*. *Adv. Appl. Sci. Res.* 7, 5–9
  99. Shivkumara KT, Manjesh GN, Satyajit Roy & Manivel P. (2019). botanical insecticides; prospects and way forward in India: A Review. *journal of entomology and zoology studies* 7(3): 206-211.
  100. Kumbhar C R (2020). Role and mechanism of botanicals in pest management. *www.justagriculture.in.* 1(2). 226-232.
  101. Hussain, T., Singh, S., Mohd. Danish, Pervez R., Hussain K., and Husain R. (2020). Natural Metabolites: An Eco-friendly Approach to Manage Plant Diseases and for Better Agriculture Farming. J. Singh, A. N. Yadav (eds.) *Natural Bioactive Products in Sustainable Agriculture*, 1-13. [https://doi.org/10.1007/978-981-15-3024-1\\_1](https://doi.org/10.1007/978-981-15-3024-1_1).

# EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON FOLIAGE OF RADISH (*RAPHANUS SATIVUS* L.) C.V. PUSA DESI

**Manoj Kumar Singh**

Department of Horticulture.

Kulbhaskar Ashram Post Graduate College, Allahabad., (U.P.), India

Received : 22.01.2023

Accepted : 26.01.2023

## ABSTRACT

Treatments were found to influence the above ground growth significantly. Three parameters that is number of leaves per plant, leaf length and leaf area per plant was evaluated with the treatments. There was a linear increase in root length and root weight at all the stages from 15 DAS to 45 DAS in ascending order. The treatment T<sub>6</sub> (50% RDF + 50% (FYM + Poultry manure+ Vermicompost + Neem cake) + PSB + *Azotobactor*) produced significantly maximum values in relation to leaves per plant, leaf length and leaf area per plant . However, the minimum values were recorded in treatment T<sub>8</sub> (Control). The probable reasons for increased leaves per plant, leaf length and leaf area per plant may be due to the presence of readily available form of nitrogen through both inorganic and organic sources (Neem cake, FYM, Poultry manure, Vermicompost and biofertilizers) Inorganic sources could have exerted positive influence on nutrient availability to match the physiological needs of the crop. In addition to that integration of Neem cake, FYM, Poultry manure, Vermicompost and biofertilizers might have improved physical and chemical properties of soil.. The probable reasons for enhanced leaf lamina and number of leaves per plant might be due to promotive effects of macro and micro nutrients from both inorganic and organic sources. Nitrogen availability might have increased vegetative growth which ultimately leads to more photosynthetic activity. Through efficient translocation of certain growth stimulating compounds leading to better absorption of nitrogen and other nutrients and their utilization might have improved the foliage growth of the plant.

**Keywords :** *Radish, foliage growth, nutrients, organic manure.*

## INTRODUCTION

Leaves are excellent source of essential nutrients needed by human beings. Leaves are full of micronutrients and antioxidants. Radish leaf has curative property. It is also a good source of roughage. The root vigour and development directly related with the leaf area per plant. Integrated nutrient management of radish crop is very remunerative It increases yield and quality both. Shelf life of crop also increased significantly. Organic manures are derived from decayed plant/

animal matters and are free from harmful chemicals. Organic manures are extremely advantageous in enriching soil fertility and do not contain any harmful chemicals. Organic manures feed the soil and maintain sustainability in the agro-ecosystem. Growing of crops by the package of organic manures brings forth the organic farming which is in vogue today and organic farming could find a new market scope. Organic farming relies on ecological processes, biodiversity and cycles adapted to the local conditions, rather than the use of inputs with

adverse effects.. There is a heavy demand for this crop throughout the year. Hence yield has to be increased further more. Organic agriculture mainly focuses on utilization of plant residues and manures in agriculture. Therefore a trail was conducted to assess the effect of Integrated nutrient management on foliage of radish in Allahabad condition.

#### Detail of Treatments:

Treatment Symbol	Treatment Details
T <sub>1</sub>	Neem cake (2.5t/ha)+FYM(20t/ha)+PSB(4kg/ha) + Azotobactor (4kg/ha)
T <sub>2</sub>	Neem cake (2.5t/ha)+Poultry manure(5t/ha) + PSB(4kg/ha) + Azotobactor(4kg/ha)
T <sub>3</sub>	Neem cake (2.5t/ha)+ Vermicompost(5t/ha) + PSB(4kg/ha)+ Azotobactor (4kg/ha)
T <sub>4</sub>	Neem cake (2.5t/ha)+PSB(4kg/ha) + Azotobactor(4kg/ha) + 50% FYM
T <sub>5</sub>	25% FYM + 25% Poultry manure + 25%Vermicompost + 25%Neem cake + PSB + Azotobactor
T <sub>6</sub>	50% Recommended dose of Fertilizers + 50% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + Azotobactor
T <sub>7</sub>	75% Recommended dose of Fertilizers + 25%(FYM + Poultry manure + Vermicompost + Neem cake) + PSB + Azotobactor
T <sub>8</sub>	RDF ( control )

## RESULTS AND DISCUSSION

### NUMBER OF LEAVES PER PLANT<sup>-1</sup>

Number of leaves plant<sup>-1</sup> of different treatments is given in Table 1. Number of leaves plant<sup>-1</sup> was recorded at 15, 30 and 45 days after sowing. Number of leaves plant<sup>-1</sup> increased significantly with the increased crop growth period. At 15days after sowing, the significantly maximum ( 6. 84 ) leaves plant<sup>-1</sup> was recorded in T<sub>6</sub> ( 50% RDF + 50% (FYM + Poultry manure + Vermicompost + Neem cake) +

## MATERIALS AND METHODS

The experiment on Effect of Integrated Nutrient Management on foliage of Radish (*Raphanus sativus* L.) c.v. Pusa Desi was carried out in Rabi season during the year 2016-2017. Experimental design was Randomized Complete Block Design. Numbers of treatments were 8 and umber of replications were 3.

PSB + *Azotobactor*) at par with T<sub>7</sub> (75% RDF + 25% (FYM + Poultry manure + Vermicompost + Neem cake) + PSB + *Azotobactor*) (6.83), while, the minimum ( 5.85 ) leaves plant<sup>-1</sup> was observed in treatment T<sub>8</sub>(Control). In case of 30 DAS, the significantly maximum ( 11.84 ) leaves plant<sup>-1</sup> was recorded in T<sub>6</sub> and at par with T<sub>7</sub> (11.17) and T<sub>3</sub> (11.67), while, the minimum ( 7.93) leaves plant<sup>-1</sup> was observed in treatment Control. At 45 DAS, significantly maximum 13.49 leaves plant<sup>-1</sup> was

**Table - 1 : Effect of integrated nutrient management on number of leaves plant<sup>-1</sup> of radish.**

Treat. Symbol.	Treatments	No. of leaves plant <sup>-1</sup>		
		15DAS	30DAS	45DAS
T <sub>1</sub>	N C(2.5t/ha) +FYM (20t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	6.21	10.11	11.80
T <sub>2</sub>	N C (2.5t/ha) +P M (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	5.97	9.63	11.12
T <sub>3</sub>	N C (2.5t/ha) + VC (5t/ha ) + PSB (4kg/ha) + Azo.(4kg/ha)	6.48	11.17	12.05
T <sub>4</sub>	N C (2.5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha) + 50% FYM	6.17	10.02	11.73
T <sub>5</sub>	25% FYM + 25% P M + 25% VC + 25% N C + PSB + Azo.	5.93	9.70	11.27
T <sub>6</sub>	50% RDF + 50% (FYM + P M + VC + N C) + PSB + Azo.	6.84	11.84	13.39
T <sub>7</sub>	75% RDF + 25% (FYM + P M + VC + N C) + PSB + Azo.	6.83	11.47	12.12
T <sub>8</sub>	RDF ( control )	5.85	7.93	10.98
	S.Em±	0.290	0.291	0.292



observed under treatment T<sub>6</sub> followed by T<sub>7</sub> (12.12) an and T<sub>3</sub> (12.05) as compared to other treatments. However, the minimum value ( 10.98 leaves plant<sup>-1</sup>) was observed in treatment T<sub>8</sub> Control. Findings are in conformity with the findings of Subramani,. (2010), Giraddi *et al* (1993) and Khalid *et al* (2015).

### LEAFLENGTH

Leaf length of various treatments of radish is given in Table 2. at 15. 30 and 45 days after sowing. At 15 DAS, the significantly higher 11.75, 11.65 and 11.17 cm leaf length were observed under treatment T<sub>6</sub> T<sub>7</sub> and T<sub>3</sub> respectively and which were at par with each other. However, the minimum (10.13 cm) leaf length was observed in treatment Control. In case of

30 DAS, significantly maximum 30.99, 28.91 and 27.35 cm leaf length were observed under treatment T<sub>6</sub>), T<sub>7</sub> respectively and which were at par with each other. However, the minimum ( 25. 42 cm) leaf length was observed in t reatment Control. As regards to 45 DAS, treatment T<sub>6</sub> T<sub>7</sub> and T<sub>3</sub> and were recorded significantly maximum 34.45, 32.41, 31.90, 31.66 and 31.59 cm leaf length, respectively and which were at par with each other. However, the minimum (27.62 cm) leaf length was observed in treatment Control. Similar results were also observed byMahabir *et al.* (1990), Randy (2016). Sentiyangla, *et al* (2010) and Subramani, *et al* (2011).

**Table - 2 : Effect of integrated nutrient management on leaf length of Radish**

Treat. Symbol.	Treatments	Leaf length (cm)		
		15DAS	30DAS	45DAS
T <sub>1</sub>	N C (2.5t/ha) + FYM (20t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	10.66	28.01	31.59
T <sub>2</sub>	N C (2.5t/ha) +P M (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	10.13	26.99	29.19
T <sub>3</sub>	N C (2.5t/ha) + VC (5t/ha ) + PSB (4kg/ha) + Azo.(4kg/ha)	11.17	28.35	31.90
T <sub>4</sub>	N C (2.5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha) + 50% FYM	10.61	27.81	31.19
T <sub>5</sub>	25% FYM + 25% P M + 25% VC + 25 C % N + PSB + Azo.	10.47	27.09	30.53
T <sub>6</sub>	50% RDF + 50% (FYM + P M + C) + VC + N PSB + Azo.	11.75	30.99	34.45
T <sub>7</sub>	75% RDF + 25% (FYM + P M + VC + N C) + PSB + Azo.	11.65	28.91	32.41
T <sub>8</sub>	RDF ( control )	10.13	25.42	27.62
	S.Em±	0.460	0.463	0.465
	C.D. at 5% level	1.404	1.414	1.424

### LEAF AREA PER PLANT

Leaf area plant<sup>-1</sup> was recorded and has been presented in table 3.The significantly maximum 276.18, 532.72 and 760.96 cm<sup>2</sup> leaf area plant<sup>-1</sup> were recorded in treatment T<sub>6</sub> followed by T<sub>7</sub> which recorded 254.16, 512.39 and 756.28 cm<sup>2</sup> and T<sub>3</sub> (243.65, 486.93 and 712.82 cm<sup>2</sup>) at 15, 30 and 45

days after sowing, respectively and which were at par with each other. It was observed the minimum ( 172. 90 , 351.32 and 607.18 cm<sup>2</sup>) in treatment Control at 15, 30 and 45 DAS, respectively. Findings are in conformity with the findings of Subramani,. (2010), Giraddi *et al* (1993) and Khalid *et al* (2015).

**Table - 3 : Effect of integrated nutrient management on leaf area of Radish**

Treat. Symbol.	Treatments	Leaf area (cm <sup>2</sup> )		
		15DAS	30DAS	45DAS
T <sub>1</sub>	N C (2.5t/ha) + FYM (20t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	235.93	476.26	641.69
T <sub>2</sub>	N C (2.5t/ha) +P M (5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha)	218.60	431.38	627.85
T <sub>3</sub>	N C (2.5t/ha) + VC (5t/ha ) + PSB (4kg/ha) + Azo.(4kg/ha)	243.65	486.93	712.82
T <sub>4</sub>	N C (2.5t/ha) + PSB (4kg/ha) + Azo.(4kg/ha) +50% FYM	226.73	451.39	641.11
T <sub>5</sub>	25% FYM + 25% P M + 25% VC + 25% N C + PSB + Azo.	224.85	433.04	628.76
T <sub>6</sub>	50% RDF + 50% (FYM + P M + VC + N C) + PSB + Azo.	276.18	532.72	760.96
T <sub>7</sub>	75% RDF + 25% (FYM + P M + VC + N C) + PSB + Azo.	254.16	512.39	756.28
T <sub>8</sub>	RDF ( control )	172.90	351.32	607.18
	S.Em±	14.302	14.392	12.312
	C.D. at 5% level	41.010	41.024	36.014

## CONCLUSION

Leaf number, leaf length and leaf area per plant was significantly influenced by Integrated nutrient management of radish crop. . The treatment T<sub>6</sub> (50% RDF + 50% (FYM + Poultry manure+ Vermicompost + Neem cake) + PSB + *Azotobactor*) yielded significantly maximum values in relation to above parameters. Farmers may be advocated for better and remunerative price of radish crop variety Pusa Desi under Allahabad conditions.

## REFERENCE

1. Giraddi *et al* (1993):Organic manure as a substitute for chemical fertilizers for high yielding radish varieties, Ind.J. Agric. Sci. 493):188-192.
2. Khalid, M.; Yadav, B.K. and Yadav, M.P. Studies on the effect of integrated nutrient management on growth and yield attributes of radish (*Raphanus sativus* L.). Ann. of Hort. 8(1): 81-83.
3. Mahabir *et al.* (1990): Some growth response of radish (*Raphanus sativus*) to different nutrients. South Indian Hort. 19:9-16
4. Randy, E. (2016). Growth and yield performance of radish (*Raphanus sativus*)

- cv Snow White in response to varying level of vermicompost application. Int. J. Sci. Res. publication, 10(1): 329-332.
5. Sentiyangla, Kanaujia, S. P.; Singh, V. B. and Singh, A. K. (2010). INM for quality production of radish. (*Raphanus sativus* L.) in acid Alfisol. J. Soils and Crops, 20 (1): 1-9.
6. Subramani, A.; Anburani, A. and Gayathiri, M. (2011). Response of Growth Parameters of radish (*Raphanus sativus* L.) to various organic nutrients and biostimulants, Asian J. Hort., 6 (1) : 32-34.
7. Subramani, A.; (2010). Effect of organic nutrientson growth and yield of Radish (*Raphanus sativus* L.) MSc.(Ag). Hort. Thesis Annamalai University, Annamalainagar.

# PRODUCTIVE, REPRODUCTIVE STATUS NUTRIENT AVAILABILITY AND STRATEGY TO ENHANCE THE PRODUCTIVITY OF ANIMALS IN AMBEDKAR NAGAR DISTRICT OF UTTAR PRADESH

<sup>1</sup>Vidya Sagar, <sup>2</sup>Pradeep Kumar, <sup>3</sup>Ram Jeet and <sup>4</sup>Ram Gopal

Krishi Vigyan Kendra, Panti, P.O. Manshpur-224168, Ambedkar Nagar, (U.P.), India

Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya, (U.P.), India

Email-vsnuat72@gmail.com

Received : 15.01.2023

ABSTRACT

Accepted : 20.02.2023

Study was carried out to find out the existing crop- livestock production system, macro and micro nutrients status in feed and fodder and feeding practices of cattle and buffaloes. A survey was conducted in Kateharil and Jalalpur blocks in Ambedkar district of Uttar Pradesh.. Fifteen farmers under three major categories on land holding basis i.e. landless (0 acre) small (2-3 acres) and large (above 5 acres) from each villages were selected. A benchmark survey was conducted through common questionnaires in order to collect the information to the farmers, family size, land holding, cropping pattern and irrigation facilities as well as livestock population, milk yield, feeding pattern and reproductive status of the animals. Land holding, livestock holding and family size were the main factors influencing the nutritional status of animals. Total cultivated area from selected villages owned as 28.52 and 17.89 per cent by small and large farmers, respectively. Main crops cultivated during Kharif season are paddy, sorghum pigeon pea, maize, cowpea, etc. while during Rabi wheat, sugarcane, lentil chickpea, mustard berseem, etc. are the major crops. Some of farmers use home made locally available concentrate ingredients such as mustered cake, lentil, gram, pigeon pea chunni, wheat ,rice bran and wheat, sorghum, barley grain etc, but not in required and appropriate amount provided it to their animals .Few farmers of both block purchased cattle feed (pullet) from the market and fed to the dairy animals. Paddy and wheat straw was the sole roughage used during all season along with available green fodder. Most of farmers did not use minerals mixture and common salt with concentrate. Cattle and buffaloes of study area were found 17.89% anoestrus and 28.52%, repeat breeding reproductive problems. Animals of surveyed area exhibited a deficiency in DM, DCP and TDN intake. On -farm trails conducted on farmers dairy animals in surveyed area on balance feeding with minerals mixture and regular de-worming. It was found that conception rate increased from 75 to 97.67%, milk yield increased 51.03%, benefit – cost ratio was found 1:1.46 and 1:1.71 in farmers practice and experimental balance feeding dairy animals. From the study it was conclude that concentrates with supplementation of protein, mineral are beneficial to improve the nutritional status and productivity of the dairy animals.

*Keywords : Livestock, nutrient, productivity*

## INTRODUCTION

Livestock make largely under estimated

contribution to rural development. They produce food, enhance soil health and crop production and

provide additional income goods and services as well as case income. District Ambedkar Nagar is agriculture based district. Vast of majority of its population (80%) were engaged in agriculture and allied activities for their livelihood. About 85% farmers came under small and marginal category. The average land holding below 1.0 ha. and productivity of crops grown in district is near but below the average productivity of state. Nearly two third of farm family in district are associated with livestock farming and 80% of them are small landholders. More than 75 per cent of the farmers keeping 2-3 dairy animals for subsistence of their livelihood. Though the productivity of animals depends on their genetic potential but it is always prudent to feed milch animals with optimum quantities of different macro as well as micro nutrients to exploit their maximum production potentials. Under typical Indian condition due to under feeding and non availability of balanced diet and also deficiency of specific nutrients. Sinha (1982) reported that farmers, in general do not feed their animals with required amount of nutrients. Further, the availability of nutrients depends on feeds and fodder consumed by animals which is again affected by season, cropping pattern, land holding capacity of farmers etc. (Pantgne *et al.*, 2002). The present investigation was, therefore, carried out to assess the existing feeding pattern, production and reproductive status of cattle and buffaloes, nutrient availability from different feed resources and present nutritional status and strategy to improve the productivity of dairy animals in Ambedkar Nagar district of Uttar Pradesh.

## MATERIALS AND METHODS

Field survey was conducted in four villages, two each from Katehari and Jalalpur blocks of district Ambedkar Nagar of Uttar Pradesh, to find out the existing crop, livestock production system, micro nutrients status in feeds and fodders and existing feeding practices. Fifteen farmers under three major categories on land holding basis i.e. landless (0 acre), small (2-5 acres) and

large (>5 acres) from each village were randomly selected. Data were collected from selected farmers through a common questionnaire on farmers, family size, land holding as well as livestock population, milk yield, feeding pattern along with usage of mineral mixture and salt and reproductive status of animals. Samples of feed and fodder offered to animals were collected from each village and calculated for proximate principles as per AOAC (1995). After collection of data, the amount of daily DM, DCP and TDN intakes were calculated from the feed intake on the basis of average nutritive values of the feed and fodders (Ranjhan, 2001). Feed intake, approximate body weight and milk yield were recorded for individual milch animal during survey. The body weight of animals was measured by using the formula as suggested by Sharma (1987). The data obtained were analyzed for overall mean and other parameters as per procedure (Snaedecor and Cochran, 1994). On –Farm Trail conducted in surveyed area on 12 farmers, six in each block on balance feeding with balance concentrate mixture along with 2% minerals mixture and 1% common salt with available dry and green fodder according to thumb rule method of feeding. It was found that supplementation of with concentrate with protein and minerals with available dry and green fodder improve the fertility and productivity of dairy animals.

## RESULT AND DISCUSSION

The average land holding, livestock holding and family size were 3.30 and 4.10 acre/family; 3.5 and 38.45 number/family, 6.30 and 7.00 members/family, respectively in Katehari and Jalalpur block (Table-1). Livestock population was high with increased land holding as well as feed resource capacity of the farmers. Cultivated area was mostly irrigated, about 54.47% farmers irrigated their field through their own bore-well in all the selected villages and owned by small and large farmers, respectively. Main crops cultivated during Kharif season are paddy, pigeon pea, maize, multicut chari, sorghum, sugarcane etc. and during

Rabi season wheat, chick pea, lentil, mustard, berseem etc. Total cattle and buffaloes population reared by landless, small and large farmers, particularly for milk production was an important source of income for small as well as large farmers. Average and holding of the farmers in Karehari block was 3.30 and in Jalalpur block it was 4.10 acre/ family. Average Milk (l/d/f) production was higher (7.40 liters) in farmers families of Jalalpur

block in comparison to Katehari block (6.70 liters) which was due to the fact of rearing some good milk producing breeds of cattle and buffaloes (Table-1), production per animal was found 5.20 in Katehari block and 6.10 l/d/animal in Jalalpur block with an overall mean value of 5.15 l/d/animal. This might due to imbalance feeding in some cases low productive breed cattle and buffaloes with reported by Tiwary et al.(2003).

**Table - 1 : Existing cattle and buffaloes farming system in Katekari and Jalalpur block**

S.N.	Attributes	Katehari	Jalalpur	Average
1.	Family size (members)	6.30	7.00	6.65
2.	Farmer's category (%)			
	Landless	10.30	15.54	12.92
	Small	51.25	46.30	48.77
	Large	27.60	18.25	22.93
3.	Av. Land holding(acre/family)	3..30	4.10	3.7
4.	Bore-well irrigation	48.28	52.65	50.47
4.	Av. Livestock holding (number/family)	3.50	3.45	3.38
5.	Av .Milk production (liters/day/family)	6.70	7.40	7.05
5.	Av. Milk production (liters/animal)	5.20	6.10	5.15
6.	Farmers fed minerals mixture and common salt to dairy animals	1.27	2.15	1.71

Dairy cattle and buffaloes in this region were generally stall fed and allowed to grazing some times. Most of the farmers use to prepare homemade concentrate mixture by blending available concentrate ingredients such as rice bran, mustard cake, pigeon pea and gram chunni, wheat bran, wheat grain etc.and provided to their animals in the form of sani (blend of concentrate and wheat or paddy straw sprinkled with water) but not in required and approximate ratio with reported by Tiwary et al. (2003). Paddy and wheat straw was the

sole roughage used during all seasons along with available green fodders. The quality of green fodder in the basal diet was more during rainy season as compared to other season. It may due to abundant availability of green fodder during rainy season. Farmers grew seasonal green fodder like sorghum, multicut chari, berseem fodder crops. Only 1.71% of farmers of targeted area were found to fortify the basal diet with to supplement mineral mixture and common salt with ration of cattle and buffaloes.

**Table - 2 : Reproductive status of cattle and buffaloes in Katehari and Jalalpur blocks**

Block	Age of first calving (Years)		Calving interval (months)		Reproductive problems	
	Cattle	Buffaloes	Cattle	Buffaloes	Anoestrus (%)	Repeat breeding (%)
Katehari	3.55	3.72	14.85	16.50	16.48	25.20
Jalalpur	3.80	4.25	14.80	17.40	19.30	31.84
Overall mean	3.35	3.96	14.8	16.95	17.89	28.52



Age of first calving (3.35 and 3.96 years for cattle and buffaloes, respectively) and calving interval (14.85 and 16.50 months for cattle and buffaloes, respectively) were found (Table-2) to be more than the normal value Benerjee, 1998). This might be due to late attainment of the matured body weight, delay in onset oestrus and failure of ovulation because animal of different categories were not getting balanced ration as per their requirement ( Table-4). Cattle and buffaloes of study area were found 117.89% anoestrus and 28.52% repeat breeding reproductive problems due to lack of minerals and also energy and protein leading to delayed anoestrus and failure in maturation of ovarian follicles.

#### ***Chemical composition and nutritive evaluation of feed and fodders-***

The chemical composition of feed and fodders is presented in Table-3. The DM content was lowest in green berseem (16.24%) among all green fodders, it might be due to succulent nature. The CP content in roughages was highest in berseem (16.47%) followed by multicut chari (11.52%) and sorghum (11.52%), while it was least in paddy straw (2.10%).

The value is close agreement with those reported by Mudgal et al. (2003). The concentrate mixture were mainly prepared incorporating locally available ingredients like rice bran, mustard cake, pigeonpea and gram chunni, wheat bran, wheat grain etc., but most of farmers used these concentrate ingredients in adequate amount, some more or less. Some farmers were also aware to feed commercial concentrate like complete feed pullet to animals. Mustard cake contained high CP (37.12%) as compared to other concentrate ingredients, where as EE content was highest in rice bran (12.78%). The ash content was found to be highest in rice bran (22.16%) followed by berseem green (20.22%), wheat straw (16.81%), paddy straw (16.39%) and incomplete feed pullet (15.76%). However content of ash in paddy and wheat straw is partially available to animal body because these contain high level of acid in salable ash which mainly the silica. Most of commercial concentrate mixture also contains a fairly high level of crude protein but it might be due to fortification of urea or other non-protein nitrogenous compounds. As such it is quite difficult to asses the source of such protein.

**Table - 3 : Chemical composition of feeds and fodders (% on DM basis)**

S.N.	Feeds/ fodders	DM	CP	CF	NFE	EE	Total Ash
1.	Rice bran	92.42	12.30	14.58	38.90	12.78	22.16
2.	Mustard cake	91.87	37.12	9.35	37.16	9.81	08.59
3..	Pigeon pea chunni	92.64	18.70	17.20	53.55	2.30	08.02
4.	Gram chunni	92.25	12.47	38.62	42.10	1.62	04.86
5.	Wheat bran	93.31	16.29	7.76	67.81	3.35	04.78
6.	Wheat grain	92.28	10.34	4.69	80.52	2.45	02.46
7.	Complete feed pullets	88.23	13.76	14.60	52.35	3.34	15.76
8.	Paddy straw	92.20	2.10	37.59	42.97	0.85	16.39
9.	Wheat straw	93.67	3.04	38.18	48.19	1.02	16.81
10.	Sorghum green	18.27	9.42	26.88	48.82	2.34	11.86
11.	Berseem green	16.24	16.47	25.96	35.78	2.64	20.22
12.	Multicut chari	17.86	11.52	27.20	47.49	4.37	10.15

Nutritional status of livestock

Nutrients intake (DM, DCP and TDN) and their adequacy in terms of the requirement is presented in Table-4. The body weight of the most adult cattle and buffaloes ranged between 360-580 kg in surveyed area. The average daily intake of DM for an adult cattle and buffalo was observed as 8.65 kg which indicated that the animals got less DM than the requirement in this region. There was 20.69% deficit in DM intake per day. Daily average DCP intake through different ingredients was observed

247.58 g./ALU/day lead to deficit by 21.40% per day. Similar observation was recorded by Sinha (1982), who reported that farmers were not feeding concentrates to the animals as per requirements. This was also the agreement with the observations of Sohal *et al.* (1982) that DCP availability in different categories of animals was less as compared to standard requirements. The average TDN intake in adult cattle and buffaloes was 3.61 kg/ALU/day which was short to the extent of 13.01 per cent .

Table - 4 : Nutritional status and plane of nutrition in lactating buffaloes

Feed/Fodder	DM intake (kg/ALU+/day)			DCP intake (g/ALU/day)			TDN intake (kg/ALU/day)		
	Jalalpur	Ktehari	Av.	Jalalpur	Ktehari	Av.	Jalalpur	Katehari	Av.
Grazing*	0.94	0.62	0.78	35.63	22.15	28.80	0.52	0.39	0.41
Green fodder	1.30	1.20	1.25	67.04	42.33	54.69	0.55	0.46	0.51
Dry fodder	3.75	3.33	3.54	0.04	0.02	0.03	1.63	1.41	1.52
Concentrate	1.37	1.20	1.29	185.10	142.83	163.97	1.24	1.10	1.17
Total nutrient intake	7.36	6.35	6.26	287.81	207.33	247.58	3.94	3.26	3.61
Requirement**	8.65	8.65	8.65	315.00	315.00	315.00	4.15	4.15	4.15
Difference	1.29	2.30	1.79	27.19	107.67	67.42	0.21	0.89	0.54
Deficit /day(%)	14.91	26.59	20.69	34.18	8.63	21.40	5.06	21.45	13.01

\*Anonymous(1980); \*\*Ranjhan (2001), DM- Dry matter, ALU-Average livestock unit, DCP-Digestible crude protein, TDN- Total digestible nutrients.

Animals of Katehari block had a lover intake of DM, DCP, and TDN as compared to Jalalpur block. This shows that cattle and buffaloes were underfed in the study area. Further the economic condition of farmers of Jalalpur was comparatively better as compared to Katehari block which might have also influenced the feeding of animals in this block as the cattle and buffaloes of

Jalalpur block were better nourished. It can be concluded that the nutrients intake through different feed ingredients was not enough to fulfill the requirement of the animals as per the standard.On - farm trails conducted on farmers dairy animals (6farmers in each block) in surveyed area on balance feeding with minerals mixture and regular de-worming.

Table - 5 : Results of On –Farm Trail on Assessment of protein and minerals supplementation for improved milk production and conception rate in dairy buffaloes.

No. of trials -12, No of animals -24 (24Murrah buffaloes of 3<sup>rd</sup> calving)

Technology Option	Conception rate		Avg Milk yield/day (lit)	% increa se in milk yield	Gross cost milk production (Rs/animal)	Gross income from milk/day (Rs) @Rs. 30/litre	Net return (Rs)	B:C ratio
	No of animals conceived timely within 4 month	Present conception						
Farmers practice	9	75	6.88	-	141.25	206.4	65.15	1:1.46
T-2- Balance Feeding with de-worming	11	91.67	10.39	51.02	182.00	311.70	149.7	1:1.71

**T-1-**(Farmers practices ) Feeding of paddy /wheat straw with limited green fodder and imbalance concentrate mixture.

**T-2-** Balance feeding according to thumb rule method of feeding –Feeding balance concentrate mixture (mixed 35% grinded grain,20% oil cake, 20% pulse crop cunni,22% wheat, rice bran, 2% miners mixture and 1% common salt with available dry and green fodder with de-worming 1<sup>st</sup> day and 30<sup>th</sup> day and after 4 month regular interval.

It was found (Table-5) that supplementation of concentrate with protein and minerals and common salt with available dry and green fodder and regular de-worming improve the fertility and productivity of dairy animals. Similar finding was reported by Lall *et al.* (2001), who observed that high plane of nutrition with proper minerals supplementation improves production and estrus condition in animals. In the present situation of scarcity of greens and high cost of concentrates, improvement of quality of existing feed resources and the use of unconventional feed with supplementation of mineral mixture might be the solution to improve the plane of nutrition of the animals. From the study it can be concluded that by feeding the animals as per the feeding standards, there is a further scope for improvement in productivity and fertility of dairy animals. It is better to prepare homemade concentrate mixture provided it is scientifically blended in proper proportions with all type of feed ingredients with mineral mixture and common salt for dairy animals to enhance the productivity.

## REFERENCES

1. Anonymous. 1980. Integrated Natural and Human Resource Planning and Management in Hills of U.P. Progress Report of Foundation Funded Project. G.B.P.U.A.T., Pantnager, India.
2. AOAC. 1995. Official Methods of Analysis, 15th ed. Association of Official Analytical Chemist, Washington, DC.
3. Banerjee, G.C., 1998. A Textbook of Animal Husbandry, 8<sup>th</sup> ed. Oxford and IBH Publishing Company Private Limited, Delhi. India, pp. 194-195.
4. Lall, D., Sikka, P., Arora, U. and Chauhan, T.R., 2001. Effect of high plane of nutrition and mineral supplementation on blood mineral profile, T3-T4 levels and infertility status of anoestrus buffaloes. Proceeding of 5<sup>th</sup> Animal Nutrition Conference, November 9-11, 2001. National Dairy Research Institute, Karnal, India. Pp. 190. (Abstr.)
5. Mudgal, V., Mehata, M.K., Rana, A.S. and Nanavati, S., 2003. A survey on feeding practices and nutritional status of dairy animals in Madhya Pradesh. Indian Journal of Animal Nutrition, 20: 217-220.
6. Pantgne, D. D., Kulkarni, A.N., Gujar, B.V. and Lalyankar, S.D., 2002. Nutrient availability of milch Marathwari buffaloes in their home tract. Indian Journal of Animal Nutrition. 19:41-46.
7. Ranjan, S. K., 2001. Animal Nutrition in Tropics. 5<sup>th</sup> Rev. ed. Vikash Publishing House Private Limited., New Delhi., India, pp. 491-555.
8. Sharma, R.J. 1987 Pashu Dhan Prabandhan. 1<sup>st</sup> ed. Director Communication, University Press, G.B.P.U.A.T., Pantnagar, India. pp. 478-480.
9. Sinha, M. N. 1982. Gap analysis of relation to feeding recommendation. Annual Report. National Dairy Research Institute, Karnal, India. pp. 168-169.
10. Snedekar, G.W. and Cochran, W.G., 1994. Statistical Methods. 8<sup>th</sup> ed. Iowa State University Press, Ames, Iowa, USA.
11. Sohal, T.S. and Singh, J.N. AND Singh, J.P. 1982. Impact of intrusive extension education, the adoption of scientific dairy farming by landless rural families around Karnal. Indian Journal of Dairy Science, 35: 447-453.

# CONTENT ANALYSIS OF AGRICULTURE INFORMATION APPEARED IN DAILY NEWS PAPERS OF JAUNPUR, U.P.

**Km. Bhawana Singh and N. K. Mishra**

Department of Agricultural Extension

T D PG College, Jaunpur, (U.P.), India

Corresponding email : bhawanasingh1999jnp@gmail.com

Received : 11.11.2022

**ABSTRACT**

Accepted : 15.12.2022

It appears that the study analyzed the coverage of agriculture-related information in daily newspapers (primarily English and Hindi) in Jaunpur, Uttar Pradesh over a period of six months. The study found that Hindustan gave the maximum coverage to agriculture-related advertisements (27.4%), while The Times of India gave the maximum coverage to news and views on agriculture (86%). The study also found that there was no specific agenda or focus area regarding agriculture across the newspapers. The Hindu gave the maximum coverage to agriculture news (82.3%), while Dainik Jagran gave the maximum coverage to agriculture views (28.6%). In terms of specific agriculture-related topics covered, The Hindu had the most coverage of crop production (41%) and food and grain management (34%), while Dainik Jagran had the most coverage of horticulture (33%) and pest management (46.1%). The Times of India had the most coverage of irrigation (32.3%) and MSP (39.2%), while Hindustan had the most coverage of monsoon (37.4%) and other agriculture-related topics (39.5%).

***Keywords :** pest management, irrigation, advertisements, food and grain management*

## INTRODUCTION

Newspaper is one of the important communication media which provides a climate for national development. It makes the knowledge available where it is needed. It provides a forum for discussion and decision making. It helps to raise the general level of people's aspirations and the process of their modernization. News provides all sorts of news including that of development activities, agriculture policies, technical knowledge, etc. Newspaper is such a mass media that can provide technical information to agriculture sector at the right time and in the right way within a shortest possible time. The Indian media are booming on all the front i.e. prints, electronic and web journalism.

All this owes its credit to globalization and economic reforms ushered in to during 1991-1996. The thrust and impetus of the economic reforms and globalization received before 1991-1996 and after, resulted in the reformatting of the news papers, especially the print media, which not only increase their number of the page but also began to issue special supplements each day under different categories gender wise (women page), subject wise (Education Employment or opportunities Finance/investment, Health, Youth page Matrimonial, classified etc.

This was done in order to widen their readership and to cater to the vast advertising requirements of business establishments, large

Software and Hardware multinational and industries, besides bank and infrastructure (telecom and mobile) organizations that has started burgeoning since 1995. Among the various method and techniques, mass media play a significant role. Through media one can disseminate new agriculture information new extension programmes, Government Scheme and policies relating to the agriculture development. This will serve a basis for agriculture development. Mass media play a significant role in bringing awareness among people and in motivating them to be participating in nation building. The press (news papers) being a pioneer among the mass media has always received attention and exerts clout in the development process of a country. It has innumerable roles and function towards society because it directly influences the later. That is why, How to the press is that always takes the form and coloration of the social and political structures within which it operates. In the context of India society, the press has established the tradition of being the custodian of the rights of the people. The press to a supportive attitude to the newly formed government. It helped in informing and educating people about various development needs and in mobilizing public support for different policies adopted by the government for initiating development process in the country. During that time, some newspapers retained their independence and become critical of the establishment in their balanced, impartial and natural reporting, while other newspaper opted to become government handout in order to reap corporating benefits.

Today, the country has attained self-sufficiency in food grains. Besides policy formulation and long-term plans, it is basically the development communication which ensures that thrust areas are identified, nurtured and propagated. The role of media is thus highly important for agriculture sector. This research project has been undertaken to focus on the role of print media in agriculture development while taking print media in to consideration . It is thus appropriate the role of newspapers in

agriculture development should be made the term of reference. The role of newspapers in northern region especially Punjab, can well be assessed by evaluating Hindi, Punjabi and English newspapers as these three languages are well read, spoken and written here. This study thus finds it appropriate that research is initiated with “Critical Analysis of Agriculture Content in the, The Times of India, The Hindu, Dainik jagran and The Hindustan.”

## **MATERIALS AND METHODS**

A list of all the English newspapers distributed in Jaunpur was obtained from the dist. information officer, Jaunpur. The leading English newspapers in Jaunpur Dist. of Uttar Pradesh were selected on the basis of following criteria suggested by Maslog (1983).

1. Geographic distribution (Whether it reaches to all over state or some parts of state).
2. Stability (consistency or regularity in publication, whether it is published regularly or not.)
3. Outreach (measured in terms of circulation or number of copies printed).

On the basis of these criteria, The Times of India and The Hindu in English language and Dainik Jagran and The Hindustan in hindi language were identified as a leading news papers in the Jaunpur Dist. of Uttar Pradesh.

The selection of English and Hindi newspapers issues was done for the period, April 1, to September 30, 2021. This period was selected for the study because of the availability of newspaper issues.

The researchers collected data by manually analyzing the selected newspapers for the study period. This involved reading through each issue of the newspapers and identifying articles, news items, and advertisements related to agriculture. The data collected was analyzed using content analysis. This involved systematically categorizing the identified articles, news items, and advertisements related to agriculture into various themes and topics. The



findings of the study were interpreted and presented in the form of percentages, and tables to enable easy understanding.

RESULTS AND DISCUSSION

Space wise coverage given to the news, views and advertisements in the four news papers.

The Table 1 show that in the Dainik jagran, Hindustan, The Times of India and The Hindu the leading Hindi and English daily news papers from Jaunpur, Hindustan (27.4%),Dainik jagran (20.6%),The Hindu (18.7%) and The Times of India

(13.9%) space was the sold space. The portion of the papers that is advertising.

Advertising and views and news content are typically based on a ratio of (27.4%) and (72.5%) respectively. Both are directly proportionate to each other. Increase of the ratio of any of the two means the decrease of the ratio of the other. Therefore the news and views content in The Times of India was 86.0%, The Hindu 81.2%, Dainik jagran 79.3% and in Hindustan 72.5% respectively.

Table - 1 : Space – wise coverage given to the news, views and advertisements in The Four news papers.

Sr. No	Newspapers	Total space given to Ads (col cm <sup>2</sup> )	Total space given to News and views (col cm <sup>2</sup> )	Total content (col cm <sup>2</sup> )
1.	Dainik jagran	2801 (20.6%)	10776 (79.3%)	13577
2.	Hindustan	2059 (27.4%)	5441 (72.5%)	7500
3.	The Times of India	1202 (13.9%)	7413 (86.0%)	8615
4.	The Hindu	1422 (18.7%)	6164 (81.2%)	7586

Write- up wise coverage given to the news and views in the four news papers.

The Table 2 show that in the Dainik jagran, Hindustan, The Times of India, and The Hindu the leading Hindi and English daily news papers from Jaunpur. The share of news in The Hindu was 82.3%, The Times of India 76.8%,Hindustan 75.2% and Dainik jagran 71.3% in total number of news.

Views and News content were distributed as per ratio of 82.3% and 28.6% respectively. Both are directly proportionate to each other. Increase of the ratio of any of the two means the decrease of the ratio of the other. Out of total views content the proportion of agricultural views in Dainik jagran was 28.6%, Hindustan 24.7%, The Times of India 23.1% and The Hindu 17.6% respectively.

Table - 2 : Write- up wise coverage given to the news and views in the four news papers.

Sr. No.	Newspapers	Total no. of agriculture news ( cm <sup>2</sup> )	Total no. of agriculture views ( cm <sup>2</sup> )	Total no. of write up (news and views)
1.	Dainik jagran	7684(71.3%)	3092(28.6%)	10776
2.	Hindustan	4096(75.2%)	1345(24.7%)	5441
3.	The Times of India	5697(76.8%)	1716(23.1%)	7413
4.	The Hindu	5076(82.3%)	1088(17.6%)	6164

Crop production and the related sub- categories.

The Table 3 show the proportion of crop production and related sub categories out of total content . In crop production The Times of India shares 39%, Dainik jagran also contribute 39%,. Regarding Food and grain management, The Hindu shares 34% , Horticulture Dainik jagran

was best with the share of 33 % and for Crop damage The Hindu was maximum with 10%.

The number of crop production news and stories are maximum in the Hindi and English papers i.e. Crop production (6765) Food and grain management (4859), Horticulture (4154) Crop damage (1528) respectively.

Table - 3 : Crop production and the related sub- categories.

Sr. No	News papers	Crop production		Food and grain mg mt.		Horticulture		Crop damage		Total Content in (cm)
1.	Dainik jagran	1936	39%	924	18%	1642	33%	418	8.4%	4920
2.	Hindustan	1468	36%	1167	29%	1107	27%	279	6.9%	4021
3.	The Times of India	1945	39%	1582	32%	921	18.7%	467	9.5%	4915
4.	The Hindu	1416	41%	1186	34%	484	14%	364	10%	3450

Irrigation and the related sub categories.

The Table 4 show the proportion of irrigation sub categories out of total content . The Times of India contributes 32.3%through irrigation and Hindustan shares 37.4 through Mansoon followed by The Hindu (35.3%) . Regarding Soil and water conservation, The Times of India scores 25%, and in Pest management. Dainik jagran

figured 46.1% which was followed closely by Hindustan (36.00%).

The number of Irrigation news were maximum in the Hindi and English papers i.e. Irrigation (2780) Monsoons (3741) Soil and water conservation (2305) Pest Management (4005) respectively.

Table - 4 : Irrigation and the related sub categories. Cooperative, MSP and other related sub- categories.

Sr. No	Newspaper	Irrigation		Mansoons		Soil and water conservation		Pest mg mt.		Total content
1.	Dainik jagran	515	14%	750	21%	596	17.2%	1598	46.1%	3459
2.	Hindustan	380	13.2%	1072	37.4%	374	13%	1034	36%	2860
3.	The Times of India	1185	32.3 %	912	24.9%	922	25%	642	17.5%	3661
4.	The Hindu	700	24.5%	1007	35.3%	413	14.4%	731	25.6%	2851

The Table 5 show the space in Cooperative and the related sub-categories. The Hindu have maximum nes of cooperative with the percentage of 44.5. Regarding MSP The Times of India leads with 39.2% and for other sub categories

Hindustan shares 39.5% . The number of co-operative stories are maximum in the Hindi and English papers i.e. Co-operative (2399) MSP (2194) ,other (2290), respectively.

**Table - 5 : Cooperative, MSP and other related sub- categories.**

<b>Newspapers</b>	<b>Co-operative</b>		<b>MSP</b>		<b>Other</b>		<b>Total content</b>
Dainik jagran	710	32.5%	664	30.4%	805	36.9%	2179
Hindustan	690	34.6%	514	25.8%	788	39.5%	1992
The Times of India	451	30.4%	582	39.2%	450	30.3%	1483
The Hindu	548	44.5%	434	35.5%	247	20%	1229

## CONCLUSION

On the basis of above results it was concluded that the daily newspapers especially English and Hindi are a preferred media for news, views and advertising agriculture related products. During the six month study it was come to light that number of advertisement related to agriculture input in the, Total space given to Ads maximum coverage was given by Hindustan (27.4%). Regarding total space given to news and views, maximum coverage was given by The Times of India (86%).

The reason for this study asserts that there is no thrust area or a specified agenda regarding agriculture. During the six month study it come to light that number of agriculture related sub categories were in The Hindu crop production (41%), The Hindu Food and grain management. (34%), Dainik jagran Horticulture (33%), The Hindu Crop damage (10%) were prominent figures.

Other agriculture related activities like irrigation The Times of India covers highest i.e. 32.3% , Hindustan for Mansoon (37.4%) . For Soil and water conservation The Times of India contributes 25%, and in Pest management Dainik jagran scores 46.1%, Cooperative have maximum coverage in The Hindu (44.5%), MSP The Times of India (39.2%) and in case of Other Hindustan (39.5%) was best.

## REFERENCES

1. Al Foori, R. (2015). Patterns of environmental coverage in Omani newspapers: a constructionist study of news frames and production Influences. PhD. thesis, University of Leicester, UK.
2. Antilla, L. (2005). Climate of skepticism: US newspaper coverage of the science of climate change' *Global Environmental Change*, vol.15, 338-352.
3. Dhillon, Bhupinder (1982). Content analysis of farm information contained in selected Punjabi Dailies circulating in Punjab. Unpublished M.Sc. Thesis. PAU. Ludhiana
4. Dutt, B.; Garg, K.C. and Bhatta, A. (2013) A quantitative assessment of the stories on environmental issues published in English-language Indian dailies', *Annals of Library and Information Studies*, vol. 60, 219-226.
5. Mishra, O. P. and Verma, O. S. (1998). Agricultural information coverage in Indian Dailies: A content analysis. *Indian Journal of extension Education*. Vol. 34. New Delhi. 127-32

# SIGNIFICANCE OF ENVIRONMENTAL FACTORS IN HUMAN LIFE MANAGEMENT WITH SPECIAL REFERENCE TO HEALTH

<sup>1</sup>Rakesh Kumar Srivastava and <sup>2</sup> Santosh Kumar Arasiya

<sup>1</sup>Department of Ayurveda,

<sup>2</sup>Department of Business Management

Mahatma Gandhi Chitrakoot Gramogaya Viswavidyalaya,

Chitrakoot, Satna, (M.P.). India

Received : 27.02.2023

ABSTRACT

Accepted : 28.03.2023

Today's human life of whole modern world is deeply concerned with the environmental crisis. The environmental factors are foundation wherein man himself in close relationship with nature. Though both man and nature are created by the almighty, yet man becomes the consumer and nature is an object to consume. It is true that we need to consume natural resources because our needs have increased enormously, but we must not ignore the fact of getting balanced nature in present era, environmental science and ecology are disciplines of modern science under study of environment and its constituents is done with minute details. As the environmental problem is a burning issue all over the world and human health is directly related with environmental and requires more and more efforts from all the sides to protect the internal and external environment in which, the traditional methods may help a lot if practiced. Keeping this view in mind the present work entitled "Significance of environmental factors in human life management with special reference to health" has been taken to explore the ancient wisdom regarding human health in relation to environmental factors. Aim of this study is to collect and explore the Ayurvedic view regarding environmental factors and its effect on human health, which may be a great help in the present era of ecological imbalance.

**Keywords :** *Environment, Air(vayu), water(jala), place(desha), time(kala), health life management*

## INTRODUCTION

Ayurveda is not only a system of medicine, but deals with entire aspect of human life. It is the science of living being and comprises the knowledge about the health for happy and fruitful life, which is perceived by the ancient sages through their keen observation of nature down the ages. They have tried to understand the harmonious relationship between the man and nature. The concept of environmental factors in Ayurveda are

quite comprehensive. Unlike modern science, it has considered not only the physical but also the spiritual aspect of environment as life is also the combination of physical and spiritual component and both are complimentary to each other. By intimate contact with nature the ancient sages realized the uniformity of nature and man, to solve the mystery of life. The Ayurvedic scholars applied that knowledge in the field of medical science and established the law of uniformity between man and

universe known as “Lok- Purusha Samya” in Charaka Samhuta. As the universe comprises i.e. Panchmahabhuta and Avyakta Brahma (unmanifested consciousness) likewise a person consists of Panchmahabhuta and Atman (soul). A purusha always depends upon on Loka for his survival and vice versa. Maintenance of equilibrium for healthy relation between Loka (macrocosm) and Purusha (microcosm) is the most important factor for achieving a healthy eco-system.

Acharya Sushruta explained the constitution of man and stated that as the moon, the sun and the air sustain and control the activity of cosmos with releasing, receiving and dispersing effect ; likewise kapha, pitta and vata sustain and control the activity of body as the pillars of human being. He has also expressed how the ecological balance is maintained by the interaction of abhyantara prana and vahya prana, harmonious relation of which supports the human being.

Ayurveda believes in nature cure rather than medication. The concept of environmental factors like vayu, jala, desa, kala etc, are closely related with men's health status because men always in close relation with the environment for their existence.

**Objectives of the study-** The entire study is descriptive in nature which contain following objectives.

1. To study the role of vayu and its management in human life and health.
2. To study the role of jala and its management in human life and health.
3. To study the role of desa and its management in human life and health.
4. To study the role of time and its management in human life and health.

Many factors like vayu, jala, desa and time and various diseases like fainting, bleeding, thirst, exhaustion, sensation, discolouration, lassitude due excessive sun light effects causes of environmental factors affects the human life and health.

## **Role of Vayu (Air) and its management-**

Vayu is one of the most important environmental factor on which the human life is based. Without air one can not survive for a single minute. The action of normal and vitiated vata and causes of vitiation as well as method of pacification are mentioned in detail, inside the body and outside the body (in the environment). Ayurvedic scholars have shown intricate relationship between the internal and external vata in the 12<sup>th</sup> chapter of Charak samhita sutra sthan. Vayu is all powerful, producer and indestructible; causes positive factors, creatures and brings about happiness and misery; he is regulator, viswakarma (performing all sorts of functionings), Visnu (protector) moves in the entire nature, what else vayu himself is the Lord (all powerful). The air has been given the status of god by the Ayurvedic scholars and its different aspects related to human life as well as health and disease has been described elaborately. It is considered important among the three doshas from physiological, pathological and treatment point of view. Acharya Charaka also mentioned the effects of unvitiated vayu manifested in or outside the body. Among tridosha, special importance of every context and Acharya Sarangdhara even gives a remarks that pitta, kapha both are pangu (paralysed) along with other dhatus, they move with air where this want, like the clouds in the sky. As the body and manas are closely related each other and vata possess rajoguna, therefore when it is in normal form initiate different activities and even it is mentioned in Charaka samhita that prana vayu which is a type of vata is initiator and controller of mind that's why when vata is vitiated it does not affect the body only but the mind too and the activities of mind affected accordingly.

The sincere regards to vayu, too, is conducive to health, improvement of strength and complexion, valour, development, improvement of knowledge and maximum exposure of life span. Thus the vayu is life and vitality. It is the supporter of all embodied beings. Vayu is verily the whole universe and it is the



lord of all. The man in whose body, the vayu is unimpeded in its course and lies in its normal habitate and is in its normal condition lives longer than even a hundred years fully free from diseases as mentioned in Chikitsa sthana. A physician must know the properties, action, causes of vitiation and action of unvitiated and vitiated vata along with method of pacification not only inside the body but also outside the body too. Because it can be well understood by external affairs easily. If the air of a particular place consists of high percentage of smoke. It causes serious disorders in human beings. Acharya Sushruta used the term 'Dhumopahata' for this condition and describe its features, which are dyspnea, excessive sneezing flatulence, cough, burning and redness of eyes etc. Acharya Vagbhatta also described the properties of pravata (heavy breeze) and apravata (light breeze). Pravata (heavy wind) causes dryness, discoloration, stiffness, burning sensation etc. While Apravata (light wind) is opposite in the properties tht of pravata. The effects of vitiated vayu in nature (environment) are –derangement of six seasons, complication in creatures and overflowing of the lakes etc. Similarly, the causes of pollution and methods of purification of polluted vayu with the help of herbs are also described in Ayurvedic classics which are lacking in modern sciences till date. Thus vayu is very important for human being and has given due consideration from health as well as disease point of view.

**Role of Jala (water) and its managment:-** Jala is an important environmental factor and essential to all form of life. In ancient literature, water is considered as Amrita (nectar). It destroys dirt and disease of all kind. They have developed a cultural tradition of pilgrimage on the bank of rivers for purification s of water. It is said in Padma purana that who pollutes water goes to hell to condemn the water pollutions forcefully. This shows their protective attitude towards environments which is the acute need of today's world also. In Ayurveda the rain water is considered as good for health especially

in the autumn season because in Charaka samhita the properties of rain water also described according to season for e.g. the fresh rain water of rainy season is heavy, blocking of channel and sweet in taste while that of autumn is thin, light and non blocking of channel. Not only this, the taste of water also depends upon the properties of land on which it present as well as the vessel in which it is kept for e.g. taste of water is astringent in white soil and bitter taste in pale soil. Rain water collected in a good vessel has properties like tridosha–alleviating, strengthening, rasayana etc. Pure and safe water is the basic requirement for every human being to survive. The properties of river water also vary according to their origin and direction of flow and they produce affect on health accordingly for e.g. the river originating from Himalaya and Malaya having water like nector. This shows that how keenly they observe the nature and its effect on health and disease.

One thing which is very interesting here to mentioned that they have developed their own methodology for the examination of water in their own way because during those days no laboratory and sophisticated tools and technology was available like today. In Sushruta samhita the method of examinations of gangetic and ocean water is described as – a lump of cooked sali rice, neither sticking nor of abnormal colour put in a silver utensil should be kept outside in open while it is raining ; if stayed for muhurta there is no change it should be taken as gangetic water and therefore is change in colour and consistency it should be known as oceanic water also comes down with rains in the month of asvina, it becomes like gangetic one.

The method of collection and preservation which have been mentioned in our Ayurvedic literature is still practical in present era. The scientist of present time are also advising the similar method for collection, preservations and recharging of water which have been advised in Sushruta Samhita for the protection and conservation of water. In some of the countries of the world these methods are in practice

and these are the best methods to overcome the crisis of water. The cause of polluted water and its effect on health in form of water born disease like long continued fevers, cough, dyspnea, enlarged lymph glands and diarrhea, etc. are described in all text. Different natural methods for purification of water like boiling, heating, and keeping in sun ray advised along with its treatment with herbs like kataka (clearing nut), Gomedaka (cinnabar stone), vishgranthi (lotus root) etc, and scenting with flowers of nagkeshar, champaka, utpala, patola etc. It will be better if the water is purified with natural means and herbs because these are cheap and ecofriendly as well as prevents the unwanted effects of chemicals used for purifications in present times. So it will be said it will be said that the Ayurvedic literature is very rich in this regard, and the only need is to practice and promote these views at different level.

**Role of Desa and its management :-** The term desa is used for the place where the individual borne and resides as well as the plants and herbs are grown along with the body of the patient in different terms like deha, desa, and bhumi desa etc.

Our ancient scholars know the importance of knowledge of place where a person because every person have a direct relation regarding health and disease with their habitat, that's why they given emphasis to examine the nature of land with a view to ascertain the specific features of persons well as the *ausadha dravya* (drug) in different localities. Mainly three types of Desa have been described from habitat point of view and their relation with the health and diseased condition of a person.

While examining the patients one should consider that in what type of land patient is born, grown or diseased and specific concerning diet, behavior, conduct and strength etc.

After the examination of land (habitate) about the knowledge of patient or drug, the examination of patient should be done because patient is the substratum of act (treatment). The examination of the patient should be conducted for

the knowledge of the span of life or the degree of strength and morbidity.

It is also mentioned that, a physician must know that articles (mainly diet) which are unwholesome but got adoptability from habitat point of view should not be withdrawn suddenly because it will cause withdrawal effect. Therefore it should be withdrawn gradually. Few examples of suitable items have been mentioned according to habitat such as for Bahlikas, Palavas, Chinese, Sulikas, Yavanas and Sakas, meat, wheat, madhvika (a type of wine), weapons and fire etc. are suitable.

The inhabitants of Prachya desa (eastern region) are suited to fish, those of Sindhu suited to milk, oily and sour preparations are suitable to those of Asmaka and Avanti regions.

For inhabitants of Malaya region tubers, roots and fruits are suitable. Liquid gruel is suited in south while churned drink in north-west. In Madhya desa (central region) barely, wheat and milk products are suitable. For the patient of these regions drug should be prescribed along with the items suitable to them because the suitable thing provides enough strength quickly and does not harm even if taken plentiful. Acharya Charaka also stated that the physician ignorant of place etc, and prescribing treatment only with the formulations fails because there are so many variations in respect of age, strength, and body etc., according to the habitat of patient.

Not only the knowledge of habitat and body of patient is enough but the drugs should also be cultivated and collected according to place because potency of drug (plant origin) depends on its place of cultivation, time of collection and their proper preservation. Place of origin directly influenced the properties of any plant.

Jaloukas (leaches) which used in different diseases as non surgical procedure are big, strong, swiftly, eating too much and particularly non-poisonous. These types of Jaloukas (leaches) are found in the areas of Yavana (Arab countries), Pandya (South India), Sahya (Hill beyond narmada)

and Pautan (region around Mathura).

In kasyap samhita the puerperal management has been described according to the place of living. This is a specific contribution of Kasyap samhita in the field of Prasuti tantra and stri roga for eg. in Jangal desa (dry area), the disease of vata and pitta dosa are more prone, thus here due to the congeniality of oleaginous substances, the use of such substances is strongly recommended, specifically for women having just delivered.

Acharya Sushruta has also prescribed specific management for puerperal women of Jangal desa in which use of good quantity of oleaginous substance is advised. Thus the management of puerperal women should not be considered in isolation, it should be used considering the congeniality for living place and caste.

Treatment of Amlapitta according to desa also also a unique contribution of Kasyap Samhita. In human beings, this disease (amlapitta) often develops in marshy place that is why it should be treated with the medicine growing in Jangal desa (arid zone). If it does not get pacified with this, the person should go to other place, because a particular desa (region) is known as good where people live with disease free state.

The herbs grown in certain places are favorable to the protect of people of those places. The Ayurvedic scholars observe that the nature produces such plants and trees to act as remedy generated in that region and climate, for example the Red Indian peoples were suffering from severe malaria but they also found a natural remedy as cinchona bark in their locality. Similarly many indigenous drugs are beneficial for the Indian people as a remedy for disease, more prone in Indian climate.

Thus it is clear that the knowledge of Deha desa (patient) and Bhumi desa (habitat) is very important for physician to prescribe the proper treatment and wholesome and unwholesome items to combat the patients as well as to explain the prognosis of a disease to the patient or his attendant.

**Role of Time and its management-** It is an

important environmental factor which is related every movement and every aspect of human life. It also considered as the cause of creation of all universal constituents and has given the status of god in all Ayurvedic classics. It is only one but it is divided in accordance to seasonal variations, movement of sun, as well as the status of patient. Acharya Charaka has classified the kala in to two types- Nityaga and Avasthik; Nityaga (eternally moving) is related to seasonal suitability while Avasthika (conditional) is related to disorder. On the basis of movement of Sun and moon is divided into two ayana and six ritu and for each ritu a special seasonal regimen is prescribed to maintain health and prevent the disease. The purification therapy is also advocated according to season. In Charak Samhita, the division of ritu is done for prevention point of view in Sutra sthana while for purification point of view in Vimana sthana.

Kala (time) is again very important factor for feeding and sleeping habits. Any person who take their meal on proper time have a good health timely eating is the best among those factor which are responsible for maintaining health. The day time sleep is prohibited during all the season except Grisma ritu. This show their scientific vision regarding the prevention and cure of disease in relation to time factor.

The collection of herbs is also advised according to the season. Acharya Sushruta said that the hot herbs should be collected in hot season while the herbs having cold herbs should be collected in cold season. Thus their properties are not affected.

The other environmental factors which affect the life of human being are sunlight, rain and fire. Sunlight leads to perspiration, fainting, bleeding disorders, thirst, exhaustion, fatigue, burning sensation and discoloration, whereas shade protects from all these. Rain is lassitude while mist, fog causes fear, delusion and increase of kapha and vata. Fire mitigates vata and kapha relieves stiffness, cold and shivering, mitigate ama, moistness and aggravates vata and pitta.

CONCLUSION

On the basis of above descriptive matter, it can be cocluded that Vayu (air), Jal (water), Desa (place) and Kala (time) management are those factors which affects positively and negatively both to the human life and health. Where their the sudha vayu (pure air), sudha jal (pure water), Sudha desa (pure place) and proper time management positively affects the human life and health whereas asudha vayu, jala, desa and improper time management negatively affects the human life and health.

The other environmental factors which affect the life and health of human beings are sunlight, rain and fire. The sunlight leads to perspiration, fainting, bleeding disorders, thirst, exhaustion, fatigue, burning sensation and discoloration whereas shade protects from all these. Rain is lassitude while mist, fog causes fear, delusion and increase of kapha and vata dosha. Fire mitigates vata and kapha relieves stiffness, cold and shievering mitigates ama, moisten and aggravates vata and pitta dosha.

REFERENCES

1.	Bhatt,P,Ramesh : Astang Samgraha (sutra sthan), Chaukhamba Orientalia, Varanasi, 1 <sup>st</sup> Ed,2005.	2.	Gaur, B.L : Astang Hridaya (sutra stah ), Chaukhamba Oientalia Varanasi, 1 <sup>st</sup> Ed, 2007.
		3.	Goswami, P.K : Concept of Desa and Kala as described in Ayurvedic Smhitaa (Brihatrayi) and to assess its applied aspect in present era , M.D (Ay) Thsis , IMS,BHU,1993.
		4.	Sharma , P.V : Charak samhita with English translation , (vol 1-5) Chaukhamba Orientalia Varansi, 2008.
		5.	Sharma P.V : Susruta samhita with English translation and Dalhana commemetary, (vol 1-3) Chaukhamba Orientalia, Varnasi , 1999.
		6.	Sharma , R.K Das , Bhagwan : Charak samhita with English translation and critical exposition based on Chakrapani tika (vol 1-6) Chaukhamba Orientalia, Varanasi, 2008.
		7.	Shastri , Ambikadutta : Susruta samhita (vol, 1-2) Chaukhamba Sanskrit Samsthan , 2004.
		8.	Upadhyaya, Yadunant : Madhav Nidan (part. 1- 2) Chaukhamba Sanskrit Samsathan, Varanasi, 2003.

# CONSTRAINTS AND CHALLENGES IN THE MARKETING OF VEGETABLES: A STUDY OF VEGETABLE GROWERS IN THE NAWADA DISTRICT OF BIHAR, INDIA

**Vipul Kumar, N. K. Mishra and Pradeep Kumar Yadav**

Department of Agricultural Extension

T. D. P.G. College, Jaunpur, (U.P.), Indina

Corresponding E-mail: vipulkumarasma@gmail.com

Received : 08.12.2022

**ABSTRACT**

Accepted : 10.01.2023

**This research aimed to identify the constraints faced by vegetable growers in the marketing of vegetables in the Nawada district of Bihar, India. The study was conducted through a survey of 120 respondents. The results indicated that the majority of farmers expressed several constraints, including the lack of irrigation facilities, absence of improved vegetable varieties, and shortage of skilled labour. In addition, farmers also faced challenges related to long distances to market, high production costs and inadequate storage facilities. Lack of finance and transport facilities were also identified as significant constraints. Other unspecified psychological and mental constraints were also reported by a substantial number of respondents. Despite the limitations of the study, the findings suggest that addressing the major constraints identified in this research could improve the marketing of vegetables in the study area.**

***Keywords :*** Vegetable, constraints, marketing.

## INTRODUCTION

Vegetable production is a critical component of the agricultural economy in many countries by providing both food security and income for farmers. However, vegetable growers often face numerous challenges in marketing their produce, leading to lower incomes and reduced access to markets. These challenges can include a range of constraints related to the production, processing, and distribution of vegetables, such as lack of irrigation facilities, absence of improved vegetable varieties, shortage of skilled labor, inadequate storage facilities, and high production costs.

In particular, vegetable growers in developing countries often face significant constraints in accessing markets due to poor

infrastructure and limited resources. These constraints can lead to reduced competitiveness, increased post-harvest losses, and decreased quality of produce, resulting in lower prices and profits for growers. Despite the importance of vegetable production for food security and economic development, little is known about the specific constraints faced by vegetable growers in marketing their produce in many regions.

This research aims to identify the major constraints faced by vegetable growers in the marketing of vegetables in the Nawada district of Bihar, India. By identifying the key constraints and challenges faced by vegetable growers, this study can inform policy and interventions aimed at improving the marketing and distribution of vegetables, leading to increased income and



improved food security for growers and consumers alike.

MATERIALS AND METHODS

The research on constraints and challenges in the marketing of vegetables in the Nawada district of Bihar, India was conducted using a survey method. The study sample consisted of 120 vegetable growers from 10 villages in the district. Data was collected through a structured questionnaire, which was developed based on the objectives of the study. The questionnaire consisted of closed-ended questions, which allowed for quantitative data analysis. The questionnaire was pretested to ensure its reliability and validity. The survey was administered to the respondents in person, with the help of trained research assistants. The respondents were selected using a stratified random sampling method, based on the size of their landholdings. The survey was conducted in the local language to ensure clear communication. Data was analyzed using descriptive statistics, including percentages and frequencies.

RESULTS AND DISCUSSION

Constraints faced by vegetable growers in marketing of vegetable

The results of the study indicate that the most significant constraint faced by vegetable growers in the marketing of vegetables in the

Nawada district of Bihar was the lack of irrigation facilities with 77.55% of the respondents expressing this as a major challenge. The second most common constraint reported was the lack of improved vegetable varieties with 72.50% of the respondents indicating this as a major challenge. The third most common constraint was the high cost of production with 68.33% of the respondents expressing this as a challenge. Fourth one was the absence of storage facility with 63.33% of the respondents reporting this as a challenge. The fifth constraint was the lack of finance, with 61.66% of the respondents indicating this as a challenge. The sixth most common constraint faced by vegetable growers was the lack of skilled labor, with 56.66% of the respondents reporting this as a challenge. The seventh most common constraint was the lack of transport facilities, with 55.83% of the respondents reporting this as a major challenge. The constraint of others specified i.e. psychological, mental etc, with 50.83% of the respondents expressing this as a challenge was eighth most common constraint faced by vegetable growers. The ninth most common constraint was the long distance to market, with 46.66% of the respondents indicating this as a major challenge. Similar results were reported by Wankhade *et al.* (2013), Holkar *et al.* (2018), and Kulkarni *et al.* (2019).

Table - 1 : Constraints faced by vegetable growers in marketing of vegetables.

Sl. No.	Constraints	Frequency (N=120)	Percentage	Rank
1.	Lack of irrigation facilities	93	77.55	I
2.	Lack of skilled labour	68	56.66	VI
3.	Absence of storage facilities	76	63.33	IV
4.	High cost of production	82	68.33	III
5.	Lack of transport facilities	67	55.83	VII
6.	Long distance to market	56	46.66	IX
7.	Lack of finance	74	61.66	V
8.	Lack of improved vegetable varieties	87	72.50	II
9.	Others	61	50.83	VIII

## SUGGESTIONS

The study found that the majority of vegetable growers suggested that the prices of inputs should be minimized (90.83%), timely technical guidance should be provided (85.00%), and good and healthy seedlings should be provided (74.16%). Proper marketing facility should be Established (70.00 %), imparting training on new technology (65.00%), guidance on raising nursery (56.66%), providing knowledge regarding recommended

doses of fertilizers and pesticides (48.00%), Other suggestions included regulating the rate of agricultural produce (33.33%) and regular visits by horticultural officers (27.50%). The study concludes that the major suggestions given by vegetable growers include minimizing input prices, providing timely technical guidance, and ensuring proper marketing facilities. Similar suggestions have been reported by Hipparkar (2013) and Gurjar et al. (2017).

**Table - 2 : Suggestions made by vegetable growers to the constraints faced by them**

S.N.	Items/ Practices	frequency	percentage
1.	Training on new technologies should be imparted to the farmers.	58	48.0
2.	Rate of produce should be regulated.	78	65.0
3.	Good and healthy seedlings should be provided.	89	74.16
4.	Price of seed should be minimized.	109	90.83
5.	Regular and timely visit of the farm should be necessary by horticulture officer.	33	27.5
6.	Proper marketing facility should be established.	84	70.0
7.	Sufficient electric power should be available for long time	40	33.33
8.	Guidance should be provided to raise nursery	68	56.66
9.	Timely technical guidance should be provided to the farmers.	102	85.0

## CONCLUSION

In conclusion, the study highlights the various constraints and challenges faced by vegetable growers in the Nawada district of Bihar, India. The major constraints identified in this study include lack of irrigation facilities, lack of improved vegetable varieties, lack of skilled labor, high cost of production, lack of finance, and absence of storage and transport facilities. The vegetable growers also provided various suggestions, including minimizing input prices, providing timely technical guidance, and ensuring proper marketing facilities. It is important for policymakers and stakeholders to take note of these findings and work towards addressing these issues to improve the marketing and overall production of vegetables in the region. The study also adds to the existing literature on the challenges faced by vegetable growers and highlights the need for further research in this area.

## REFERENCES

1. Gurjar, R. S., Gour, C. L., Dwivedi, D. and Badodiya, S. K. 2017. Entrepreneurial

- behavior of potato growers and constraints faced by farmers in production and marketing of potato and their suggestion. *Plant Archives*, 17(1): 427-432.
2. Hipparkar, B. G. 2013. Entrepreneurial behaviour of pomegranate growers. M.Sc. (Agri.) Thesis, V.N.M.K.V. Parbhani, Maharashtra.
3. Holkar, S. C., Wanole, S. N., Bande, K. D. and Mardane, R. G. 2018. Relational analysis of entrepreneurial behavior of banana growers. *International Journal of Chemical Studies*, 6(3): 2407-2411.
4. Kulkarni, N. P. and Jahagirdar, K. A. 2019. Entrepreneurial behavior and constraints faced by the rose growers. *Asian Journal of Agricultural Extension, Economics & Sociology*, 32(4): 1-8.
5. Wankhade, R. D., Sagane, M. A. and Mankar, D. M. 2013. Entrepreneurial behaviour of Vegetable growers. *Agriculture Science Digest*, 33(2): 85-91.

# A PRELIMINARY STUDY OF PREDATORY BUGS OF MIZORAM, INDIA

Sonam Jahan<sup>1</sup>, Preety Khare<sup>1</sup>, Sandeep Kushwaha<sup>2</sup> and Hemlata Pant<sup>3</sup>

<sup>1</sup>Government Science College, Jabalpur, Madhya Pradesh, India

<sup>2</sup>Zoological Survey of India, Central Zone Regional Center, Jabalpur Madhya Pradesh, India 482002

<sup>3</sup>CMP, Degree College, University of Allahabad, Prayagraj, U.P.

<sup>2</sup>Corresponding author Email: sandeepkushwaha\_17@yahoo.com

Received : 11.10.2022

ABSTRACT

Accepted : 12.11.2022

The study yielded the identification of 16 species of predatory bugs belonging to 2 families of the order Hemiptera, among them 13 species reported for the first time from Mizoram.

**Keywords :** Bugs, study, families

## INTRODUCTION

A Distant (1902, 1904 & 1906) recorded a detailed account of Hemiptera fauna in north East India. In India, 6,479 species of Hemiptera have been reported (Chandra *et al.*, 2018), 392 species were reported by Chandra *et al.*, 2020, and 505 species of Assassin bugs by Mukherjee *et al.*, 2020. Apart from these, no detailed studies have been carried out in this area. Families of terrestrial Hemipteran (Heteroptera) predators included the Families like Reduviidae, Phymatidae, Nabidae, Anthocoridae, Pentatomidae, Phyrrochoridae, Scutelleridae, Miridae, Lygaeidae etc. Predatory insects of these families have been promoted as indigenous natural enemies of pest management practices in forest and agro-ecosystems. Earlier study hemiptera from Mizoram done by Chakraborty and Bal, 2007 and Biswas and Bal, 2007, Suman *et al.*, 2022.

Order HEMIPTERA Linnaeus, 1758

Suborder HETEROPTERA Latreille, 1810

Infraorder CIMICOMORPHA Leston, Pendergrast and Southwood, 1954

Super family CIMICOIDEA Latreille, 1802

Family REDUVIDAE

1. Genus *Polididus* Stål, 1858

1. *Polididus armatissimus* Stål, 1859

1859. *Polididus armatissimus* Stål, *Ofv. Vet.-Ak.*

*Forh.*,: 376

*Material examined*: 2 exs, MNP, Dist, Champhai, 3.v.2019, coll. Sonam Jahan, 1exs, Teirei river, Dist, Mamit, 25.v.2019, Coll. Sonam Jahan.

*Distribution*: India: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal. Elsewhere: Bangladesh, China, Former USSR, Japan, Myanmar, Philippines, and Sri Lanka.

2. Genus *Rhynocoris* Kolenati, 1857

2. *Rhynocoris costalis* (Stål, 1866)

1866. *Reduvius costalis* Stål, *Ofv. K. Vet. Ak. Forh.*, **23**: 285.

2006. *Rhynocoris costalis* (Stål): Ambrose, *Zoos' Print Journal*, **21** (9): 11.

*Material examined*: 1 exs, Tuichar, Dist, Mamit, 22.11.19 coll. Sonam Jahan, 2exs, Teirei river DTR, Dist. Mamit, 18.xi.2019, Coll. Sonam Jahan, 1 exs, Phuldungsei IB, Dist, Mamit, 2.xii.2018, Coll. Sonam Jahan.

*Distribution*: India: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Meghalaya, Sikkim, Uttarakhand, Uttar Pradesh, West Bengal. Elsewhere: Malay Peninsula, Myanmar, and

Indonesia.

3. ***Rhynocoris fuscipes*** (Fabricius, 1787)

1787. *Reduvius fuscipes* Fabricius, *Mant. Ins.*, **2**: 312.

1986. *Rhynocoris fuscipes* (Fabricius): Ambrose and Livingstone, *J. Bombay Nat. Hist. Soc.*, **83** (1): 176.

*Material examined*: 1 exs, Phuldungsei IB, Dist, Mamit, 2.xii.2018, Coll. Sonam Jahan, 1 exs, Tuichar, Dist, Mamit, 22.xi.2019 coll. Sonam Jahan.

*Distribution*: India: Andhra Pradesh, Chhattisgarh, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Odisha, Tamil Nadu, and West Bengal. Elsewhere: Bangladesh, China, and Sri Lanka.

4. ***Rhynocoris marginatus*** (Fabricius, 1794)

1794. *Reduvius marginatus* Fabricius, *Ent. Syst.*, **4**: 196.

2010. *Rhynocoris marginatus* (Fabricius): Biswas and Bal, *Fauna of Uttarakhand, State Fauna Series*, **18**: 260.

*Material examined*: 1 exs, Chitha, Dist, Mamit, 24.xi.2018, Coll. S. Kushwaha.

*Distribution*: India: Andhra Pradesh, Assam, Chhattisgarh, Delhi, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, North India, Odisha, Punjab, Sikkim, Tamil Nadu, Telangana, Uttarakhand, Uttar Pradesh, and West Bengal. Elsewhere: China, and Sri Lanka.

5. ***Rhynocoris squalus*** (Distant, 1904)

1904. *Harpactor squalus* Distant, *Fauna Brit. India, Rhynchota*, **2** Diagnosis: 333.

2006. *Rhynocoris squalus* (Distant): Ambrose, *Zoos' Print Journ.*, **21** (9): 12.

*Material examined*: 2 exs, Teirei River, Dist. Mamit, 8.12.18, coll. Sonam Jahan, 1exs, DTR, Dist, Mamit, 18.11.19, Coll. Sonam Jahan

*Distribution*: India: Chhattisgarh, Himachal Pradesh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Sikkim, and West Bengal.

3. Genus ***Oncocephalus*** Klug, 1830

6. ***Oncocephalus impudicus*** Reuter, 1882

1882. *Oncocephalus impudicus* Reuter, *Act. Soc.*

*Sc. Fenn.*, **12**: 715.

*Material examined*: 1exs, Teirei IB DTR, Dist. Mamit, 21.V.2019 coll. Sonam Jahan, 2 exs, MNP, Dist. Champhai, 4.v.2019, Coll. Sonam Jahan.

*Distribution*: India: Chhattisgarh, Madhya Pradesh, Maharashtra, Manipur, Sikkim, Uttarakhand, and West Bengal. Elsewhere: China, Indonesia, and Sri Lanka.

4 Genus ***Scadra*** Stål, 1859

7. ***Scadra annulipes*** Reuter, 1881

1881. *Scadra annulipes* Reuter, *Act. Soc. Sc. Fenn.*, **12**: 309.

*Material examined*: 1 exs, MNP, Dist. Champhai, 4.5.19, Coll. Sonam Jahan, 1exs, Teirei IB DTR, Dist. Mamit, 19.xi.2019 coll. Sonam Jahan.

*Distribution*: India: Chhattisgarh, Kerala, Madhya Pradesh, Mizoram, Tamil Nadu and West Bengal.

**Remark**: Endemic to India.

5 Genus ***Euagoras*** Burmiester, 1835

8. ***Euagoras plagiatus*** (Burmiester, 1834)

1834. *Zelus plagiatus* Burmiester, *Nov. Act. Ac. Nat. Cur.*, **16** (1): 303.

2006. *Euagorus plagiatus* (Burmiester): Ambrose, *Zoos' Print Journ.*, **21** (9): 8.

*Material examined*: 1exs, Phuldungsei. Dist. Mamit, 2.xii.2018 coll. Sandeep Kushwaha, 2exs, Dampa rengpui, Dist. Mamit, 17.xi.2019 coll. Sonam Jahan.

*Distribution*: India: Andaman Island, Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Tamil Nadu, Telangana, Tripura, Uttarakhand, and West Bengal. Elsewhere: China, Indonesia, Japan, Malaysia, Myanmar, Philippines, Singapore, and Sri Lanka.

6 Genus ***Valentia*** Stal, 1865

9. ***Valentia apetala*** (Vuillefroy, 1864)

1864. *Valentia apetala* Vuillefroy *Hémiptères nouveaux. Annales de la Société entomologique de France*, **4**, 141–142.

*Material examined*: 1exs, Tuichar, Dist. Mamit, 21.xi.2019, Coll. Sonam Jahan.

*Distribution*: Manipur, Mizoram, and West Bengal.



Elsewhere: Myanmar, Malaysia and Singapore.

7. Genus *Tribelocephala* Stål, 1853

**10. *Tribelocephala indica*** (Walker, 1873)

1873. *Opisthoplatys indica* Walker, *Cat. Het.*, **8**: 20.

2006. *Tribelocephala indica* (Walker): Ambrose, *Zoos' Print Journ.*, **21**(9): 27.

*Material examined*: 1exs, DTR Teirei river, Dist. Mamit, 18.xi.2019, coll. Sonam Jahan 1 exs, Tuichar, Dist. Mamit, 20.xi.2019, coll. Sonam Jahan.

*Distribution*: India: Andhra Pradesh, Bihar, Chhattisgarh, Jharkhand, Kerala, Madhya Pradesh, Maharashtra, Mizoram, and West Bengal. Elsewhere: Sri Lanka.

8. Genus *Sycanus* Amyot and Serville, 1843

**11. *Sycanus croceovittatus*** Dohrn, 1859

1859. *Sycanus croceovittatus* Dohrn, *Stett. Ent. Zeit.*, **20**: 97.

*Material examined*: 2 exs, DTR IB, Dist. Mamit, 19.xi.2019, Coll. Sonam Jahan, 3 exs, Tuichar forest DTR, Dist. Mamit, 20.xi.2019, Coll. Sonam Jahan.

*Distribution*: India: Chhattisgarh, Manipur, Meghalaya, and Mizoram. Elsewhere: China, and Myanmar.

**12. *Sycanus collaris*** (Fabricius, 1785)

1785. *Reduvius collaris* Fabricius, *Spec. Ins.*, **2**: 380.

1904. *Sycanus collaris* (Fabricius): Distant, *Fauna Brit. India, Rhynchota*, **2**: 351.

*Material examined*: 2 exs, DTR IB, Dist. Mamit, 19.xi.2019, Coll. Sonam Jahan, 2 exs, DTR IB, Dist. Mamit, 15.xi.2019, Coll. Sonam Jahan, 1exs, Phuldungsei, Dist. Mamit, 14.xi.2019, Coll. Sonam Jahan.

*Distribution*: India: Andhra Pradesh, Assam, Chhattisgarh, Madhya Pradesh, Meghalaya, Odisha, Punjab, Sikkim, Tamil Nadu, Uttarakhand, Uttar Pradesh, and West Bengal. Elsewhere: China, Malayan Archipelago, Malaysia, Philippines, Sri Lanka, and Thailand.

**Subfamily SALYVATINAE**

9. Genus *Lisarda* Stal, 1859

**13. *Lisarda annulosa*** Stal, 1874

1874. *Lisarda annulosa* Stal, *En. Hem.*, **4**: 83.

1902. *Lisarda annulosa*: Distant, *Fauna Brit. India*,

**2**: 237.

*Material examined*: Bishwas and Bal 2007.

*Distribution*: India: Mizoram, Assam, Bihar, Maharashtra, Meghalaya, West Bengal. Elsewhere: Myanmar, Sri Lanka.

**Subfamily ACANTHASPIDINAE**

10. Genus *Acanthaspis* Amy.& Servo, 1843

**14. *Acanthaspis quinquespinosa*** (Fabr., 1781)

1781. *Reduvius quinquespinosa* Fabr., *Spec. Ins.*, **2**: 382.

1902. *Acanthaspis quinquespinosa* Distant, *Fauna Brit. India*, **1**: 257.

*Material examined*: Biswas and Bal 2007.

*Distribution*: India: Assam, Mizoram, Bihar, Maharashtra, Meghalaya, West Bengal. Elsewhere: Myanmar, Sri Lanka.

**Subfamily ECTRICHODIINAE**

11. Genus *Haematorrhophus* Stal, 1874

**15. *Haematorrhophus nigroviolaceous*** (Reut. 1881)

1881. *Physorhynchus nigroviolaceous* Reuter. *Act. Soc. Sc. Fenn.*, **12**: 302.

1977. *Haematorrhophus nigroviolaceous* Cook, *Oriental Insects*, **11**(1): 79.

*Material examined*: Biswas and Bal 2007.

*Distribution*: India: Mizoram, Karnataka, and Tamil Nadu.

Superfamily PENTATOMOIDEA Leach, 1815

Family PENTATOMIDAE Leach, 1815

**Subfamily ASOPINAE**

12. Genus *Cazira* (Amy. & Serv, 1843)

**16. *Cazira verrucosa*** (Westwood, 1835)

1835. *Cazira verrucosa* Westwood, *Zool. Journ.* v, p. 445, pl. xxii, f. 7

1851. *Cazira verrucosa* Dallas, *List Hem.* i, p. 82

*Material examined*: 2 exs, Lengteng WLS, Dist. Champhai, 7.v.2019, Coll. Sonam Jahan, 1 exs, Teirei river, Dist. Mamit, 18.xi.2019, Coll. Sonam Jahan.

*Distribution*: Assam, Meghalaya, Nagaland Sikkim, and West Bengal Elsewhere: Myanmar.

**RESULTS AND DISCUSSIONS**

The present study reports the presence of 16 species of predatory bugs belonging to 12 Genera.



All the species are new to Mizoram. *Cazira verrucosa* (Westwood, 1835), *Sycanus collaris* (Fabricius, 1785), *Sycanus croceovittatus* Dohrn, 1859, *Tribelocephala indica* (Walker, 1873), *Polididus armatissimus* Stål, 1859, *Rhynocoris costalis* (Stål, 1866), *Rhynocoris fuscipes* (Fabricius, 1787), *Rhynocoris marginatus* (Fabricius, 1794), *Rhynocoris squalus* (Distant, 1904), *Oncocephalus impudicus* Reuter, 1882, *Scadra annulipes* Reuter, 1881, *Euagoras plagiatius* (Burmiester, 1834), and *Valentia apetala* (Vuillefroy, 1864) are new to Mizoram. The study will help in point of view of biological control and organic farming.

### ACKNOWLEDGEMENTS

The authors are grateful to the Director, Zoological Survey of India, Kolkata, for providing the necessary facilities for the study. Thanks to Officer-in-charge Hemiptera Section, Zoological Survey of India, Kolkata. The support of Field Director and Forests staffs of Dampha Tiger Reserve, for issuing the research permit and for a accommodation is greatly appreciated. The study was conducted through the funding support of MoEFCC through NMHS scheme with project ID: NMHS/2017-18/MG44/28. Thanks are also due to the Mountains of Central Asia Digital Dataset (MCADD) and Biodiversity Heritage Library (BHL) for availing the valuable literature, authors are also thankful to Principal, Government science college Jabalpur Madhya Pradesh.

### REFERENCES

- Bal, A. and Biswas, B., 2013. Handbook on Major Hemipteran Predators of India: 1-44, (Published by the Director, Zool Surv. India, Kolkata).
- Biswas, B. and Bal, A. Insecta: Hemiptera: Heteroptera: Reduviidae. 271-276 in in Fauna of Mizoram, State fauna Series, 14:1-691 (Published by the Director, Zool. Survey of India, Kolkata)
- Chakraborty, S. P. and Bal, A. 2007. Insecta: Hemiptera: Heteroptera: Pentatomoidea. 261.269. in Fauna of Mizoram, State fauna Series, 14:1-691 (Published by the Director, Zool. Survey of India, Kolkata)
- Chandra, K. 2018. Insect fauna of States and Union territories in India. *ENVIS Bulletin: Arthropods and their Conservation in India (Insects & Spiders)* 14(1): 189-218.
- Chandra, K., Hassan, M.E., Kushwaha, S. and Mukherjee, P. 2020. Insecta : Hemiptera. In: Faunal Diversity of Biogeographic Zones: North East India : 149-174. (Published by the Director, Zool. Surv. India, Kolkata)
- Chandra, K., Kushwaha, S. and Jehamalar, E.E., 2020. True Bugs of Central India, (Chhattisgarh and Madhya Pradesh). *Rec. zool. Surv. India, Occ. Paper No.*, **403** : 1-136, (Published by the Director, Zool. Surv. India, Kolkata)
- Distant W. L. 1906. *The fauna of British India including Ceylon and Burma*, Rhynchota III: 1-502.
- Distant W. L., 1902. *The fauna of British India including Ceylon and Burma* Rhynchota I: 36-421.
- Distant W. L., 1904. *The fauna of British India including Ceylon and Burma* Rhynchota I: 26-416.
- Mukherjee, P., Chandra, K., and Hassan, M.E. 2020. Catlog of Reduviidae (Hemiptera) of India. *Rec. zool. Surv. India, Occ. Paper No.*, **401** : 1-240, (Published by the Director, Zool. Surv. India, Kolkata)
- Suman, K., Jahan, S., Kushwaha, S., Sharma, L.K., and Saha, P. C., 2022. First records of Genus *Hecalus* Stål, 1864 (Hemiptera: Cicadellidae) from Dampa tiger reserve, Mizoram with an updated checklist from India. *Rec. zool. Surv. India: Vol. 121(3)*:11–19.

# ENTREPRENEURIAL BEHAVIOR OF RURAL WOMEN IN JAUNPUR DISTRICT (UTTAR PRADESH)

**Ilma Siddique, N.K. Mishra and Pradeep Kumar Yadav**

Department of Agricultural Extension

T. D. P.G. College, Jaunpur, (U.P.), India

Corresponding email: [ilmasiddique031@gmail.com](mailto:ilmasiddique031@gmail.com)

Received : 19.01.2023

**ABSTRACT:**

Accepted : 12.02.2023

**This study aims to explore the entrepreneurial behavior of rural women in Sirkoni block of Jaunpur district. The purpose of this study is to identify the factors influencing rural women to become entrepreneurs and to explore the challenges they face while starting and managing their businesses. The study found that a majority (70.8%) of the respondents were middle-aged and around 25% were educated. The study also revealed that the majority of the respondents (27.5%) are involved in agriculture and dairy enterprises. In terms of family structure, 55% of the respondents belonged to nuclear families. Additionally, 92.5% of the respondents possessed a medium level of mass media exposure. The study also found that a majority (55%) of the respondents had a low level of annual income. However, 40% of the respondents possessed a medium level of entrepreneurial behavior. These findings provide valuable insights into the entrepreneurial behavior of rural women and highlight the need for interventions to enhance their skills and knowledge.**

**Keywords :** *Factors influencing, entrepreneurial behavior, enhance, dairy enterprises*

## 1. INTRODUCTION

Women hold an idiosyncratic position in development of any society. Development of any society can't take place if women do not contribute their share. According to UN commission " Women constitute half of the world's population, accomplish about two third of its work hours and receive one tenth of the world's income". Women not only contribute the major portion of population but also richly contribute in the economy. Women entrepreneurship in economic development of any nation has been recognized for its significant contribution. The women folk can easily be

considered as backbone of society of a nation and counter part of men in every sphere. Women are now changing the traditional views for them, now they do not limit themselves to the category of beneficiaries rather than they are giving tough competition to their male counterpart. Women are now actively participating in the process of development of society. Her skill, knowledge, ability and capacity to work are quite often the only source of survival in poor household. Thus, they play an important role in eliminating poverty from their families. The empowerment and autonomy of women and the improvement of women's social,

economic, and political status is essential for achievement of transparent, accountable government, administration and sustainable development in all spheres.

Every woman by nature possessed the traits of an entrepreneur by managing their household activities. But, they were unaware of their hidden potential. At the time of independence, because of globalization and privatization, they were forced to turn to be an entrepreneur. They realized their hidden potential and stepped their feet in each and every sector. Now a days, women entrepreneurs became successful and made a remarkable impact on their sector. 'Woman' is the key for success of any human being because of their excellent qualities such as hard-working nature, patience, cordial affiliation, convincing capacity, communication etc., in handling multifaceted activities. On the other hand, women in rural areas are comparatively less educated, economically poor, confined to limited geographical boundaries and live under rigid structural constraints. Entrepreneurship is one of the prospective options to uplift rural women by generating self-employment opportunities.

## MATERIALS AND METHODS

The study on the entrepreneurial behavior of rural women in Sirkoni block of Jaunpur district is conducted using a quantitative research design. A survey questionnaire was used to collect data from 120 respondents who are rural women entrepreneurs. The questionnaire developed was based on the literature review and previous studies on entrepreneurial behavior. The survey questionnaire was pre-tested on a small group of respondents to ensure its validity and reliability.

In addition to the survey, the study also used qualitative methods to explore the challenges faced by rural women entrepreneurs. Focus group discussions and in-depth interviews will be conducted with a small sample of rural women entrepreneurs to gain a deeper understanding of their experiences and perspectives. The qualitative data was analyzed thematically. The sampling technique

used in this study is convenience sampling. The respondents were selected on the basis of their availability and willingness to participate in the study. The study used a structured questionnaire with closed-ended questions to collect quantitative data. The questionnaire was administered through face-to-face interviews. The data collected was analyzed by using descriptive statistics such as frequencies, percentages, means, and standard deviations.

Nandapurkar (1982) measured the entrepreneurial behaviour of Farmers by developing a scale with ten components of entrepreneurial traits. Raghavacharyalu (1983) developed a scale using seven components of entrepreneurial Traits. Similar scale was done by Porchezian and Vijayaraghavan (1991) with some modifications. Similar scale was done with suitable modifications used in this research.

S.N.	Category	Score
1.	Low level entrepreneurial behaviour	Below (mean-SD)
2.	Medium level entrepreneurial behaviour	(Mean-SD to Mean +SD)
3.	High level entrepreneurial behaviour	Above (Mean + SD)

## RESULTS AND DISCUSSION

### Distribution of respondents according to their age.

It is clear from the Table 1 that majority i.e.70.8 per cent of respondents were middle aged followed by old i.e.15.8 per cent and young age i.e.13.3 per cent, respectively.

**Table - 1 : Distribution of respondents according to their age**

S.N.	Category	Frequency	Percentage
1.	young age	16	13.3
2.	middle age	85	70.8
3.	old age	19	15.8
	<b>Total</b>	<b>120</b>	<b>100.0</b>

Majority of middle aged people may be

because they are more enthusiastic to work more energetic and hardworking followed by old aged people because they have the sense of responsibility followed by young aged people.

**Distribution of respondents according to their level of education:**

It is evident from the Table 2 that majority i.e. 25.00 per cent of respondents were educated up to high school, 21.7 per cent were educated upto intermediate, 18.3 per cent respondents had middle school education, 15.0 per cent respondents posses primary school education, 12.5 per cent respondents were illiterate and 7.5 per cent of respondents possess education above intermediate.

**Table - 2 : Distribution of respondents according to their level of education**

S.N.	Category	Frequency	Percentage
1.	Illiterate	15	12.5
2.	Primary	18	15.0
3.	middle school	22	18.3
4.	high school	30	25.0
5.	Intermediate	26	21.7
6.	above intermediate	9	7.5
	<b>Total</b>	<b>120</b>	<b>100.0</b>

Various government and non-government agencies have played a major role in developing an educated society. Efforts taken from so many years now have sounding effect now. This trend can be attributed to the high literacy status and reduced dropout rates of the state. It is considered mandatory for every child; either boy or girl, in every household to get educated. This high level of education makes the entrepreneurs to be aware of new opportunities as well as running of the enterprise smoothly.

**Distribution of respondents according to their enterprise:**

It is clear from Table 3 that Majority of the respondents i.e. 7.5 per cent were involved in enterprise of agriculture along with dairy, 16.7 per cent of respondents were involved in agriculture along with dairy and poultry, 13.3 per cent of

respondents were involved in enterprise of dairy along with poultry, 10 per cent of respondents were involved in enterprise of agriculture, 9.2 per cent of respondents were involved in enterprise of dairy along with tailor, 5.8 per cent of respondents were involved in enterprise of poultry along with stiching, 2.5 per cent respondents were involved in enterprise of bamboo handicrafts and 0.8 per cent of respondents were involved in enterprise of tailor along with agriculture and bamboo handicrafts along with agriculture and dairy.

**Table - 3 : Distribution of respondents according to their enterprise**

S.N.	Category	Frequency	Percentage
1.	Agriculture	12	10.0
2.	agriculture+ dairy	33	27.5
3.	Dairy	11	9.2
4.	Tailor	3	2.5
5.	tailor+ agriculture	1	0.8
6.	bamboo handicrafts	3	2.5
7.	bamboo handicrafts+agriculture	1	0.8
8.	tailor+dairy	11	9.2
9.	dairy+	7	5.8
10.	Poultry + tailor		
11.	dairy +poultry	16	13.3
12.	dairy+poultry + agriculture	20	16.7
13.	Other	2	1.7
	<b>Total</b>	<b>120</b>	<b>100.00</b>

Most of the respondents were involved in multiple enterprises, one of the major causes of this is increasing inflation and necessity and responsibility to feed family. Elimination of poverty is the main aim of rural women which make them stepping forth towards entrepreneurship. The results are in line with the findings of Tekale (2013).

**Distribution of respondents according to their family type:**

It is clear from table 4 that majority of the respondents i.e. 55 per cent belonged to nuclear family and rest i.e. 45 per cent belonged to joint family.

**Table - 4 : Distribution of respondents according to their family type**

S.N.	Category	Frequency	Percentage
1.	Nuclear	66	55.0
2.	Joint family	54	45.0
	<b>Total</b>	<b>120</b>	<b>100.0</b>

Nowadays, joint family is assumed to be an obstacle in way of economic and industrial development because there is less independence to think beyond the four walls of house. The ever increasing needs, ambition and self-dependence of individuals give rise to nuclear families in the society.

#### **Distribution of respondents according to their mass media exposure**

It is clear from table 5 that majority of the respondents i.e. 92.5 per cent of respondents possess medium level of mass media exposure followed by low level i.e. 5.8 per cent and high level i.e. 1.7 per cent of mass media exposure.

**Table - 5 : Distribution of respondents according to their mass media exposure:**

S.N.	Category	Frequency	Percentage
1.	Low	7	5.8
2.	Medium	111	92.5
3.	High	2	1.7
	<b>Total</b>	<b>120</b>	<b>100.0</b>

This is because those who are belonging to medium income category possess either a radio or television in their homes. However TV viewing was reported as the major means of exposure. Besides all everybody have mobile phones which serve as fastest means. Findings are in line with **Nagesh (2006)**.

#### **Distribution of respondents according to their annual income:**

It is clear from table 6 that majority of the respondents i.e. 55 per cent possess low level of annual income followed by medium level i.e. 37.5 per cent and high level 7.5 per cent of annual income.

**Table - 6 : Distribution of respondents according to their annual income**

S.N.	Category	Frequency	Percentage
1.	Low	66	55.0
2.	medium	45	37.5
3.	High	9	7.5
	<b>Total</b>	<b>120</b>	<b>100.0</b>

One of the main reasons behind their low level of income is small land holdings and lack of inputs which make enterprise suffer. Findings are in line with Malliga (2008).

#### **Distribution of respondents according to their level of entrepreneurial behaviour:**

It is clear from table 7 that majority of the respondents i.e. 40 per cent possess medium level of entrepreneurial behavior followed by high i.e. 31.7 per cent and Low level i.e. 28.3 per cent of entrepreneurial behavior.

**Table - 7 : Distribution of respondents according to their level of entrepreneurial behaviour**

S.N.	Category	Frequency	Percentage
1.	Low entrepreneurial behaviour	34	28.3
2.	Medium Entrepreneurial behaviour	48	40.0
3.	High entrepreneurial behaviour	38	31.7
	<b>Total</b>	<b>120</b>	<b>100.0</b>

Most of the women belong to medium to high experience level, medium to high mass media exposure, medium to high extension participation which leads to medium to high level of entrepreneurial behavior. Findings are in line with **Chidananda (2008)**.



**CONCLUSION**

In conclusion, the study on entrepreneurial behaviour of rural women in Sirkoni block of Jaunpur district revealed some interesting findings. The majority of the respondents were middle-aged and educated. It was found that the majority of the respondents were involved in agricultural enterprises along with dairy, and belonged to nuclear families. It was also observed that a significant number of respondents had a medium level of mass media exposure and possessed a low level of annual income. However, it was encouraging to note that a majority of the respondents possessed a medium level of entrepreneurial behaviour, which is a positive sign for their future prospects. Overall, the study provides valuable insights into the entrepreneurial behaviour of rural women and can be used to design policies and programs that can further promote and support their entrepreneurial endeavours.

**REFERENCES**

1. Chidananda, M. (2008). A study on entrepreneurial behavior of dry land farmers in Karnataka state. *M.Sc. (Ag.) Thesis*, submitted to Acharya N.G. Ranga Agricultural University, Hyderabad.
2. Malliga, J.(2008). Effectiveness of Compact Disc (CD) lesson on clean milk production techniques among milkmen. Unpublished M.Sc. thesis, Tamil Nadu Veterinary and Animal Sciences University, Chennai
3. Nagesh.(2006). A Study on entrepreneurial behaviour of Pomegranate growers in Bagalkot district of Karnataka. *M.Sc. (Ag) Thesis*, University of Agricultural Sciences, Dharwad.
4. Tekale, V.S.; Bhalekar, D.N. and Shaikh, J.I.(2013). Entrepreneurial behaviour of dairy farmers. *International Journal of Extension Education*,9: 32-36

# RURAL DEVELOPMENT THROUGH ENTREPRENEURSHIP

## DEVELOPMENT: A ROADMAP TO HUMAN RESOURCES DEVELOPMENT

**Shashi Singh<sup>1</sup> and Kamlesh Singh<sup>2</sup>**

<sup>1</sup>Sunbeam College for Women, Varanasi, (U.P.), India

<sup>2</sup>K.A.P.G. College, Prayagraj, (U.P.), India

Corresponding Email: ms.shashisingh@gmail.com

Received : 10.09.2022

**ABSTRACT**

Accepted : 12.10.2022

Rural areas, which are field for primary production, supply food and raw materials to urban areas and are main source of human resources for industrial areas and are maintaining rural values like clean environment, natural beauty and cultural traditions are plunged in problems like poverty and backwardness and are under threat of drainage of human resource through migration. These rural areas could be developed by their human resource development by imparting them skill and knowledge through building their entrepreneurship capacity so that they may manage their farms could market their product more properly and mould their product more price fetching through value addition and they could establish their own firms and enterprises for running rural trade very better. In this their income would increase and living standard will be improved which is also a requirement for human resource development.

**Keywords :** Rural development, entrepreneurship, human resource, human capital

## INTRODUCTION

Rural areas have traditionally been a field for primary production. Additionally, they have not only supplied industrial areas with food and raw materials, but also used to be the main source of human resources and original capital accumulation, which provided the basis for the economic and demographic growth of the center. At the same time, there are a number of values, which are generally considered to be positive and have been sustained better in, rural, than in urban areas these rural values are clean environment, natural beauty, cultural traditions. These are natural parts of rural life and nobody thought about them as important resources for economic development. But these rural areas are

suffering from many problems as the world has been experiencing worst food crisis and hunger in rural areas is nothing new. Rising food prices have developed into a global crisis. Indeed the 800 million people estimated to be living in hunger in the world; the vast majority is in rural areas. It is indeed a cruel irony that those workers and small farmers who feed the world often have the least resources to feed themselves and their families.

To examine entrepreneurship and human resource development as a rural development strategy, this paper explores the links between entrepreneurship and rural human resource development. Development theories of economic growth have large lyigno red the existence of

entrepreneurship, but pressures resulting from global competition and corporate restructuring have prompted development scholars and professional alike to focus more attention on entrepreneurship as a n area of policy and practice.

Many rural areas - lacking a sufficient economic basis - continue losing theirpopulation and are in danger of becoming deserted or losing their original character [rural values] completely. Nemes (2005) further added that with the longerosion of human resources in many rural areas, social networks and kinship relations disappeared or were weakened. Rural areas are also likely to lose most of their human resources and social networks, which is a serious obstacle for rural development today. Therefore, it is necessary to seek some remedy of problems of rural areas. Many researchers have given their solutions. One among the mis rural entrepreneurship development, as Ahmad et.al. (2011) concluded that rural entrepreneurship is acknowledged as an important component that contributes to the economic development of a country. McElwee (2005) has also explained this concept, asserting that farmers, agricultural business, researchers and governments have recognized the need for a more entrepreneurial culture in the farming business. The development of entrepreneurial skills of farmers is a significant issue, which needs to bead dressed by all stakeholders in the agricultural socio-economic network (i.e. farmers' associations, research and advisory organizations, market and chain parties, governmental and social agencies).

This paper is dedicated to expand understanding of entrepreneurship and its conceptual underpinnings as well as its potential as a rural human resource development strategy for economically disadvantaged and undeveloped rural areas.

### Rural Entrepreneurship

It should be comprehensive, flexible, culturally sensitive and integrated, and should require providers to collaborate rather than operate

independently or in isolation. Ahmad et.al. (2011) expressed this concept (referring Wortman, 1990 and Petrin, 1994) that rural entrepreneurship is one of the foundations of rural economic development. Rural entrepreneurship generally can be defined as creation of a new organization that introduces a new product, serves or creates a new market, or utilizes a new technology in a rural environment. Entrepreneurship in rural areas include widening the base of a farm business to include all the non-agricultural uses that available resources can be put to or through any major changes in land use or level of production other than those related solely to agri culture.

Rural areas are space where human settlement and infrastructure occupy only a small share of the landscape, where natural environment is dominated by 10000 persons, where the pastures, forests, mountains and deserts, settlements are of low density, about and is available at a relatively low cost so most people work on farms and where high transaction cost affects the activities, associated with long distance from cities and poor infrastructures.

Rural development has evolved through time as a result of changes in the perceived mechanisms and / or goals of development. Development that benefits rural populations; where development is understood as the sustained improvement of the population standard of living or welfare. Rural development encompasses agriculture, education, infrastructure, health, and capacity building for other than on-farm employment, rural in situations and the needs of vulnerable groups.

### Human Resource Development HRD

Abdullah (2009) reported that Harbis on and Myers offered the first definition of HRD in 1964. This definition is very broad in perspective, as it elaborates HRD in relation to culture, the economy and social and political contexts rather than individuals and organizations. They defined HRD as:“The process of increasing the knowledge, the skills and the capacities of all the people in a society.

In economic terms, it could be described as the accumulation of human capital and its effective investment in the development of an economy. In political terms, HRD prepares people for adult participation in the political process, particularly as citizens in a democracy. From the social and cultural points of view, the development of human resources helps people lead fuller and richer lives, less bound to tradition. In short, the processes of HRD unlock the door to modernization”.

Human resource development (HRD) is a planned approach to learning aimed at change in knowledge, skills understanding, attitudes, values and the behavior of a learner or a group of learners. It is often associated with technical goals aim in gat the provision of at rained work force to promote the knowledge and skills required by a society in order to acquire better prosperity. However, for some educators and development planners, HRD is an end in itself and its goal should be to realize human potential and developing individual self-reliance.

HRD has gained increasing application as a goal, and as a process in the developmental field. As agoalitis equated with the development of human capacity and uplift-ment of human aspirations. In terms of process, HRD involves activities related to education, training, empowerment, awareness raising, skills enhancement, team building, community mobilization and development, organization development, entrepreneurship development, sensitization and conscientization, human resources planning and policies. The emerging concept of HRD puts people at the center of development, because development is not only by people, it is also for people. Thus human development, instead of stressing on the formation of human capital for development, emphasizes on enlarging people's choices in order to improve their quality of life. Kumar (2005) expressed that HRD is not only training for operational skills but also includes behavioral skills a sit ultimately aims to create an enabling culture wherein the capabilities are “acquired, sharpened and used”

## Problems of Rural Areas

Rural areas are suffering from problem of poverty and under development and anxiety of loosing their human resource through migration. As reported by many studies in the following words:

Nemes (2005) asserted that many rural areas- lacking a sufficient economic basis, continue losing their population and are in danger of becoming deserted or losing their original character [rural values] completely. Nemes (2005) also asserted that with the longer osion of human resources in many rural areas, social networks and kinship relations disappeared or were weakened. Nevertheless, remote places, for the same reason, were also likely to lose most of their human resources and social networks, which is a serious obstacle for rural development today.

Anriquez & Stamoulis (2007) also narrated (referring some studies) that most of the world's poor live in rural areas. In 2001 that among the poorest 1.2 billion people in the world, surviving with less than a dollar per day, three out of four lived in rural areas. They constitute the poorest fifth of world population and do not earn enough to cover their food needs. In a recent study World Bank estimate that in 2002, 75% of the developing world poor still live in rural areas. Part of this correlation between rurality and poverty is given by the fact that some countries, indirectly define the poor as rural.

Ghauri (2009) and Arif (n.d) have expressed that the world has been experiencing worst food crisis and hunger in rural areas is nothing new. Rising food prices have developed into a global crisis. Indeed the 800 million people estimated to be living in hunger in the world; the vast majority is in rural areas. It is indeed a cruel irony that those workers and small farmers who feed the world of ten have the least resources to feed themselves and their families. Atta ur Rahman et. al. (2011) narrated that historically rural areas lag far behind their urban counterparts on multiple indicators of social and economic well being. Conscious efforts are employed in developing countries to bring up the

serviced livery in rural are as at par with urban areas. This is not to say that urban areas area ta higher level of development always. However, there is anecdotal evidence on the lag between urban and rural areas. Heilig (2002) explaining '**Human Dimension**' expressed that the basis of all rural development are people. If a rural are a has massive out migration of young people or if a large percentage of the farmers is above the age of 65 (as is the case in Italy, Greece, or Portugal), it will be very difficult to initiate endogenous economic growth. The human dimension also includes the educational level of the population, their cultural identity and their social structure. Human factors are not only relevant in the rural areas: it is to consider the impact of urban life-style change on rural areas, such as changes in leisure activities or food consumption of the urban majority.

According to Arif (n.d) workers (Human resource) in rural areas suffer high rates of poverty, food insecurity, death, injury and illness. They are also often denied basic human rights. Mainly due to the in formal character of agricultural production, but also to other factors such as incomplete markets, asymmetry of information, high transaction costs, and imperfect functioning of complementary markets (especially land and credit).

Therefore, it is necessary to develop rural areas so that they may remain source of water, food, natural resources and recreational centers. Factors, which cause handicap in the development of rural human resource and ultimately rural development, can be eliminated by development to frural entrepreneurship.

**Rural Development is the Solutions of Problems**

Alleviation of rural poverty and hunger is possible by development of rural areas. Nwachukwu & Ezech (2007) have revealed that rural development is a veritable tool, for fighting poverty and achieving economic prosperity, at the grassroots level. The concept of rural development embraced by most countries connotes a process through which rural poverty is all eviated by sustained increases in the

productivity and incomes of low-income workers and househ olds.

Nwachukwu & Ezech (2007) also stated that "Rural Development' simply connotes a sustained improvement in the quality of life of the rural people. It implies consistency in approach in which micro and macro economic, social, political, cultural and technological variables are engineered, combined and implemented as an organic and dynamic whole for the benefit of the people. Anríquez & Stamoulis (2007) asserted that since the 1970's rural development, as a concept has been highly associated with the promotion of standards of living and as a precondition for reducing rural poverty. This pro-poor bias was born from the understanding that, particularly in societies where wealth is extremely concentrated, mean incomes could grow without improving the well being of the most dispossessed. On the other hand, the focus on human capital formation, through the provision of social services in rural areas has been constantly stressed since the 1970's. Originally, this focus stemmed from social equity considerations : it is fair that all of society's members have access to services like education and health.

Atchoarena & Holmes (2004) stated that in the late 1990s, new thinking on rural development stressed concepts and approaches such as community participation, empowerment, and sustainable livelihoods in the broader context of poverty reduction. The development community is currently renewing its efforts towards rural development with fresh insights into the key factors that militate against rural development and poverty reduction.

Kolawole and Torimiro (2005) quoting Chambers (1983) expressed that “Rural Development”, “is a strategy to enable a specific group of people, poor rural women and men, to gain for themselves and their children more of what they want and need. It involves helping the poorest among those who seek a livelihood in the rural are as to demand and control more of the benefits of



development”.

### **Importance of Building Human Capital for Rural Development**

According to Zhemoyda (2007) it is well known that the human potential is a basic strategic resource and one of the main driving forces of the economic growth in any country. Among other things, the specifics of able-bodied population's allocation and migration can significantly affect the sustainable development of regions that certainly differ in patterns of socio-economic development.

Barro & Lee (2000) have also asserted that human capital, particularly that attained through education, has been emphasized as a critical determinant of economic progress. A greater amount of educational attainment indicates more skilled and more productive workers, who in turn increase an economy's output of goods and services. An abundance of well-educated human resources also helps to facilitate the absorption of advanced technology from developed countries.

Moulton (2001) narrated quoting World Bank (2000) that alleviating poverty has become, in recent years, the fundamental argument for policies that redistribute public goods more equitably. The relation of any given growth rate to poverty reduction depends on the investments in people (human resource development). More equitable the investment is, greater is the impact of growth in lowering the incidence of poverty. As put forth by economist T.W. Schultz (1964), education is essential to alleviating poverty, because the creation of human capital's the creation and distribution of new wealth.

As Anríquez & Stamoulis (2007) have expressed that rural development is essentially a part of structural transformation characterized by diversification of the economy away from agriculture.

Therefore it is necessary to decrease total dependency of rural people on agriculture and divert their attention towards new relevant education, skill or techniques. That education, art or skill is

entrepreneurship. So that they may establish their small firms and can market their agriculture product or their village values with or without value addition. What is entrepreneurship and how much it is helpful and can develop the human resource and be successful in rural development is explored in following studies.

### **Entrepreneurship**

Entrepreneurship is the mechanism in which knowledge is commercialized and used to stimulate economic growth. Henderson (2006)

TIP Strategies Inc. (2008) asserted that entrepreneurship is becoming more commonly accepted as an essential tool in the economic development toolbox. Especially in rural areas, communities are recognizing that a “grow your own” strategy has a higher probability of success than recruiting a major employer to the area. In addition, entrepreneurship strategies that foster new business creations are often more cost effective than incentives paid to recruit businesses to a community. Robinson et al (2004) reported referring several studies that small enterprise development is purported to be more sustainable as compared to traditional business attraction approaches that tend to be more costly, considering how much of the local tax base communities are expected to give away over a period of time. Due to the multiplier effects that accompany enhanced small enterprise development, the most apparent contribution of entrepreneurship to increased community welfare is the creation of new jobs and the generation of additional income as new firms start and existing ones grow. A substantial body of evidence suggests that the small business sector has yielded the bulk of new jobs in the United States. Given this record, entrepreneurship as a rural development strategy within low-income communities in the United States has continued to gain credibility. Such credibility has prompted government and donor agencies to expand funding for entrepreneurship development programs and more articles now appear in both the scholarly and popular media

about the success of this 'new approach' on incomes, employment generation, and social empowerment. Interestingly, this development strategy is perhaps the first major economic development paradigm to be applied to low-income areas in both developed and developing economies simultaneously. Robinson et al (2004) also argued that many development scholars and professionals believe supporting small businesses within low-income communities is a plausible development strategy to combat poverty. Some suggest that entrepreneurship is critical to the maintenance of a healthy economy and if economic development is to be effective, new businesses in low-income areas must be started through local initiatives. Entrepreneurship is "the process of uncovering or developing an opportunity to create value through innovation and seizing that opportunity without regard to either resources (human and capital) or the location of the entrepreneur-in a new or existing company.

Kolawole & Torimiro (2005) are quoting Goldmark & Rosengard, (1981) and Jibowo, (1992) expressed that entrepreneurship development program has various components such as financial assistance, training, technology, marketing, general research services, institutional brokering and raw materials and other inputs/services supply". Government and community people must, therefore, work hand in hand to realize the goal of sustainable rural entrepreneurship development and employment promotion (PREDEP) for grass roots transformation. What then are the factors, which are likely to encourage participatory rural entrepreneurship development and employment promotion (PREDEP)? Agriculture and small-scale industries are primary employers of labor in rural communities. Examples of small scale industries which are prominent in rural areas are "blacksmithing, gold-smithing, watch repairing, bicycle repairing, basket weaving, barbing, palm wine tapping, cloth weaving, dyeing, food selling, carpentry, brick-laying, pot-making, leather works and drumming". Even though found in urban areas,

these industries are more prominent in the rural areas. It has, therefore, been acknowledged that the rural setting is an arena of many industries, which could be developed to contribute significantly to the national economy, just as "rural people are more frequently self-employed or family workers than urban people".

McElwee (2005) asserted that in the last few years, farmers, agricultural business, researchers and governments have recognized the need for a more entrepreneurial culture in the farming business. The development of entrepreneurial skills of farmers is a significant issue, which needs to be addressed by all stake holders in the agricultural socio-economic network (i.e. farmers' associations, research and advisory organizations, market and chain parties, governmental and social agencies). Henderson (2006) concluded that entrepreneurship is increasingly being recognized as a primary engine of economic growth. By combining existing resources with innovative ideas, entrepreneurs add value through the commercialization of new products, the creation of new jobs, and the building of new firms. The Global Entrepreneurship Monitor indicates that nations with higher levels of entrepreneurial activity enjoy strong economic growth. In short, entrepreneurs are the link between new ideas and economic growth.

Sidhu and Kaur (2006) asserted that entrepreneurship is the only solution to the growing employment among rural youth. It helps to generate employment for number of people within their own social system. This is more beneficial for women in rural areas as it enables them to add to the family income while taking care of their farm, home and livestock centered tasks. Rural women possess abundant resources to take up an enterprise. She has the benefit of easy availability of land and livestock base raw material and other resources. Hence she can effectively undertake both production and processing oriented enterprises. But to be a successful entrepreneur, women should possess certain fundamental qualities beside the support of

the family and government organizations. Entrepreneurial development among rural women helps to enhance their person capabilities but also decision-making status in the family and society as a whole.

Sathiabama (2010) is of the opinion that development of the society is directly related with the Income Generation Capacity of its members with agriculture, and the key income generation activity the entrepreneurship on farm and home can directly affect the income of a major chunk of our population. The growth of modernization processes such as industrialization, technical change; urbanization and migration further encourage it. Sidhu and Kaur (2006) have already expressed similar thoughts about entrepreneurship that development of the society is directly related with the income generation capacity of its members. With agriculture as the key income generation activity the entrepreneurship based on farm and home can directly affect the income of a major chunk of our population. The growth of modernization processes such as industrialization, technical change; urbanization and migration further encourage it. Entrepreneurship on small scale is the only solution to the problems of unemployment and proper utilization of both human and nonhuman resources and improving the living conditions of the poor masses.

Sathiabama (2010) concluded (quoting Prabha Sigh, 2009) that entrepreneurship on small scale is the only solution to the problems of unemployment and proper utilization of both human and non-human resources and improving the living condition of the poor masses.

Lashgarara et al (2011) argued that Entrepreneurship reduces unemployment, increases the people's productivity, resource, and the community's income. Entrepreneurship requires a particular culture, which is very difficult to grow and requires a long-term effort. Ability of understanding the changes and discovering the opportunities, participation and teamwork, creativity, spirit of

independence and responsibility, risk, and jeopardizing are all the constructive elements of this culture, which are not achieved by short-term and task force plans. Best strategy for developing entrepreneurial culture in rural are as is improving entrepreneurial education through various promotional and training programs.

Ahmadetal (2011) revealed that rural entrepreneurship is one of the foundations of rural economic development. Rural entrepreneurship generally can be defined as creation of a new organization that introduces a new product, serves or creates a new market, or utilizes a new technology in a rural environment. Entrepreneurship in rural areas include widening the base of a farm business to include all the non-agricultural uses that available resources can be put to or through any major changes in land use or level of production other than those related solely to agriculture.

## CONCLUSION

From the study of above arguments extracted from very rich literature it can be concluded that the rural areas, which are life vein of urban and industrial population are badly suffering from poverty and low standard of life. Almost 75 percent of world poor are residing in rural areas and rurality is another name of poverty. They are to be developed. For development their income is to be raised. Income can be raised if they fetch better prices of their products, which are mainly agriculture items. 'Rural people's income can be raised if they can add more value in their products, if they can more properly market their products. This all is possible by giving them such knowledge and skill of entrepreneurship. By the knowledge of rural entrepreneurship rural people can prove themselves better grower, better trader and better marketer due to creation of a new organizations that introduce new products, serve or create a new market, or utilize new technology in rural environment, leading to enhancing human potential and developing individuals' self-reliance.

## REFERENCES

1. Abdullah, Haslinda (2009) "Definitions of H'D:Key Concepts from a National and International Context, European Journal of Social Sciences –Volume10, Number 4(2009)
2. Adil, Sultan Ali; Abdul Ghafoor and Abdul Majeed Nadeem (2005) "Investigations in to the Human Resource Development Status and its Impact on Farm Output in Rural Areas of District Jhang, Pakistan, Journal of Agriculture & Social Sciences,1813–2235/2005/01–1–10–13, <http://www.ijabjass.org>
3. Adinyira Emmanuel, Oteng-Seifah Samuel, Adjei-Kumi Theophilus (2007) "Sustainability assessment of rural development: A review of methodologies", "Sustainable rural development: What is the role of the agri-food sector?" Martin Petrick, and Gertrud Buchenrieder (eds., 2007) Studies on the Agricultural and Food Sector in Central and Eastern Europe, Vol. 39, Halle (Saale), IAMO, pp. 18-27.
4. Ahmad, Abd Razak Wan; Fauziah Wan; Yusoff, Haris Md Noor and Ahmad Kaseri 'amin (2011) " Preliminary Study of 'rural Entrepreneurship Development Programin Malaysia", International Conference On Management (Icm2011) Proceeding, PP.537-546
5. Anríquez, Gustavo and Stamoulis, Kostas (2007) "Rural Development and Poverty 'education : Is Agriculture Stillthe Key?", ESA Working Paper No.07-02, June 2007 Agricultural Development Economics Division, The Food and Agriculture Organization of the United Nations, [www.fao.org/es/esa](http://www.fao.org/es/esa)
6. Atchoarena, Davidand Holmes, Keith (2004) "The Role of Agricultural Colleges and Universities in 'ural Development and Life long Learning in Asia "Paper presented at the 15<sup>th</sup> Conference of the Asian Association of Agricultural Colleges and Universities, held in Nagoya, Japanon 27–30 September 2004
7. Barro, Robert J. and Lee, Jong-Wha (2000) "International Data on Educational Attainment : Updates and Implications" CID Working Paper No.42, April 2000 Center for International Development at Harvard University.
8. Edgcomb Elaine (2008) "Entrepreneurship Development Systems: The W. K. Kellogg Foundation Demonstration, Conference Presentation by Elaine Edgcomb St Louis, Missouri, November 6, 2008.
9. Ghauri Farha Naz Ghauri (2009) "World Food Crisis : Causes, Trends and Strategy", Journal of Management and Social Sciences, Vol. 5, No. 1, (Spring 2009) 51-56
10. Heilig, Gerhard K.(2002) "European' Rural Development (E'D)-Project Description 4<sup>th</sup> Revision, April 18, 2002, International Institute for Applied Systems Analysis Schlossplatz 1,2361 Laxenburg, Austria.
11. Henderson1, Jason (2006) "Understanding 'ural Entrepreneurs at the County Level : Data Challenges", Federal Reserve Bank of Kansas City–Omaha Branch-U.S. Bureau of the Census, Working Paper-October 2006
12. Kolawole O.D. and Torimiro, D.O (2005) "Participatory 'ural Entrepreneurship Development for Grass roots Transformation : A Factor Analysis", Journal of Humanity and Ecology,Vol.18 Issue3,pp.193-198,©Kamla-Raj2005.
13. Lashgarara, Farhad; Roshani, Nsim and Najafabadi, Maryam Omid (2011) "Influencing factors on entrepreneurial skills of rural women in I lam City, Iran", African Journal of Business Management Vol. 5(14), pp. 5536-5540, 18 July, 2011 <http://www.academicjournals.org/AJBM>

14. Nwachukwu, Ifeanyi N. and Ezeh, ChimaI. (2007) "Impact of Selected' Rural Development Programmes on Poverty Alleviation in Ikwuano LGA, Abia State, Nigeria MPRA Paper No.13720, African Journal of Food, Agriculture, Nutrition and Development, Volume 7 No. 5, 2007
15. Nemes, Gusztáv (2005) "Integrated 'ural Development: The Concept and its Operation" KTI / IE Discussion Papers, MT. DP, 2005/6, Published by the Institute of Economics Hungarian Academy of Sciences, Budapest, 2005.
16. Robin son Kenneth L; Wylin Dassie and 'alphD.Christy (2004) "Entrepreneurship and Small Business Development as a 'ural Development Strategy", Southern'ural Sociology, Vol. 20, No. 2, 2004, pp.1-23 ,Copyright O 2004 by the Southern Rural Sociological Association.
17. Sidhu, Kiran jot and Kaur, Sukhjeet (2006) "Development of Entrepreneurship Among 'Rural Women", Journal of Social Sciences, Vol. 13 issue 2, pp.147-149.
18. Kamla- Raj 2006 "The National Concept of H 'D" Assistance for Strengthening Human 'Resources Development Capabilities in Asia and the Pacific Retrieved September 23, 2008 from <http://education.nic.in/cd50years/z/8T/F3/8TF30101.htm>
19. Oleksandr V. (2007) "Regional specificity of rural labour allocation and migration in Ukraine", Sustainable rural development: What is the role of the agri-food sector?
20. Martin Petrick, and Gertrud Buchenrieder (eds., 2007) Studies on the Agricultural and Food Sector in Central and Eastern Europe, Vol. 39, Halle (Saale), IAMO, pp.67-79.



# A STUDY ON ADOPTION BEHAVIOUR OF FARMERS ABOUT MAIZE PRODUCTION TECHNOLOGY IN MUFTIGANJ BLOCK OF JAUNPUR DISTRICT

**Mamata Jayasawal and N. K. Mishra**

Department of Agricultural Extension

T. D. P.G. College, Jaunpur, (U.P.), India

Corresponding email: jaiwalji5554@gmail.com

Received : 11.01.2023

**ABSTRACT**

Accepted : 15.02.2023

This study aimed to assess the adoption behavior of farmers regarding maize production technology in the Muftiganj block of Jaunpur district. The research data collected from a sample of respondents and analyzed various demographic factors along with their knowledge level and adoption behavior. The study revealed that the majority of respondents (48.3%) fell into the middle age group, indicating that this age bracket was more prominent in the sample. Furthermore, a significant proportion of respondents (29.1%) had completed their education up to the high school level. In terms of caste representation, the majority of respondents (40.8%) belonged to the Other Backward Class (OBC) category. Regarding family structure, the highest percentage (70.00%) of respondents belonged to joint families. In terms of knowledge levels related to improved maize production technology, the study found that 52.5% of respondents had a medium level of knowledge, while 25.00% had a low level and 22.5% had a high level. Regarding the adoption behavior of improved maize production technologies, the study categorized respondents based on their extent of adoption. The results indicated that the majority of farmers (44.18%) fell into the medium adoption behavior category. These findings provide valuable insights into the adoption patterns of farmers in the Muftiganj block of Jaunpur district regarding maize production technology. The study highlights the need for targeted interventions to increase knowledge and encourage adoption of improved practices among farmers to enhance maize production in the region.

**Keywords :** Demographic factors, production technology, adoption behavior

## INTRODUCTION

Maize (*Zea Mays*) is the 3<sup>rd</sup> most important cereal crop of the world. It is a principal staple food in many countries particularly in the tropics and subtropics. It is widely cultivated throughout the world. Maize is regarded as the “Queen of Cereals”. Being a C4 plant, it utilizes solar radiation more

efficiently even at higher radiation intensity. In general, it has greater worldwide significance as human food, animal feed and a source of large number of industrial products. The maize is cultivated throughout the year in all states of the country for various purposes including grain, fodder, green cobs, sweet corn, baby corn, popcorn

in peri-urban area. The predominant maize growing states that contributes more than 80 per cent of the total maize production are Andhra Pradesh 20.9 per cent, Karnataka 16.5 per cent, Bihar 8.9 per cent, Uttar Pradesh 6.1 per cent, Madhya Pradesh 5.7 per cent, Himanchal Pradesh 4.4 per cent. Apart from these states maize is also grown in Jammu and Kashmir and North-Eastern states. Hence, the maize has emerged as important crop in the non-traditional regions i.e. peninsular India as the state like Andhra Pradesh which ranks 5th in area (0.79 m ha) has recorded the highest production (4.14 mt) and productivity (5.26t/h<sup>3</sup>a) in the country, although the productivity in some of the districts of Andhra Pradesh is more or equal to the USA. (*Source-<https://farmer.gov.in>*)

In 2021, maize production for World was 1,210 million thousand tonnes. Maize production of World increased from 308 million thousand tonnes in 1972 to 1,210 million thousand tonnes in 2021 growing at an average annual rate of 3.18 per cent.

MATERIALS AND METHODS

The study was conducted in Muftiganj block of Jaunpur district (Uttar Pradesh) during 2022. This block was purposively selected because large number of villagers of the block growing maize crop. A list of villages of the selected block was prepared and 10 villages were selected with the simple random sampling method for the study. All the maize grower was taken as the population of the study. From this population a sample of total 120 selected through proportionate random sampling technique. Number of respondents were found to be in proportion to the sample size is selected from entire size of grower population of concerned village.

The adoption behavior about maize production technology refers to the extent of adoption of recommended improved farm practices. The questions regarding improved varieties, seed rate, seed treatment, sowing time and method, recommended dose of chemical fertilizer, and plant protection etc. were selected.

The weightage of 3 for complete adoption, 2 for partial adoption and 1 for no adoption of each practice was assigned. The respondents were classified into low, medium and high on the basis of mean  $\pm$  S.D.

S.N.	Categories	Score
1.	Low (Mean - S.D.)	1
2.	Medium (Mean $\pm$ D.)	2
3.	High (Mean+ S.D)	3

RESULTS AND DISCUSSION

Distribution of respondents according to their Age

It was observed from table 1 that the majority of the respondents i.e. 48.3 per cent were belonged to middle age group of 43 to 55 years, 28.33 per cent respondents were of old age group ( above 55 years), 23.4 per cent respondent were under young age group ( below 42 years).

Thus, it may be concluded that the maximum maize growers belong to middle age group (43 to 55 years).

Table - 1 : Distribution of respondents according to their Age

S.N.	Age Categories (years)	Respondents (N = 120)	
		Frequency	Percentage
1	Young (Below 42years)	28	23.4
2	Middle (43 to 55 years)	58	48.3
3	Old (Above 55 years)	34	28.3
	Total	120	100

The result of present study showed that majority of the respondents 48.3 per cent were of middle age group. This might be due to the fact that farmers of this age group are more innovative to adopt new technology than other age group. They easily understand the benefits of improved varieties and recommended practice. So they adopt recommended package earlier. The findings of Kumar (2021) confirm the present finding.

### Distribution of respondents according to their Education

It was observed from table 2 that the highest number of respondents (29.1 per cent) were upto high school education, 24.1 per cent had possessed intermediate, 20.00 per cent respondents were having primary school education , Graduate 12.5 per cent and Post graduate 7.7 per cent, However only 6.6 per cent respondents were Illiterate.

**Table - 2 : Distribution of respondents according to their Education**

S.N.	Categories	Respondents (N = 120)	
		Frequency	Percentage
1	Illiterate	08	6.6
1	Primary	24	20.0
2	High school	35	29.1
3	Intermediates	29	24.1
4	Graduate	15	12.5
5	Postgraduate	09	7.7
	<b>Total</b>	<b>120</b>	<b>100.00</b>

The result of the present study showed that the level of education, majority of the respondents was high school (secondary class) 29.1 per cent. This might be due to adequate education facilities in their village are more conscious about education.

### Distribution of respondents according to their caste

It is seen from table 3 that most of the respondents (40.8 per cent) belonged to OBC category followed by 31.6 per cent farmers who belong to SC/ST category and a considerable number of farmers 27.6 per cent were of general caste. It was concluded that majority of the respondents were belonged to OBC.

**Table - 3 :Distribution of respondents according to their caste**

S.N.	Categories	respondents ( N=120)	
		Frequency	Percentage
1.	General	33	27.6
2.	OBC	49	40.8
3.	SC/ST	38	31.6
	<b>Total</b>	<b>120</b>	<b>100.00</b>

The result of the present study show that Majority of the respondents (40.8 per cent) belonged to OBC caste category due to more population of OBC caste as compared to other caste in the study area.

### Family type

It was observed from table 4 that the majority of the respondents i.e.70.00 per cent belonged to joint family and 30.0 per cent belonged to nuclear family. Thus, it can be stated that the maximum maize grower 70.0 per cent were from joint family.

**Table - 4 : Distribution of respondents on the basis of their Family type:**

S.N.	Category	Respondents (N=120)	
		Frequency	Percentage
1	Joint	84	70
2	Nuclear	36	30
	<b>Total</b>	<b>120</b>	<b>100</b>

Majority of the respondent 70.00 per cent belonged to joint family. The findings of **Sharma and Sharma (2007) and Kumar (2015)** also confirm the present finding.

### Land holding

It was observed from table 5 that maximum numbers of the respondents 50.8 per cent were small farmers followed by middle farmers 35.8 per cent and large farmers 13.4 per cent respectively. Thus, it had been concluded that maximum 50.8 per cent maize growers owned small size of land holding.

**Table - 5 : Distribution of respondents on the basis of their Land holding**

S.N.	Category	Respondents N-120	
		Frequency	Percentage
1.	Small Farmers (<2 acre)	61	50.8
2.	Medium farmers (2-4 acre)	43	35.8
3.	Large Farmers(>4 acre)	16	13.4
	<b>Total</b>	<b>120</b>	<b>100.00</b>

**Distribution of respondents according to their Land holding**

Thus it may be concluded that majority of the respondents had less than One hectare agricultural land. This might be on account of fragmentation of holding due to continued division in joint family.

**Knowledge level**

It was observed from table 6 that out of 120 respondents 52.5 per cent had medium level of knowledge about improved maize production technology followed by 25.00 per cent farmers having Low level of knowledge regarding maize production technology. However, 22.50 per cent respondents had high knowledge level.

**Table - 6 : Distribution of farmers on the basis of Knowledge level about recommended maize cultivation practices (N=120)**

S.N.	Knowledge level	Respondents ( N =120)	
		Frequency	Percentage
1	Low level knowledge	30	25.00
2	Medium level knowledge	63	52.50
3	High level knowledge	27	22.50
Total		120	100.00

A higher percentage of growers (52.50 per cent) obtained medium knowledge of maize production practices and almost the remaining per cent of growers 25.0 per cent where from low level of knowledge, however only 22.5 per cent belonged to high knowledge group. That was due to communication contact and the maize growers were in regular touch with the social network.

**Level of adoption**

The distribution of the respondents according to their extent of adoption (overall) of selected maize production technologies is shown in Table 7 revealed that most of the farmers 44.18 per cent had belonged to medium adoption level category whereas, 29.17 and 27.06 per cent of them in high and low adoption categories of maize production technologies, respectively.

**Table - 7 : Distribution of respondents according to their adoption level**

S.N.	Categories	Respondents ( N=120)	
		Frequency	Percentage
1.	Low (<46 score)	35	29.17
2.	Medium (46-75 score)	53	44.18
3.	High (>75 score)	32	27.06
Total		120	100.00

Majority of respondent's had medium adoption of the recommended package of maize production practices. That might be due to their medium level of knowledge about the recommended package and innovativeness. The respondents were found to be of some traditional in nature to adopt new technology.

**CONCLUSION**

In conclusion, the study on the adoption behavior of farmers regarding maize production technology in the Muftiganj block of Jaunpur district revealed significant findings. The majority of respondents (48.3%) belonged to the middle age group, indicating their active involvement in maize cultivation and technology adoption. Furthermore, a considerable percentage of respondents (29.1%) had completed their education up to the high school level, emphasizing the role of education in technology adoption. The study also highlighted that 40.8% of the respondents belonged to the Other Backward Class (OBC) category, reflecting the socio-economic background of the farmers. Additionally, a significant majority (70.00%) of respondents came from joint family backgrounds, which could influence their decision-making process. In terms of knowledge levels, it was found that 52.5% of respondents possessed a medium level of knowledge about improved maize production technology, with 25.00% having low knowledge and 22.5% having high knowledge. The distribution of respondents based on the extent of adoption revealed that 44.18% of farmers belonged to the medium adoption behavior category. These findings provide valuable insights into the demographic

characteristics and adoption patterns of farmers in the Muftiganj block by highlighting the importance of targeted interventions to enhance knowledge and promote the adoption of improved maize production technologies among farmers in the region.

REFERENCES

1.	Kumari, M.; Srivastava, A. K.; Singh, R. P.; Ratan and Kumar, A. (2009). Relationship of socio-personaland economic variables with gain in knowledge in nutrition training Progromme. <i>Journal of Community Mobilization and Sustainable Development.</i> 4 (II) :53-57.	3.	Kumar, G. D. S. and Popat, M. N. (2011). Knowledge and adoption of aflatoxin management practices in groundnut farming in Junagadh, Gujarat, India. <i>An Open Access Journal published by ICRISAT.</i> 3(1).
2.	Kumar, A. (2000). Adoption and constraints in cotton production technology Haryana. M.Sc. (Ag.) Thesis, CCSHAU, Hissar.	4.	Sharma, K.; Dhaliwal, N.S. and Kumar, A. (2015). Analysis of adoption and constraints perceived by small paddy growers in rice production technologies in Muktsar District of Punjab State, India. <i>Indian Res. J. Ext. Edu.</i> 15 (2): 20-23.
		5.	Singh, B. K.; Singh, D. K.; Yadav, V. P. S. and Singh, L. (2010). Adoption behaviour of commercial potato growers in District Ghaziabad (Uttar Pradesh). <i>Indian Res. J. Ext.Edu.</i> 10 (3):5-9.



# DEVELOPING AN EFFICIENT AND SUSTAINABLE DISPOSAL AND INCINERATION SYSTEM FOR OPTIMAL MENSTRUAL WASTE MANAGEMENT

**Jyoti Verma, Hemlata Pant, Nikita Rawat and Anuradha Yadav**

Department of Zoology,

CMP Degree College, University of Allahabad, Prayagraj-211001

E-mail address: diatombuster@gmail.com

Received : 10.01.2023

**ABSTRACT:**

Accepted : 12.02.2023

Improper disposal of menstrual waste poses environmental pollution, health risks, and social stigmatization worldwide. This abstract proposes a SMART disposal and incineration system to effectively manage menstrual waste. The SMART system combines innovative technologies and waste management strategies to ensure safe and sustainable handling. It integrates waste collection, segregation, treatment, and disposal to minimize environmental impact and promote inclusivity. Intelligent segregation methods separate menstrual waste from other streams, minimizing contamination risks. Specialized incineration technologies dispose of menstrual waste efficiently and safely, with filtration mechanisms preventing harmful emissions. The system emphasizes resourcefulness by exploring waste-to-energy conversion, promoting sustainability and reducing reliance on traditional sources. It addresses stigma and promotes menstrual health education through awareness campaigns and initiatives to drive behavioral change and acceptance. Implementing the SMART system revolutionizes practices, leading to a cleaner environment, improved public health, and reduced stigmatization. By combining technology, sustainability, and community engagement, this system provides a comprehensive solution for menstrual waste management.

*Keywords : Menstruation, sustainable, disposla*

## INTRODUCTION

Menstruation is a natural and vital process in a woman's reproductive cycle, involving the periodic bleeding of the uterine corpus. It occurs every month and typically lasts for 3-5 days, but can sometimes extend up to 7 days. During menstruation, a woman generates waste known as menstrual waste, which includes menstrual absorbents stained with blood and human tissue remnants, Upadhyay Suman et, al., (2012), Tripathi, Janhavi and Pant , Hemlata (2010) and Tripathi Janhavi and Pant Hemlata (2012).

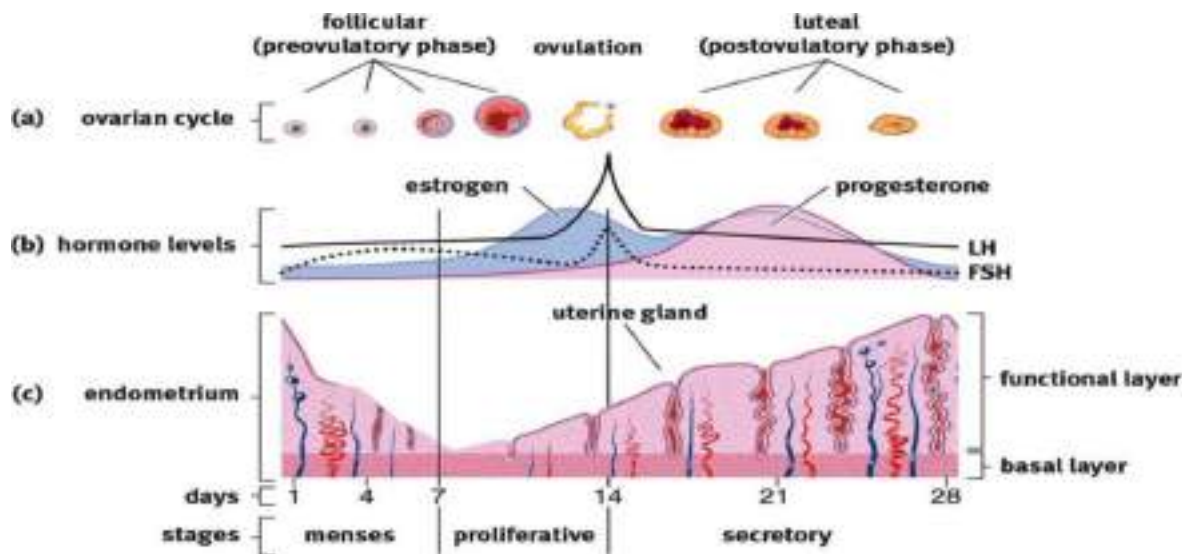
There are various menstrual absorbent products available, such as sanitary napkins, tampons, menstrual cups, reusable pads, menstrual cloth, bamboo fiber pads, and banana fiber pads. Over the course of a woman's lifetime, she experiences approximately 459 monthly periods, resulting in the generation of around 125 to 150 kg of sanitary waste. The onset of menstruation usually begins at the age of 12 in girls, although some girls may experience their first menstruation earlier. In India, a country with an approximate population of 40 crore menstruating women, less than 20% of

them use sanitary pads. The adoption rate of sanitary napkins is 52% in urban areas, but less than 20% in the country as a whole.

Menstrual hygiene is an essential aspect of sanitation for women and girls, which is often neglected in sanitation program implementation in low- and middle-income countries, yet is critical for women's health and dignity as well as environmental safety (Sommer et al. 2013; Tilley et al. 2013). An onsite incineration facility provides a cost-effective

means of reducing pathogen and volume levels associated with menstrual waste disposal, alleviating environmental problems associated with improper disposal. The installation of small-scale incinerators within toilet facilities may provide an effective and discrete way of disposing of menstrual absorbents, as it is aligned with decentralized waste treatment methods. These are appropriate for institutional settings such as schools and workplaces.

**Fig.: Stages of The Menstrual Cycle in The Females**



Inadequate access to menstrual hygiene management has been shown to have negative impacts on women's health, education, and employment opportunities. It can lead to severe health issues such as toxic shock syndrome, reproductive tract infections, and other uterine diseases. Despite being a natural process, menstruation is often considered unclean and dirty in Indian society. Women worldwide employ various strategies to manage their periods, influenced by personal preferences, resource availability, socioeconomic status, cultural beliefs, and education level.

Menstrual beliefs, knowledge, and practices are closely tied to menstrual hygiene

management, and many women face restrictions related to cooking, work activities, bathing, worshiping, and food consumption during their periods. In some areas, there is a taboo against burying bloody menstrual cloth. Instead, clothes should be washed and then buried to prevent contamination, often done secretly or in hidden corners to avoid being seen by others. There have been beliefs that menstrual fluids could be used for black magic, leading to practices like washing the menstrual cloth only at night when others are asleep to avoid potential harm. Women were also believed to be physically attacked by witches. The burial of menstrual waste was thought to prevent witches from locating human blood, thereby protecting

women from infertility and potential harm. These prohibitions are more prevalent in rural areas compared to urban areas.

Disposing of sanitary pads involves various methods, including throwing them in open spaces, burning them in open pits, burying them (whether they are compostable or not), or flushing them in toilets, which can cause clogs and hinder the natural degradation of human waste. The majority of menstrual waste consists of commercially disposable pads (approximately 93%) and homemade cloth pads (around 6-7%). A study revealed that nearly one-third of commercial pad waste had a wet weight of more than 20 grams, indicating a moisture content above 50%. Moist waste and incomplete incinerator processing can result in pollutant emissions.

With regard to menstrual waste, the Indian government has encouraged incineration as part of its Swachh Bharat (Clean India) mission (2018). India has a significant amount of menstrual waste, with an estimated 121 million women disposing of 113,000 tons of menstrual hygiene waste (12.3 billion pads) annually. It is estimated that sanitary napkins take at least 500-800 years to decompose which is equivalent to 4 plastic bags. Super-absorbent polymers (SAP), which are extensively used by women of all classes, do not degrade. They gradually break down into micro-plastics, which contaminate soil, water, and air, as well as enter the food chain, injecting poisons into the food humans and animals ingest. Dioxins, which are used to bleach the absorbent core and cause side effects in the body such as pelvic inflammatory disease, ovarian cancer, immune system damage, impaired fertility, and diabetes, are two of the ingredients used in commercial non-biodegradable menstrual napkins that have serious health consequences for women.

## RESULTS AND DISCUSSION

Incineration is the process of burning waste at a high temperature (rapid oxidation) and converted into ash. It is a process that eliminates

organic elements in waste materials and is also known as controlled-flame combustion or calcination. Incineration is regarded as a volume-reduction technique for lowering landfill costs. While disposal is the action or process of getting rid of something. Better ideas for disposing of menstrual waste are:

**Use of incinerators:** Using incinerators in an eco-friendly way creates less pollution. To emit fewer hazardous gases, they should be run at a certain temperature of roughly 800°C. They should be placed in schools, institutions, and slum regions, as well as in the community.

**Toilets with chutes:** These are unique toilets with a shoulder-level Chute built into the standard deep pit. To speed up the disintegration of soiled napkins, a chemical agent was put to the pit five times per month.

**Reusable cloth pads:** These reusable cotton pads are a wiser alternative because they contain fewer chemicals and plastic. As a result, they decompose quickly in comparison to other commercial items.

**Biodegradable cloth pad:** Chemical and plastic content must be reduced in commercial sanitary products. Encourage the use of bamboo, banana, water hyacinth, and sea sponge pads.

**Clay or cemented incinerators:** The usage of clay and cement incinerators by the "Vatsalya Foundation" in Gujrat communities is a good step forward in menstrual hygiene management. This incinerator, termed "Ashudhinashak" by a woman named "Swati," burns many sanitary napkins at once without emitting any smoke. Rural women embrace this environmentally friendly and low-cost invention because they previously had trouble disposing of them.

**Covered Bins:** Menstrual waste should be collected in special covered bins. Manufacturing companies should supply disposal bags with color-coded instructions for properly disposing of these products. Schools and institutions should be able to freely distribute these bags. Menstrual waste should not be thrown away with household trash. Pads

should be neatly wrapped with newspaper before being discarded in the trash. It should also be safe for rag pickers because it does not expose them to

microorganisms that cause sickness.

### MENSTRUAL PRODUCTS WITH THEIR LIFESPAN

	Tampons	Pads	Menstrual Cups	Menstrual Discs	Period Underwear
Cost	\$5-15/pack	Single use: \$5-10/pack  Reusable: \$5-25/pad	\$20-40/cup	Single use: \$20/8-pack  Reusable: \$40/disc	Single use: \$7/3-pack  Reusable: \$30-50/pair
Lifespan	4-6 hours per use	4-6 hours per use  Reusable pads can last up to 5 years	12 hours per use  Some cups can last 10+ years	12 hours per use  Reusable discs can last for years	Same as non-period underwear  Meant to be washed or thrown out after use
Material	Cotton or other fibers	Cotton or other fibers	Medical grade silicone	Medical grade plastic or silicone	Cotton or other fibers
How is it worn?	Inside	Outside	Inside	Inside	Outside
DIY?	No	Yes	No	No	Yes
Difficulty Level	Medium	Low	Medium	High	Low

In India, sanitary waste disposal has become a growing issue because the plastic used in disposable sanitary napkins is not biodegradable, posing health and environmental risks, because of the unstructured methods of municipal solid waste management and weak community collection, disposal, and transportation networks in cities and villages, the impact is more pronounced. Furthermore, one of the most persistent problems with sanitary waste has always been its classification, i.e., whether it is biomedical or plastic waste. Soiled napkins, diapers, condoms, tampons, and blood-soaked cotton are disposed of after being separated into biodegradable and non-biodegradable components, according to the Solid Waste Management (SWM) Rules, 2016. Items contaminated with blood and body fluids, such as cotton, dressings, soiled plaster casts, lines, and bedding, constitute bio-medical waste and should be burned, autoclaved, or microwaved to kill microorganisms, according to the Bio-Medical Waste Management Rules, 2016. According to the website Down to Earth, 432 million pads are discarded each month.

The Government of India, through the CPCB, has created the guidelines on sanitary waste management to ensure proper disposal of sanitary waste in the exercise of the power provided by section 14(i) of the Solid Waste Management, Rules, 2016 and in response to public objections and suggestions. The majority of existing sanitary waste management facilities meet the 2016 SWM Rules, which are as follows:

- Rule 3(19), “dry waste” means waste other than bio-degradable waste and inert street sweepings and includes recyclable and non-recyclable waste, combustible waste and sanitary napkins and diapers, etc;
- Rule 3(41), “sanitary waste” means wastes comprising of used diapers, sanitary towels or napkins, tampons, condoms, incontinence sheets, and any other similar waste;
- Rule (4)(b), states that wrap securely the used sanitary waste like diapers, sanitary pads, etc., in the pouches provided by the manufacturers or brand owners of these products or in a suitable wrapping material as



instructed by the local authorities and shall place the same in the bin meant for dry waste or non-bio-degradable waste;

- Rule 15(zg) (iv) & (vi), stated that the Local Authority and Nagar Panchayat shall create public awareness through information, education, and communication campaign and educate the waste generators on wrapping used sanitary waste securely as and when generated in the pouches provided by the brand owners or a suitable wrapping as prescribed by the local body and place the same in the bin meant for non-biodegradable waste. The Local Authority and Nagar Panchayat shall also educate the public on the segregation of sanitary waste at the source
- The duty of the maker or brand owner of disposable products and sanitary products is outlined in Rule 17. The following is a list of napkins and diapers:

All manufacturers of disposable products such as tin, glass, plastic packaging, etc., or brand owners who introduce such products in the market shall provide necessary financial assistance to local authorities for the establishment of a waste management system.

All such brand owners who sell or market their products in such packaging materials which are non-biodegradable shall put in place a system to collect back the packaging waste generated due to their production.

Manufacturers or brand owners or marketing companies of sanitary napkins and diapers shall explore the possibility of using all recyclable materials in their products or they shall provide a pouch or wrapper for disposal of each napkin or diaper along with the packet of their sanitary products.

## GLOBAL SCENARIO ON DISPOSAL AND INCINERATION

The global scenario on disposal and incineration varies across countries and regions.

Here are some key aspects of the global scenario on disposal and incineration:

### 1. Disposal Methods:

- *Landfilling*: Landfilling is a common method of waste disposal worldwide. It involves burying waste in designated landfills. However, landfills can contribute to environmental pollution and resource depletion if not properly managed.

- *Dumping*: In some areas with inadequate waste management infrastructure, dumping waste in open areas or bodies of water still occurs, leading to significant environmental and health hazards.

- *Waste-to-Energy (WtE)*: Waste-to-Energy facilities convert waste into energy through processes such as incineration or gasification. WtE helps reduce the volume of waste while generating electricity or heat. It is increasingly adopted in some countries as a means of sustainable waste management.

### 2. Incineration:

- Incineration is the process of burning waste at high temperatures. It can be used for various types of waste, including municipal solid waste, medical waste, and hazardous waste.

- Incineration facilities can be designed to minimize environmental impacts and generate energy from the heat produced. Advanced technologies, such as waste heat recovery systems, are utilized to increase efficiency and reduce emissions.

- Some countries have well-established incineration practices and infrastructure, while others are gradually adopting this method to manage waste.

### 3. Regional Differences:

- *Europe*: Many European countries have advanced waste management systems that prioritize waste reduction, recycling, and energy recovery. Incineration is widely used in countries like Sweden, Denmark, and the Netherlands, where waste is efficiently managed.

- *North America*: The United States and Canada have a mix of waste management practices. While landfilling remains common, there is an increasing focus on waste reduction, recycling, and energy recovery through incineration or WtE technologies.



- *Asia*: Waste management practices in Asia vary significantly. Some countries, like Japan and South Korea, have well-developed waste incineration systems, while others are still heavily reliant on landfilling or informal waste disposal.
- *Developing Countries*: Many developing countries face challenges in waste management due to inadequate infrastructure and limited resources. Informal waste picking and open dumping are prevalent in some regions, leading to environmental and health risks.

**4. Environmental Concerns:**

- Incineration can help reduce the volume of waste and recover energy, but it must be properly regulated and monitored to minimize emissions of pollutants and ensure compliance with environmental standards.
- Public concerns regarding air emissions, release of toxic substances, and potential health impacts have led to the development of stricter regulations and emission control technologies in many countries.

**5. Shifting Paradigm:**

- There is a growing global emphasis on waste reduction, recycling, and a circular economy approach. Many countries are implementing policies and strategies to promote waste minimization and resource recovery while minimizing the reliance on disposal methods like landfilling and incineration.

It's important to note that waste management practices and policies can vary significantly across countries and regions, influenced by factors such as infrastructure, resources, cultural attitudes, and regulatory frameworks. The global trend is moving towards sustainable waste management practices that prioritize waste reduction, recycling, and resource recovery while minimizing environmental impacts.

**INDIAN VIEW ON DISPOSAL PRACTICES CHALLENGES**

In India, disposal practices and the use of incinerators for waste management have been evolving over the years. Here is an overview of the

Indian view on disposal practices and the use of incinerators and Challenges and Concerns:

- *Infrastructure and Capacity*: India faces challenges in terms of inadequate waste management infrastructure and limited incineration facilities. The capacity to handle the growing waste generation in urban areas needs to be improved.
- *Emission Control*: Proper emission control measures are crucial to minimize the release of pollutants during incineration. Stringent monitoring and compliance with emission standards are necessary to protect the environment and public health.
- *Public Perception*: Incineration has faced opposition in some communities due to concerns about emissions, pollution, and the potential health impacts on nearby residents. Public awareness and engagement are essential to address these concerns and build confidence in incineration as a waste management option.

**Government Initiatives:**

- The Indian government has been emphasizing sustainable waste management practices and the promotion of waste-to-energy technologies, including incineration with energy recovery.
- The Swachh Bharat Abhiyan (Clean India Mission) launched in 2014 aims to achieve an open defecation-free and clean India. It includes provisions for solid waste management, waste segregation, and the promotion of sustainable waste management practices, including the use of incinerators in certain contexts.

**Waste-to-Energy (WtE) Projects:**

- Some waste-to-energy projects in India employ incineration as a means to convert waste into energy. These projects use advanced technologies to reduce emissions, generate electricity, and promote sustainable waste management.

It is important for India to adopt a comprehensive and integrated approach to waste management, focusing on waste reduction, segregation, recycling, and the proper treatment of hazardous waste. While incineration can play a role

in managing certain types of waste, it should be implemented in accordance with environmental regulations and best practices to ensure minimal environmental impact and protect public health.

## **ENVIRONMENTAL CORRELATION WITH THE SANITARY WASTE MANAGEMENT**

Sanitary waste management has significant environmental correlations due to the potential impacts on ecosystems, air quality, water pollution, and overall environmental sustainability. Here are some key environmental correlations associated with sanitary waste management:

1. *Landfill Pollution*: Improper disposal of sanitary waste in landfills can lead to environmental pollution. Sanitary pads and other disposable products contain plastic and other non-biodegradable materials that can persist in the environment for hundreds of years, contributing to landfill pollution.

2. *Water Pollution*: Sanitary waste, if not managed properly, can contaminate water bodies. When disposed of inappropriately, such as being flushed down toilets or thrown in open spaces, sanitary waste can reach rivers, lakes, and oceans, leading to water pollution. The chemicals and pathogens present in menstrual waste can pose risks to aquatic ecosystems and human health.

3. *Greenhouse Gas Emissions*: The production, disposal, and incineration of sanitary waste can contribute to greenhouse gas emissions, exacerbating climate change. Manufacturing sanitary products require energy and resources, while incineration releases carbon dioxide and other greenhouse gases into the atmosphere if not properly controlled.

4. *Air Pollution*: Improper incineration of sanitary waste can release harmful pollutants, such as dioxins and furans, into the air. These pollutants are toxic and can have adverse effects on human health and the environment. It is essential to ensure that incineration facilities are equipped with proper emission control measures to minimize air pollution.

5. *Resource Depletion*: The production of disposable sanitary products relies on the extraction of natural resources, such as wood pulp and petroleum-based materials. Unsustainable consumption of these resources for sanitary waste generation contributes to resource depletion and environmental degradation.

6. *Microplastic Pollution*: Many sanitary products contain plastic components that can break down into microplastics over time. These microplastics can enter water bodies, soil, and food chains, posing risks to ecosystems and wildlife.

To mitigate these environmental impacts, sustainable sanitary waste management practices are crucial. This includes promoting the use of eco-friendly and biodegradable sanitary products, encouraging waste reduction and recycling, implementing proper waste segregation and disposal systems, and promoting awareness and education on responsible waste management. Additionally, exploring waste-to-energy technologies with proper emission control can help reduce environmental impacts while harnessing energy from sanitary waste.

## **CONCLUSION**

Enhancing the promotion of menstrual hygiene requires a comprehensive approach that includes education, awareness, and appropriate disposal methods. To promote menstrual hygiene, it is essential to introduce a dedicated course on menstruation and menstrual hygiene management. Teachers should receive training on how to effectively impart knowledge about menstruation to their students. Women and girls can be informed about new menstrual products, different manufacturers, government policies, and related information through social media and electronic platforms.

Collaboration between government and non-government organizations is crucial in promoting education on menstruation, menstrual hygiene management, the importance of toilets at home, hand hygiene, and reproductive system

health. Emphasis should be placed on reusable sanitary pads or cloth pads to address the issue of disposal. Girls and women need to be aware of the risks associated with improper disposal, such as throwing used menstrual products in open spaces or flushing them down toilets.

Toilets should be equipped with dustbins that have proper lids, and where feasible, incinerators should be installed in homes, schools, and community facilities. Reusable pads and other menstrual products made from natural fibers can be composted, and deep burial can be adopted as a disposal method. Microwave technology can also be used to treat menstrual waste, rendering it non-toxic and suitable for incineration or disposal in landfills without emitting harmful toxins into the air. In India, there is awareness about the need for incinerators in various states and cities such as Amritsar, Haryana, Jaipur, Hubballi, Pune, and others, particularly in government girls' schools, public toilets, hospitals, transportation hubs, factories, and rural areas. However, implementation of these measures is still pending, despite the existence of policies, laws, and funding aimed at installing incinerators.

It is important to prioritize the implementation of such initiatives and ensure that they are effectively carried out to address the menstrual waste management challenges in the country. By combining education, awareness, and appropriate disposal methods, we can make significant progress in promoting menstrual hygiene and safeguarding the environment.

REFERENCE

1. Bhatt, Neeti and Gupta, Vanya. March 2020, “Menstrual waste disposal in India”, National Faecal Sludge and Septage Management (NFFSM) Alliance, pp: 13-20
2. Bhawan, Parivesh, May 2018 “Guidelines for management of sanitary waste”, Solid Waste Management Rules, 2016, Ministry of Environment and Forest pp: 7-8
3. Behl, Manka (2018), “Scientific disposal of sanitary pads a reality”, The Times of India,

- (<https://timesofindia.indiatimes.com/city/nagpur/scientific-disposal-of-sanitary-pads-a-reality/articleshow/64563683.cms>)
4. Elledge, F. Myles, Muralidharan, Arundati, Parker, Alison, Ravndal, T. Kristin, Siddiqui, Mariam, Toolram, P. Anuj, and Woodward, P.Katherine (2018), “Menstrual Hygiene Management and Waste Disposal in Low and Middle-Income Countries- A review of the literature, Int J Environ Res Public Health, v15(11), (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6266558/>)
5. Express News Service (2021), “Menstrual waste disposal adding to India's environmental crisis: study, The New Indian Express (<https://www.newindianexpress.com/nation/2021/jun/03/menstrual-waste-disposal-adding-to-indias-environmental-crisis-study-2311185.html>)
6. Gandhi, Riya (2020), “Conscious periods: How you dispose of used pads matters” Eco Intelligent (<https://eco-intelligent.com/2020/08/15/how-you-dispose-used-pads-matters/>)
7. Jahan, Farjana, Nuruzzaman, Md., Sultana, Farhana, Mahuf, Tishan, Mehjabin, Rahman, Mahbubur, Akhand, Farhana, Luby, P. Stephen, Unicomb, Leanne and Winch, J.Peter (2020), “Piloting an acceptable and feasible menstrual hygiene products disposal system in urban and rural schools in Bangladesh”, Jahan et al. BMC Public Health, 20:1366, pp: 3-4, 10-12
8. Kaur, Rajanbir, Kaur, Kanwaljit, and Kaur, Rajinder (2018), “Menstrual Hygiene, Management, and Waste Disposal: Practices and Challenges Faced by Girls/Women of Developing Countries” Journal of Environmental and Public Health Volume 2018 Article ID 1730964, PP:2-6
9. Kara, Sukaran (2021),” A Research Study about the Expectations from Sanitary

Napkins, Current Problems and Design of a Functional Sanitary Napkin”, Journal of Institue Of Science And Technology Volume 37, Issue 1, pp: 75-76

10. Kjellen, Marianne, Pensulo, Chibesa, Petter, Nordqvist, and Fogde, Madeleine (2011), “Global review of sanitation system trends and interactions with menstrual management practices”, Stockholm Environment Institute, Kräftriket 2B 106 91, pp: 18-23
11. Malaviya, Sushmita, 26th February 2019, 'The mammoth task of managing menstrual waste in India', DownToEarth
12. Mahesh, Priti, and Mehrotra, Akansha (2021), “Menstrual product and their disposal”, Toxic link pp:22-29
13. Mayaram, Arvind (2021), “A case for environment-friendly sanitary pads”, Hindustan Times, (<https://www.hindustantimes.com/opinion/a-case-for-environment-friendly-sanitary-pads-101617113330182.html>)
14. Sisadaran, Sarani, Kachori, Prateek, Raj, Antony, Ramalingam, Sudha, Stoner.R., Brian, L, Katelyn, Sellgren, and Grego, Sonia (2021 ), Physical properties of menstrual hygiene waste as feedstock for onsite disposal technologies, Journal of Water, Sanitation and Hygiene for Development, 11.3, pp: 1-3
15. Thakre, S. B., Thakre, S. S., Reddy, M.,

Rathi, N., Pathak, K., and Ughade S., “Menstrual hygiene: knowledge and practice among adolescent school girls of Saoner, Nagpur District,” Journal of Clinical and Diagnostic Research, vol. 5, no. 5, pp. 1027–1033, 2011.

16. Upadhyay, Suman, Shukla Vinod Kumar and Pant, Hemla (2012): Studies on Parents and Children attitude about sex education. Vijanana Parishad Anusandhan Patrika, Vol. 55(4), Page No. 20-25.
17. Tripathi, Janhavi and Pant, Hemlata (2010-11): Kishorio me Masik Dharm ke samay hone wale Sharirik Parivartan Avum Manovaigyanic Tatha Samjik Prabhav Ka Adhdhyayah, Gramin Vikas Sandesh, 5 (1,2) Page No. 42-45
18. Tripathi, Janhavi and Pant, Hemlata (2012): Studies and Physiological Changes of Menstrual of Cycle in Girls. National Conference on Chemistry & Life, Organised by Dept. of Chemistry, CMP College, Alld. (U.P.) dated 16-17 Sept. Page No. 68

# EFFECT OF LEAD CHLORIDE EXPOSURE ON BLOOD GLUCOSE LEVEL AND PROTECTIVE EFFECT OF *S. NIGRUM* AND TRACE ELEMENTS

Amardeep Sagar, Kavita, D. K. Chauhan\* and Divya Singh

Department of Zoology, C. C. S. University, Meerut-250 004 (India)

\*Immunotoxicology Lab, Department of Zoology, C. C. S. University, Meerut-250 004 (India)

\*Correspondence @ Dr. D. K. Chauhan, Email: drdushyant.zoology@gmail.com

Received : 15.01.2023

ABSTRACT:

Accepted : 20.02.2023

The present study aimed to investigate the effects of lead chloride ( $PbCl_2$ ) exposure on blood glucose and hepatic glycogen level in albino rats in three durations 5 days, 21 days and 45 days. This study also evaluate the protective effect of plant extract of *Solanum nigrum* and trace elements Zinc and Selenium against lead chloride toxicity. The experimental rats were divide into six groups randomly and maintained for all three exposure period. The observations showed that lead chloride toxicity induced no elevation in blood glucose level at 5 days but slightly increase in 21 days and highly increased in 45days of exposure in comparison to control group rats. This pattern also followed in hepatic glycogen level in all exposure period in comparison to control group rats. The groups of rats treated with plant extract of *Solanum nigrum*, Zinc and Selenium mix with feed showed the protective effect. These agents maintained the blood glucose and hepatic glycogen level very efficiently in all the exposure group rats in comparison to lead chloride treated rats. These findings showed the protective effect *S. nigrum*, zinc and selenium in lead chloride environmental and occupational exposure.

**Keywords:** *S. nigrum*, lead chloride, zinc, selenium, albino rats

## INTRODUCTION

Lead exposure is common problem in environment and in various kinds of occupations. Lead toxicity may be induced by its some common derivatives as lead chloride, lead nitrate and lead acetate is very common. Lead chloride is on the right to know hazardous substance list cited by OSHA, IARC, ACGIH, NTP, NIOSH and EPA. Lead chloride is a probable human carcinogen. It is basically exposed by environmental pollution and occupational practices. Present investigation deals the exposure of lead chloride in three acute, sub chronic and chronic period subsequently in comparisons to control. Lead chloride also may cause some acute health effects as irritation in eyes, reduced memory, disturbance in sleep, upset stomach, loss of appetite. In chronic exposure, lead

chloride may cause lung, brain, stomach, liver and kidney cancer.

The uses of nutritive trace elements and some plant extracted antioxidants prevents against these type of toxicants effectively. In present study *Solanum nigrum* plant extract and zinc and selenium were evaluated against the toxicity of lead chloride in special concern to blood glucose level and glycogen content storage and its conversion in liver of albino rats. This investigation will helpful to diagnose the hyperglycemic condition of lead occupational workers as well as environmental exposure of lead.

Diabetes mellitus is a major heterogeneous endocrine and metabolic disorder, characterized by altered metabolisms of carbohydrate, lipid and protein, which not only lead to hyperglycemia but



also cause many complications, such as hyperlipidemia, hypertension and atherosclerosis, Bakirel (2008). The increased glucose level tends to glucose auto oxidation and auto oxidative glycosylation of proteins, which leads to oxidative stress, contributes to the development and progression of diabetes along with secondary complications (Baynes, 1991 and Ceriello, 2003).

Glycogen is an important biochemical component of a cell. It is required to perform various physiological activities being a chief source of energy. Liver is considered as a metabolic center for the synthesis of glucose from stored glycogen and is used whenever it is required. Although the breakdown of glycogen into glucose and vice-versa is a normal phenomenon in liver but when any toxicant enters into the liver, it disturbs the glycogen synthesis.

## MATERIALS AND METHODS

The experimental animals were divided randomly into six groups as control, in this group healthy animals of about average weight were selected and feed upon dose vehicle only. Second group was treated with lead chloride @ 100mg/kg b.w. in feed, third group was treated with *S. nigrum*@500 mg/kg b.w.fourth group treated with lead chloride with *S. nigrum* at the same dose of third group, fifth group treated with lead chloride with trace elements (Zinc and Selenium @ 5 mg/kg b.w.), sixth group treated with lead chloride with *S. nigrum*

and trace elements both in the same dose used in previous groups. All the groups were sacrificed according to exposure period for the evaluation of blood glucose level and glycogen content in hepatic tissues.

## RESULTS AND DISCUSSION

The group of experimental rats treated by *S. nigrum* alone decrease the blood glucose level in all the exposure period, it was found highest decrease in 45 days period. In the next group rats were feed with lead chloride dose 100mg/kg b.w. alone for all the exposure periods and results showed the successive increase (P versus respective control $\leq$ 0.05) according to exposure period. In the fourth group rats were treated with lead chloride along with *S. nigrum* dose 500mg/kg b.w. and results showed the slightly decrease of blood glucose level in comparison to third group (lead chloride alone). In the fifth group rats were treated with lead chloride along with trace elements (Zinc and Selenium@ 5mg/kg b.w.) and observed that blood glucose level was reduced slightly in comparison to third group (lead chloride alone). In last group experimental rats were treated with both *S. nigrum* and trace elements along with lead chloride in previously described doses in all the exposure periods. The results on blood glucose level in this group showed highest decrease in blood glucose level in comparison to third group (lead chloride alone, Table-1).

**Table 1: Effect of acute and chronic toxicity of lead chloride and effective measures of *Solanum nigrum* and trace elements on Blood glucose level in albino rats.**  
(Values are Mean $\pm$ S.E. and expressed in (mg/100ml of blood), N=6)

S. No.	Dose (mg/kg b.w.)	Duration of Exposure		
		5 Days	21 Days	45 Days
1	Control	89.5 $\pm$ 1.7	90.1 $\pm$ 0.7	88.7 $\pm$ 0.8
2	<i>S. nigrum</i>	88.4 $\pm$ 1.1	82.0 $\pm$ 0.6*	75.0 $\pm$ 1.7*
3	Lead Chloride	95.4 $\pm$ 0.1	110.7 $\pm$ 0.2*	140.8 $\pm$ 2.4*
4	Lead chloride + <i>S. nigrum</i>	92.0 $\pm$ 0.2*	102.0 $\pm$ 1.1*	130.0 $\pm$ 1.7*
5	Lead chloride + Supplements	94.0 $\pm$ 0.1	104.0 $\pm$ 1.4*	131.0 $\pm$ 1.1*
6	Lead chloride + Supplements + <i>S. nigrum</i>	90.4 $\pm$ 1.0*	96.8 $\pm$ 1.3*	99.0 $\pm$ 1.8*

\*Statistical analysis: P versus respective control $\leq$ 0.05

Medicinal plant extracts have been valuable anti- diabetic agents and may involve one or more active components responsible for blood glucose reduction (Farnsworth, 1995 and Grover *et al.*, 2002). In the present study *Solanum nigrum* ethanolic extract treated group exhibited significant reduction of blood glucose level as compared to control. This result was supported by the findings of Poongothai *et al.*, 2010. In addition *Solanum nigrum* glycoprotein inhibits the activity of cholestyramine-induced hepatic HMG-Co A reductase at 40µg/g head body weight (Lee *et al.*, 2005). Validation of

the ethno botanical use of the leaves of *Solanum nigrum* (Solanaceae), *Vitexnegundo*(Verbanaceae) and stems of *NopaleaCochinellifera*as anti- diabetic agents using the oral glucose tolerance test showed that there was no significant lowering in blood glucose levels by *Solanum nigrum* (Villasefiorand Lamadrid, 2006). Aaliet *al.* (2010) have reported that the daily oral administration of ethanolic extract of *Solanum nigrum* at a dose of 250mg/kg bw was given to albino rats for 5 and 7 days respectively leads to significant decrease in blood sugar compared to control.

**Table 2: Effect of acute and chronic toxicity of lead chloride and effective measures of *Solanum nigrum* and health supplements onglycogen content in various organs of albino rats. (Values are Mean ±S.E. and expressed as mg/100gm of tissue, N=6)**

Organ	Dose (mg/kg b.w.)	Duration of Exposure		
		5 Days	21 Days	45 Days
Liver	Control	3325 ±25.85	3320 ±13.5	3340 ±10.6
	Lead Chloride	3025 ±12.33*	2995 ±14.17*	2785 ±16.7*
	<i>S. nigrum</i>	5597 ±16.24*	5615 ±20.65*	5620 ±21.66*
	Lead chloride + <i>S. nigrum</i>	4420±12.10*	4650±14.20*	4745±10.11*
	Lead chloride + Supplements	4540±15.10*	4585±12.10*	4360±17.15*
	Lead chloride + Supplements + <i>S. nigrum</i>	5050±20.21*	5225±22.16*	5430±17.20*

\*Statistical analysis: P versus respective control <\_ 0.05

In present study the content of hepatic glycogen in lead chloride treated group of experimental rats showed significant (P versus respective control <\_ 0.05) decrease in comparison to control group. However in the next group rats treated by *S. nigrum* dose for short term and long term periods showed the highest elevation in glycogen content in liver tissues. Further, in next groups rats were feed by *S. nigrum*, trace elements and both *S. nigrum* and trace elements along with

lead chloride showed slightly increase in glycogen content respectively in comparison control group. These results showed the efficacy of *S. nigrum* and trace elements (zinc and selenium) against lead chloride toxicity which induce the hyperglycemic conditions (both glucose and glycogen level) in rats. So this study proved the hypoglycemic property of *S. nigrum* extract along with zinc and selenium (Table-2).

It has been reported that disruption of

glycogen storage is associated with dysfunctional and dystrophic changes in the liver and kidney due to inhibition of key enzymes in carbohydrate metabolism such as hexokinase, glucokinase, and phosphoglucomutase (Aldridge, 1951 and Reeves, 1979). Hossain *et al.* (2010) also reported that the level of glycogen content in liver is reduced to 49% in diabetic rats as compared to the normal control rat, but treatment with different fractions of *Mangifera indica* improved the level of glycogen content to their normal level.

Depletion of liver glycogen content was seen in the diabetic control group. A significant increase in the glycogen content of liver was observed after administration of alcoholic leaf extract of *Barlariapronitis* (Dheer *et al.* 2011). It was also observed that ethanolic extract of *Chamomile recutitilacapitula* has reversal effects on the level of glycogen in paracetamol hepatotoxicity (Gupta and Mishra 2006). In diabetes, glycogen content decreases due to enhanced glycogenolysis and the normal capacity of the liver to synthesise glycogen is impaired, which is due to insulin deficiency (Yki-Jarvinen and Taskinen, 1998).

## REFERENCES

1. Aali NS, Singh K, Khan MI and Rani S (2010). Protective effect of ethanolic extract of *Solanum nigrum* on the blood sugar of albino rats. *IJPSR*; Vol. 1, Issue 9: 97-99.
2. Aldridge WN, Barnes JM and Denz FA (1951). Biochemical changes in acute beryllium poisoning. *J. Exp. Pathol*; 31:473-84.
3. Bakirel T, Bakirel U, Keles OU, Ulgen, SG and Yardibi H (2008). *In vivo* assessment of antidiabetic and antioxidant activities of rosemary (*Rosmarinus officinalis*) in alloxan induced diabetic rabbits. *J. Ethnopharmacol*; **116**: 64-73.
4. Baynes JW (1991). Role of oxidative stress in the development of complications in diabetes. *Diabetes*; **40**: 405-412.
5. Ceriello A (2003). New insights on oxidative stress and diabetic complications may lead to a "causal" antioxidant therapy. *Diabetes Care*; **26**: 1589-1596.
6. Dheer R and Bhatnagar P (2011). A Study of the antidiabetic activity of *Barleria priories* Linn. [Http/www.ijp-online. Com](http://www.ijp-online.com), IP: 164.100: 30-85.
7. Farnsworth RN (1995). Review on Biological and Phytochemical screening of plants. *J. Pharm. Sci*; **55**: 225-276.
8. Grover JK, Yadav S and Vats V (2002). Medicinal plants of India with hypoglycemic potentials. *J. Ethnopharmacol*; **81**: 81-100.
9. Gupta AK and Mishra N (2006). Hepatoprotective activity of ethanolic extract of *Chamomile capitulain* paracetamol intoxicated albino rats. *American J. of Pharm. And Toxicol*; vol; 1 (1): p, 17-20.
10. Hossain MS, Khan MRI, Anisuzzatnan ASM, Ahmed M, Amran MS and Islam A (2010). Antidiabetic and glycogenesis effects of different fractions of ethanolic extract of leaves of *Mangifera indica* (Linn) in normal and alloxan-induced diabetic rats. *Journal of Med. Sci*; **10**: 80-86.
11. Lee SJ, Ko JH, Lim K and Lim KT (2005). 150 kDa glycoprotein isolated from *Solanum nigrum* Linn, enhances activities of detoxicant enzymes and lowers plasmic cholesterol in mouse. *Pharmacol. Res*; **51** (5): 399-408.
12. Poonthai K, Ahmed KSZ, Ponmurugan P and Jayanthi M (2010). Assessment of Antidiabetic and Antihyperlipidemic potential of *Solaum nigrum* and *Musa paradisiacain* alloxan induced diabetic rats. *Journal of pharmacy research*; **3** (9): 2203-2205.
13. Reeves AL (1979). Beryllium review of literature. Handbook on the toxicology of metals. Amsterdam: Elsevier, North-Holland Biomedical Press; 329-43.
14. Villasefior IM, Lamadrid MRA (2006). Comparative anti-hyperglycemic potentials of medicinal plants. *J. Ethnopharmacol*; **104** (1, 2, 8): 129- 131.
15. Yki-Jarvinen H and Taskinen MR (1998). Interrelationships among insulin s lipolytic and glucoregulatory effects and plasma triglycerides in non diabetic and diabetic patients with endogenous hypertriglyceridemia. *Diabetes*; **37**: 1271-78.