International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 6, 2025
https://www.theaspd.com/ijes.php

Lantana Camara Operative For Conservation Of The Sorghum Bicolor From The Infestation By Sitophilus Zeamais For The Well-Being Of Human Health

Atmaram Vitthal Andhale*

*Associate Professor, Department of Zoology, HoD. Biotechnology, MES's Nowrosjee Wadia College, Pune (Autonomous), affiliated to Savitribai Phule Pune University, Pune 411001 (MS) India.
E-mail: atmabiotech@gmail.com

ABSTRACT

In 1960, the Green Revolution was started by M.S. Swaminathan to modernize agricultural practices and report on the food supply for a rapidly growing population. But nowadays, the same revolution becomes an anxiety to the environment and human health because of the use of chemical pesticides and fertilizers. The residues of different pesticides and Chemical fertilizers, such as heavy metals, become problematic soil physicochemical properties, water, and can directly or indirectly to human health. So, in India nowadays we speak about organic farming and so on. Looking towards the challenges of infections of different food grains by Sitophilus zeamais, the present investigation emphasizes eco-friendly and natural origin pesticides to control it. To be sustainable towards human health and the environment. Bioformulations of leaves and flowers of Lantana camara were done using different organic solvents using the Soxhlet apparatus. The Butanol and Ethanol formulation of plant materials of Lantana camara against the growth of the major stored grain pest Sitophilus zeamais compared to aqueous extract. It was shown that the extracts of plant materials Lantana camara are effective against the growth and survival of S. zeamais in stored food grains such as sorghum, maize, wheat, and rice. The concentration of the extract of L. camara is directly proportional to the mortality rate of S. zeamais. As per references cited, the plant L. camara has medicinal values which will add to Sorghum bicolor when we use one of the preservative materials for food grains, has no side effects, and might boost immunity.

Keywords: *Green revolution, Sorgum bicolo, Sitophilus zeamai, Lantana camara, etc.*

INTRODUCTION

In India, because of the green revolution, Crop yield has increased, but now it has become very problematic not only to the environment but also to human health. This green revolution resolved the problem of a shortage of food, but unfortunately, the use of chemical fertilizers and pesticides increased soil and water pollution day by day. All soil parameters were altered, crop's nutritive values were modified day by day. Many pesticides have been used on an international scale from the 1950s to the mid-80s, the maximum of which can be strong and chronic inside the environment **[1].** Plant protection products also play an essential role in meeting plant health necessities and allowing international trade in agricultural products. Outside the agriculture sector, insecticides have a wide variety of uses, keeping wood or fabric, and protecting public health **[2]**. There is now overwhelming evidence that some of these chemicals do pose potential risks to humans and other life forms and have unwanted side effects to the environment **[3].** The use of insecticides in business agriculture has brought about increasing farm productivity **[4].** So, the government of India imports organic farming, sustainable agriculture, integrated pest management (IPM), and so on. In recent years Science of Biotechnology has helped resolve the problems of environmental and public health **[5]**. Pesticides are threats to human fitness and the environment. A specific pesticide may have a damaging effect

on human health while the degree of exposure exceeds the ranges taken into consideration to be safe. There can be direct exposure to insecticides or indirectly. **[6]**.

The report of IGMRI (Indian Grain Storage Management and Research Institute) post-harvest losses account for 10% of total food grains due to unscientific storage. In India, the yearly storage losses have been estimated at 14 million tons worth rupees of 7000 crores which insect alone responsible for nearly 1,300 crores. The major economic loss is caused by storage insect pests. About nearly 100 species of insects of storage grains cause economic losses. Out of these Sitophilus zeamai is one of them to show great loss. World Bank Report (1999) post-harvest losses in India account for 12 to million metric tons. These losses may be qualitative and quotative.

Sorghum bicolor (L.) commonly called Sorghum, or Jawari, is an important cereal crop grown globally for food and feed purposes **[7]**. The crop is environment-pleasant as it is water efficient, requires little or no fertilizers, and is biodegradable **[8]**. Sorghum has an extremely good advantage in both the domestic and international markets due to its growing demand for the manufacturing of meals and feed products, such as alcoholic and non-alcoholic liquids **[9]**, **[10]**. Farmers and grain processors were evolving several conventional practices via trial-and-error methods, to keep away from big losses that arise in stored grains due to insect pest infestation **[11]**.

Insect pests have been the major problem of agriculture inside the tropics for long as beneficial situations exist for the pest and terrible post-harvest handling facilities, resulting in substantial waste of farm produce and, hence, considerable loss to the economy **[12]**. Insect pests damage stored grains, consequences in decreased amount, quality, nutritional, and viability of saved cereals like sorghum, maize, wheat, and rice **[13]**. Insect pests cause severe damage to cereals stored in traditional storage systems and marketplace stores in a few parts of Nigeria **[14]**. Sorghum in Nigeria is commonly produced and stored by rural farmers at the farm/village level after harvest. The prominent storage structures present in rural areas in northern Nigeria are the mud rhombus, thatched rhombus, and underground pits **[15]**.

During storage, different species of insect pests such as Sitophilus granurius (L.), Sitophilus oryzae (L.), Sitophilus zeamais (Mostsch.), Rhyzopertha dominica (F.), Oryzaephilus surinamensis (L.), Trogoderma granarium (Ev.), Tribolium castaneum (Herbst), Sitotroga cerealella (Oliv.) and Cryptolestes ferrugineus (Stephens) were observed to cause serious damage to sorghum. The insect pests were reported to cause up to 13.12% weight loss of threshed sorghum and 8.34% weight loss of unthreshed sorghum **[15]**.

Bio-pesticides are less toxic, more target-specific, and decompose quicker compared to conventional insecticides **[16]**, **[17]**, **[18]**. Lantana camara L (Verbenaceae) (L. camara) is a significant weed of which there are some 650 varieties in over 60 countries or island groups **[19]**. Commonly called as Shrub verbenas **[20]**. Lantana camara has been an essential coniferous plant in Ayurvedic and indigenous medicinal systems **[21]**. The maize weevil, Sitophilus zeamais Motschulsky (Coleoptera: Curculionidae), is one of the most destructive stored products pests of grains **[22]** As to resolve challenges of infections of different food grains by Sitophilus zeamais, the present research topic is selected to screen out eco-friendly and natural origin pesticides to control it.

MATERIAL AND METHODS

Extracts of each plant material were extracted in Ethanol, Butanol, and Aqueous and were stored after evaporation of the solvent in the refrigerator.

Lantana camara Flower

Lantana camara Petals

Lantana camara powder

Lantana camara Laves

Lantana camara Leaves

Lantana camara leaves powder

L. camara Flower Butanol extraction

L. camara Flower Butanol extraction

L. camara Flower Butanol extraction

L. camara Flower Butanol extraction

Noninfected grains of the Sorghum bicolor (Jowar) were purchased from the local market and were screened for damaged and infected grains if any. The non-infected grains were washed in clean water and dried. The dry grains were placed in the clean glass bottle. The cap of the bottle was perforated for ventilation. A wet muslin cloth was tied at the mouth of the bottle before capping to maintain the humidity for the survival of the pest.

Infected pulses were obtained from the market and were identified at the Zoological Survey of India (ZSI), Pune. Sitophilus zeamais species of beetle was obtained. These S. zeamais were separated from the infected grains. 10 males and 10 females were released in the bottle containing 500 grams of the grains of Sorghum bicolor and were allowed to grow. The adult females laid the eggs on the grains. Beetles, when died, were removed and the culture was maintained at room temperature. After about 28 days, the young adults have begun to emerge from the grains. The adults hatched were used for the experiment and some were released in the fresh pulses again to maintain the stock culture.

The fresh leaves of Lantana camara and flowers of Lantana camara were collected from the local area and dried in the shade and then in the oven. The dried leaves were powdered in the grinder and powders of plant materials were stored in the airtight polyethylene bags. The powder was packed in filter paper and the extract was extracted in Soxhlet apparatus in 1/2:10 rations i.e., 10 gm powder in 200 ml solvent. Extracts of each plant material were extracted in Ethanol, Butanol, and Aqueous and were stored after evaporation of the solvent in the refrigerator. After eight hours of continuous extraction, the final extract was kept open to evaporate the solvent and the remaining stock solution extract was stored at 4 degrees Celsius in a refrigerator until use.

Hundred grams of the disinfected Sorghum grains were taken in each of the plastic containers. One container was maintained as a control and others were labeled and used for the experiment. The stock solution was dissolved in respective solvents that is Ethanol, Butanol, and Distilled water to prepare 1 ml working solution of different concentrations i.e., 0.2, 0.4, 0.6, 0.8, 1.0 respectively. 1 ml of working solution in different solvents with different concentrations was added in each experimental container as a dose, which contained 100 gm of sorghum grains. Containers were kept open for 48 hours in a well-ventilated room to evaporate the ethanol and butanol. After 48 hours 20 beetles (Sitophilus zeamais) from stock culture were released in each of the control and experimental containers and those containers were covered up with muslin cloth.

The mortality rate was observed for 120 hours (5 days) of exposure to different concentrations of plant extracts and was recorded.

OBSERVATIONS AND RESULTS

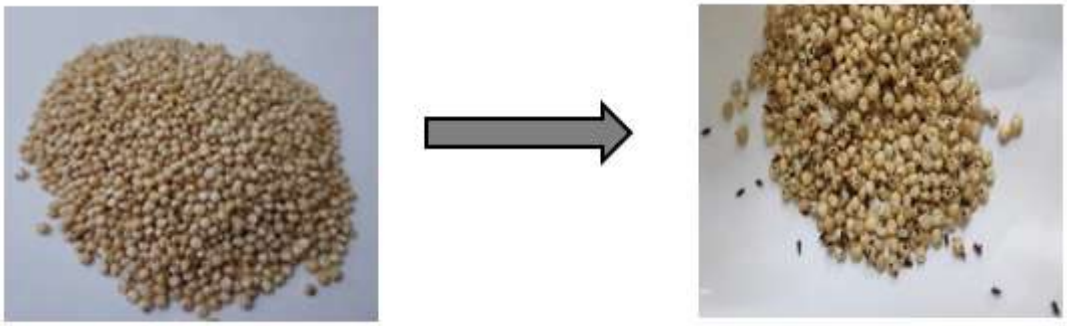


Table 1. Effect of Ethanol extract of **Lantana camara** (Flowers) on grain pest, Sitophilus zeamais in Sorghum

Conc. of Stock sol. (ml)	Dose (ml)/ 100gm	No. of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	1	0	0	5%
0.2	1	20	0	2	0	4	0	30%
0.4	1	20	3	2	2	7	2	80%
0.6	1	20	2	0	0	2	2	30%
0.8	1	20	6	0	6	8	0	100%
1.0	1	20	3	5	6	4	0	90%

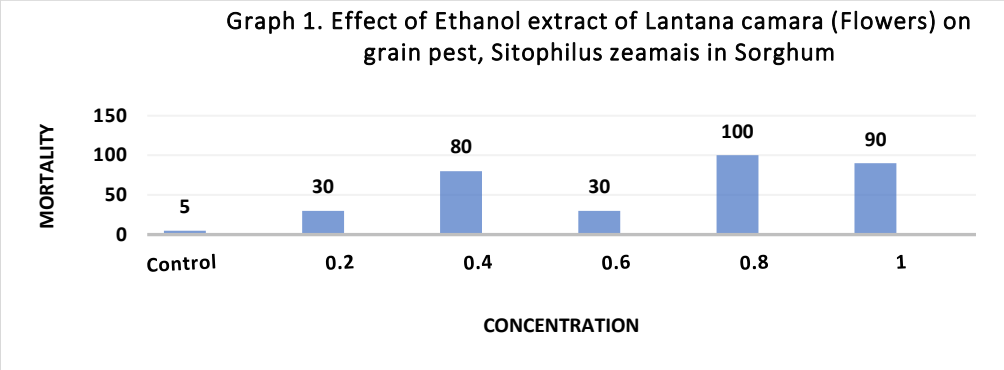


Table 2. Effect of **Ethanol extract** of Lantana camara (Leaves) on grain pest, Sitophilus zeamais in Sorghum

Conc. Of Stock sol. (ml)	Dose (ml)/ 100gm	No. of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	1	0	0	5%
0.2	1	20	0	0	2	4	8	70%
0.4	1	20	5	3	4	5	2	95%
0.6	1	20	0	2	3	7	4	80%
0.8	1	20	2	0	0	2	6	50%
1.0	1	20	0	5	2	6	7	100%

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 6, 2025
https://www.theaspd.com/ijes.php

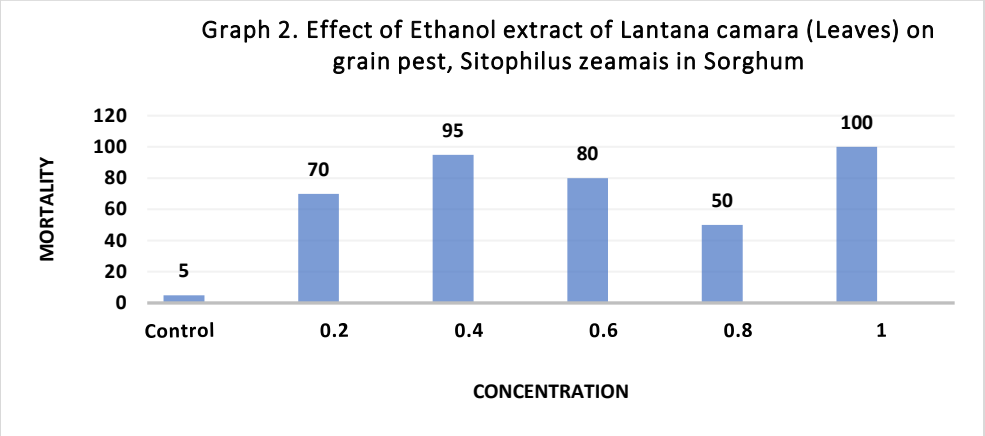


Table 3. Effect of **Butanol extract** of Lantana camara (Flowers) on grain pest, Sitophilus zeamais in Sorghum

Conc. Of Stock sol. (ml)	Dose (ml)/ 100 gm	No. of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	0	1	1	10%
0.2	1	20	2	0	6	8	2	90%
0.4	1	20	4	4	4	4	0	80%
0.6	1	20	2	4	6	1	0	65%
0.8	1	20	0	2	2	4	3	55%
1.0	1	20	0	2	0	6	0	40%

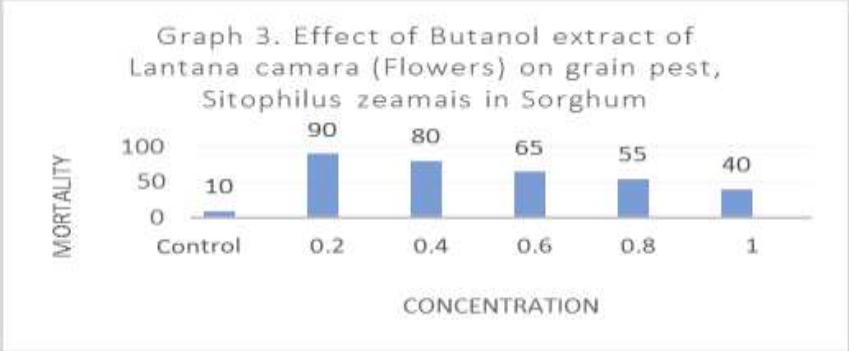


Table 4. Effect of **Butanol extract** of Lantana camara (Leaves) on grain pest, Sitophilus zeamais in Sorghum

Conc. Of Stock sol. (ml)	Dose (ml)/ 100 gm	No. of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	0	1	1	10%
0.2	1	20	4	2	2	8	0	80%

0.4	1	20	8	2	4	4	0	90%
0.6	1	20	0	2	0	6	2	40%
0.8	1	20	7	3	0	5	2	85%
1.0	1	20	4	0	4	0	0	40%

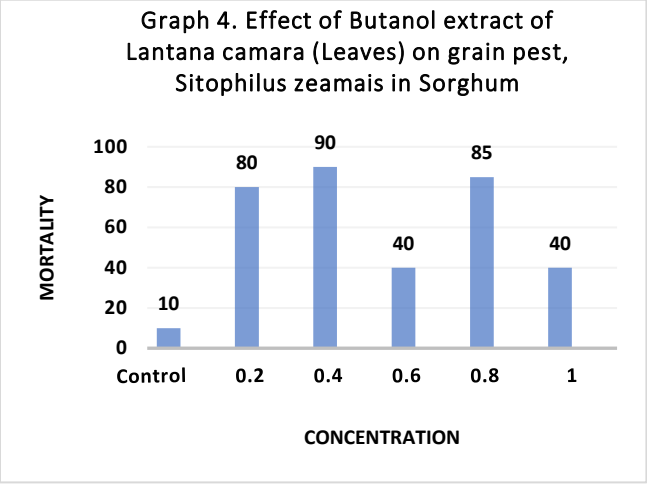


Table 5. Effect of **Aqueous extract** of Lantana camara (Flowers) on grain pest, Sitophilus zeamais in Sorghum

Conc. Of Stock sol. (ml)	Dose (ml)/ 100 gm	No. of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	0	1	0	5%
0.2	1	20	0	2	0	4	0	30%
0.4	1	20	2	2	2	0	2	30%
0.6	1	20	0	4	0	2	2	40%
0.8	1	20	0	2	4	2	0	40%
1.0	1	20	4	2	2	0	4	50%

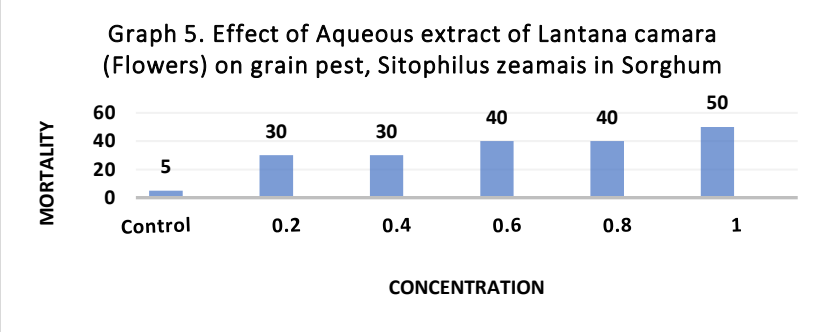
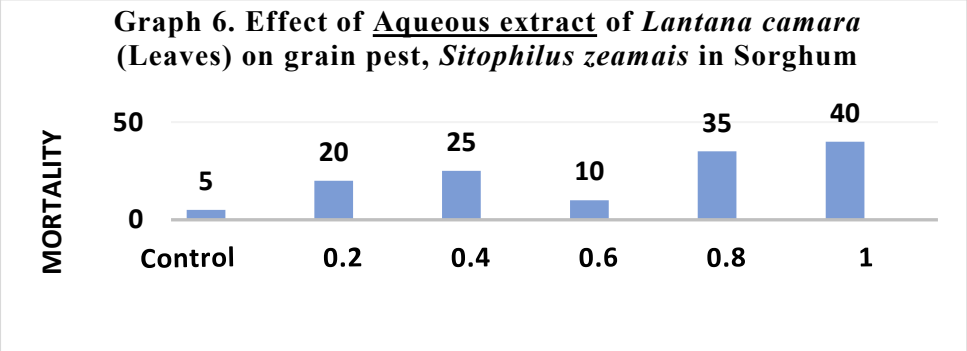


Table 6. Effect of **Aqueous extract** of Lantana camara (Leaves) on grain pest, Sitophilus zeamais in Sorghum

Conc. Of Stock sol. (ml)	Dose (ml)/ 100 gm	Number of Insects in Jar	Mortality					Total Mortality %
			24 Hrs	48 Hrs	72 Hrs	96 Hrs	120 Hrs	
Control	-	20	0	0	0	1	0	5%
0.2	1	20	2	2	0	0	0	20%
0.4	1	20	0	2	2	1	0	25%
0.6	1	20	2	0	0	0	0	10%
0.8	1	20	3	2	2	0	2	35%
1.0	1	20	2	4	0	0	2	40%



Sorghum (Sorghum bicolor) is an important cereal crop grown worldwide for food and animal feed purposes. Sorghum is a common cereal used as sprouted grains for several preparations of breakfast and meals in the country. It is highly susceptible to the infestation of the Sitophilus zeamais. S. zeamais larvae feed on the interior of individual grains, often leaving only the hulls, a flour-like grain dust, mixed with frass is evident—the female chews through the surface of the grain, creating a hole. Infested grains contain holes through which adults have emerged. Like many other stored grain pests, Sitophilus species tolerate or prefer low moisture levels in their food.

Lantana camara, plants were collected and photographed. The extract of L. camara form of the powder in different solvents was prepared in different concentrations as discussed in the Materials and Methods chapter. The experimental setup is made. The species of Sitophilus zeamais (maize weevil) was collected and cultivated to get an equal morphological character to use for the experiment.

The effect of extracts of L. camara in different solvents showed variable damage to species S. zeamais, and data were collected and tabulated in the form of the different tables and graphs as no. 1, 2, 3,4,5, and 6. It was observed that as the concentration of the working solution increases, the percentage rate of the mortality of S. zeamais also increases (Table Nos. 1, 2, 3, 6). The control of Aqueous, Ethanol, and Butanol extracts, the percent corrected mortality was 0%.

DISCUSSION

Lantana camara (L. camara) is especially used as an herbal medicinal drug and in some areas as firewood and mulch. It is also used for the treatment of cancers, chicken pox, measles, ulcers, swellings, eczema, tumors, high blood pressure, bilious fevers, catarrhal infections, tetanus, rheumatism, malaria, and ataxy of abdominal viscera, the antimicrobial, antifungal capability of leaves extract of the normally used medicinal plant L. camara **[23] [24] and [225].** The different parts of Lantana camara can be used due to the many chemicals present in treating many diseases **[26].**

Lantana camara (Verbenaceae) is a well-known medicinal plant in traditional remedies. It's also famous in folkloric treatment as the cure for numerous ailments, inclusive of rheumatism, wounds, fever, and asthma in various tribal communities. L. camara is likewise called an ornamental weed in diverse regions. Its flexible nature makes the plant invasive and broadly distributed, and turns it into a difficult weed due to its dominant nature. So, new strategies have to be developed to optimize the usefulness of this plant, which include exploring its pharmacologic capability **[27]**. Phytochemicals present in the L. camara leaves and examine the antioxidant capability of the ethanolic extract. L. camara extracts exhibited proper anti-oxidant activity, which was contributed by phenolic compounds **[28]**.
[29] has shown that the nutritive values of food are resolved by the development of leaves extracted from Eucalyptus globulus (Nilgiri) to targets of Callosobruchus aculatus. Formulation results of the leaf extract of Syzygigum cumini (Jambhul) show target Callosobruchus maculatus to reserve the food grains **[30].**

In the present investigation, the study has been done on an extract of leaves of Lantana camara and Tagetes erecta on Sitophilus zeamais in ethanol, butanol, and an aqueous solvent. It was shown that the extracts of plant materials Lantana camara are effective against the growth and survival of S. zeamais in stored food grains such as sorghum, maize, wheat, rice, etc. The concentration of extract of L. camara is directly proportional to the mortality rate of S. zeamais.

CONCLUSION

The Butanol and Ethanol formulation of plant materials of **Lantana camara** was shown to be highly effective against the growth of the major stored grain pest **Sitophilus zeamais** as compared to aqueous extract. It was shown that the extracts of plant materials Lantana camara operate against the growth and survival of S. zeamais in stored food grains such as sorghum, maize, wheat, and rice. The concentration of the extract of L. camara was shown to be directly proportional to the mortality rate of S. zeamais. As per previous citation reference plants, L. camara has Ayurvedic properties; it is equally important in the formulation of biopesticides, which give additives of its medicinal properties to stored food.

Acknowledgment:

I express my gratitude to Miss Pooja B. Avare, who made efforts to assist me during this research work. Additionally, I expressed my deep appreciation to ZSI, Akurdi, Pune, for their assistance in identifying the species, Sitophilus zeamais.

REFERENCES

1. Barra R., Cisternas M., Urrutia R., Pozo K., Pacheco P., Parra O. and Focarti S. (2001), "First report on chlorinated pesticide deposition in a sediment core from a small lake in central Chile", Chemosphere, Vol. 45, P. 749-757.
2. Mathur S. C. (1999), "Future of Indian pesticides industry in the next millennium", Pesticide Information, XXIV (4), 9-23.
3. Forget G., T. Goodman and A. de Villiers (1993), "Balancing the need for pesticides with risk to human health", Impact of Pesticides Use on Health in Developing Countries, IDRC, Ottawa, P.2. and Guleret G. O., Cakmok Y.

S., Dagliz, Aktumsek A. and Ozparlak H. (2010), "Organochloride pesticides residues in wheat from koyna region turkey", Food and chemical toxicology, Vol. 48, P. 1218-1221.
4. Mathur S. C. (1999), "Future of Indian pesticides industry in the next millennium", Pesticide Information, XXIV (4), 9-23.
5. Murugesan George W. Ware and David M. Whitacre (2004), "An Introduction to Insecticides (4th edition)", MeisterPro Information Resources, Extracted from The Pesticide Book, 6th edition.
6. Md. Wasim Akhtar, Dwaipayan Sengupta and Ashim Chowdhury (2009), "Impact of pesticide use in agriculture: their benefits and hazards", Interdisciplinary Toxicology, Vol. 2(1): 1–12
7. Rampho E. T. (2005). Sorghum bicolor (L.) Moench. www.plantzafrica.com/plantqrs/sorghum.html.
8. Simonyan KJ, El-Okene AM and Yiljep YD (2007), "Some physical properties of Samaru Sorghum 17 grains. Agricultural Engineering International", The CIGR journal Manuscript FP 07008. Vol. IX. August, 2007.
9. FAO (1999), "Sorghum: Post-harvest operations. Natural Resources Institute, Food Security Department. INPhO - Post-harvest Compendium", Food and Agriculture Organization of the United Nations. 33p.
10. Mahai S, Jamala GY, Mada DA and Medugu IA (2015) "Assessment of sorghum storage methods in Madagali and Ganye areas of Adamawa State, Nigeria", The Int. J. Engr. Sci. 4(10):01-06.
11. Adejumo BA and Raji AO (2007), "Technical appraisal of grain storage systems in the Nigerian sudan savannah", Agricultural Engineering International: The International Commission on Agricultural Engineering (CIGR). J. Sci. Res Dev. Invited Overview IX(11):1-12.
12. Okonkwo EU (1998), "Bibliography, A bibliography of plant materials used for controlling insect pests of stored products in Nigeria. Rev. Agric. Entomol."
13. Utono IM (2013a), "Assessment of grain loss due to insect pest during storage for small-scale farmers of Kebbi", IOSR J. Agric. Vet. Sci. 3(5):38-50.
14. Suleiman M. and Rugumamu C. P. (2017), "Management of insect pests of stored sorghum using botanicals in Nigerian traditional stores", Journal of Stored Products and Postharvest Research, Vol. 8(9), pp.93-102
15. Van Emden HF (2013), "Handbook of Agricultural Entomology", Wiley-Blackwell, A John Wiley & Sons Ltd., Publication. 312p.
16. Clemson HGIC (2007): Clemson Extension, Home and Garden Information Center., Organic Pesticides and Bio-pesticides, Clemson (SO): Clemon University. URLhttp://hgic.clemson.edu/factsheets/HGIC2756.htm
17. Lewis, W., van Lenteren C, Phatak S and Tomlinson J. (1997), "A Total System Approach to Sustainable Pest Management.", Proceedings of the National Academy of Science USA 94:12243-12248.
18. Badakhshan Mahdi-Pour, Subramanian L Jothy, Lachimanan Yoga Latha, Yeng Chen and Sreenivasan Sasidharan, (2012), "Antioxidant activity of methanol extracts of different parts of Lantana camara", Asian Pacific Journal of Tropical Biomedicine
19. Sanjiv Kumar, Rajat Sandhir, and Sudarshan Ojha, (2014), "Evaluation of antioxidant activity and total phenol in different varieties of Lantana camara leaves."
20. HH Saparia, M Baidya and AR Mahesh (2012), "The Detail Study of Lantana camara Plant For Their Medicinal Importance- A Review"
21. Mohammad R et al. "An ethnomedical pharmacological and phytochemical review of some Bignoniaceae family plants and a description of Biognoniaceae plants in folk medicinal uses in Bangladesh". Adv. In Nat. Appl. Sci. 2010;4(3):236-253
22. Rabia Naz and Asghari Bano (2013), "Phytochemical screening, antioxidants and antimicrobial potential of Lantana camara in different solvents", Asian Pac J Trop Dis, V. 3(6)
23. Saikia AK and Sahoo RK (2011), "Chemical composition and Antibacterial Activity of Essential oil of Lantana camara L". Middle – East J.Scientific Res. 8 (3):602.
24. Sanjeeb Kalita, Gaurav Kumar, Loganathan Karthik, Kokati Venkata and Bhaskara Rao (2012), "A Review on Medicinal Properties of Lantana camara Linn.", Research Journal of Pharmacy and Technology, ISSN 0974-3618
25. Mishra A and Singh R (2009), "Allelopathic effect of Lantana camara extract of different parts on the growth of Parthenium hysterophorus L.", Flora and Fauna 15(2): 264-266.
26. Shetty LJ, Harikiran H and Fernandes J (2009), "Pharmacological evaluation of ethanolic extract of flowers of Tagetes erecta on epilepsy", Journal of Pharmacy Research, 2, 1035-1038.

27. M Melanie, W Hermawan, H Kasmara, A H Khalifa, M M Rustama and C Panatarani (2020), "Antifeedant properties of fractionation Lantana camara leaf extract on cabbage caterpillars (Crocidolomia pavonana Fabricius) larvae", IOP Conf. Series: Earth and Environmental Science 457 012047.
28. Sanjiv Kumar, Rajat Sandhir, and Sudarshan Ojha, (2014), "Evaluation of antioxidant activity and total phenol in different varieties of Lantana camara leaves."
29. Atmaram Vitthal Andhale: (2022), "The nutritive values of food resolved by development of leaves extract from Eucalyptus globulus (Nilgiri) to Targets of Callosobruchus maculates"; "International Journal of Entomology Research" Indexed Journal, Refereed Journal, Peer Reviewed Journal ISSN: 2455-4758, Impact Factor: RJIF 8, Volume: 7 Issue: 6 Year: 2022 Page Number: 10-17
30. Atmarm Vitthal Andhale "Formulation of the leaves extract of Syzygium cumini (Jambhul) targets to Callosobruchus maculatus to reserve the food grains", International Journal of Entomology Research, Volume 7, Issue 3, 2022, Page No. 118-125.