e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 5, Issue 11, November 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

6381 907 438 6381 907 438 ijmrset@gmail.com www.ijmrset.com

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 11, November 2022 |

| DOI:10.15680/IJMRSET.2022.0511010 |

Essential Oil of *Lippia alba* as a Protectant against Stored Food Commodities

Ajay Kr Mishra, Anil K Dwivedi, Naval Kishor Dubey

[1,3]CAS in Botany, Banaras Hindu University, Varanasi, U.P., India

[2]Dept. of Botany, DDU Gorakhpur University, Gorakhpur, U.P., India

ABSTRACT: The genus *Lippia* spp., belonging to the family Verbenaceae, has been investigated with regard to its insecticidal properties against other insect storage pests, as for example, *Tribolium castaneum* . The main compounds for *L. alba* were the terpenoid Carvone (25.17%), the monoterpenoids βMyrcene (12.00%), Geranial (11.87%), Neral (10.50%) and the terpene Limonene (9.70%). That is, the main essential oil components of *L. alba* oil are the monoterpenes. Monoterpenes possess insecticidal and insect repellent properties as described the chemical composition of essential oils can show large variability, both interspecific and within the same species. It seems to depend on the genetic characteristics of the plant and on the conditions under which it was grown. This has been observed when the components of the essential oils of different *L. alba* plants grown in different areas of Brazil were analyzed .Various studies with essential oils obtained from species of the genus *Lippia* spp., as it also showed good results regarding their insecticidal effect against other insect pests . Effects against insect storage pests with it main component (Carvacrol), that exhibited the maximum percentage of mortality and the highest repellent potency with RC50 of 0.22% for *T. castaneum,* and 0.20% for *Ulomoides dermestoides* . While, reported toxicity of fumigated linalool against *T. castaneum* Herbst (Coleoptera: Tenebrionidae), *Rhyzopertha dominica* (Coleoptera: Bostrichidae), and *Sitophilus oryzae* (Coleoptera: Curculionidae), in fumigation with Linalool, one of the compounds of *L. origanoides* essential oil, where Linalool was highly effective for *R. dominica,* and caused 100% mortality at the lowest tested concentration (0.1 mL/720 mL of volume). The limonene compound present in the essential oil of *L. alba* has toxic fumigant activity against *T. castaneum* . Have shown that substances such as benzylbenzoate, β-myrcene and carvone, also present in the essential oil of *L. alba*, have good repellent properties against this pest. It also demonstrated the toxic effect of dlimonene and carvones on *T. castaneum* larvae and adults, by contact and by fumigation. The results prove the insecticidal capacity of essential oils of *Lippia* spp. genus and hence their potential as active substances against *A. obtectus*. Joining in this way, the numerous genera of plants known and whose essential oils have shown insecticidal activity against this insect [53,54], in addition to other recently discovered biological control agents, such as fungi [55–58] or bacteria [59].

KEYWORDS: *Lippia alba*, storage, pests, insecticides, pesticides, grains, plants, essential oils, toxicity

I. INTRODUCTION

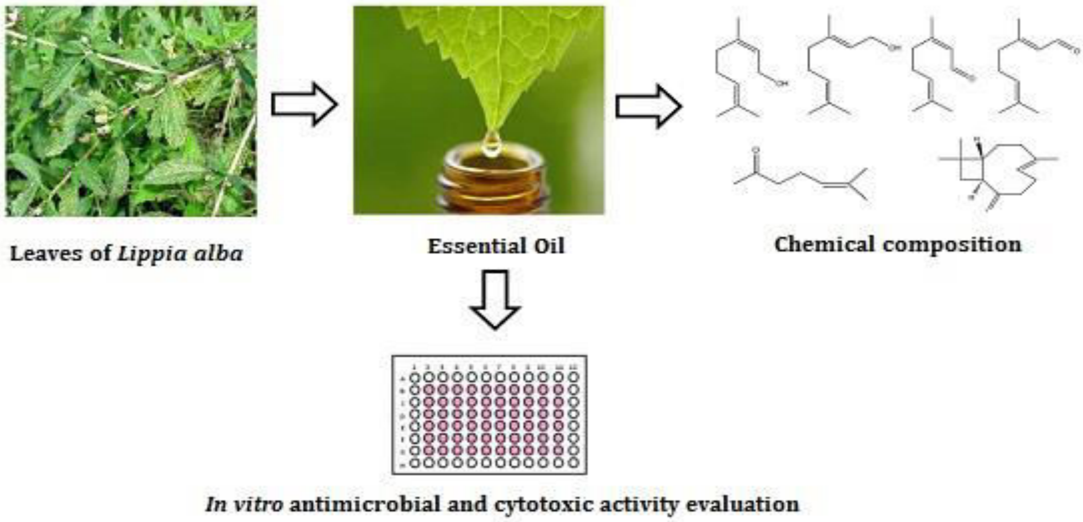
L. alba essential oils exhibited similar patterns of insecticidal activity over the insect. *L. alba* accumulated an insect mortality of 85.00 and 81.94%, respectively, significantly greatest than the lower applied doses of each essential oil.[1,2] However, all the lower doses applied of each oil were significantly greatest than the control treatment, with an accumulated mortality of 16.25%. These essential oils affected the survival of *A. obtectus* since the greatest doses applied on insects decreased the life of the bean weevil. The results prove the insecticidal capacity of essential oils of *Lippia* spp. genus and hence their potential as active substances against *A. obtectus* in environmentally low risk pest control strategies. Supplementary trials should be conducted under real storage conditions. Chemotypes I and III have been reported for different biological activities from the evaluations performed on microorganisms, fish, arthropods, small mammals, and cell lines; fundamentally associated with antibacterial, antifungal, cytotoxic, antioxidant, and sedative effects, among others. Records focused mainly on the health, fishing industry, and agrifood sectors.[3,4]Studies on the effect of *L. alba* essential oil are promising, but do not reflect a continuity of the research toward prototypes or finished commercial products. Research groups must unify evaluation methodologies and include in all studies the relationship between phytochemical and biological activity for the meta-analyses to be possible. Likewise, they must join efforts through the National System for Agricultural Innovation (SNIA, for the term in Spanish) to generate finished products that impact upon society and facilitate progress in the country's bio-economy.[5,6]

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 11, November 2022 |

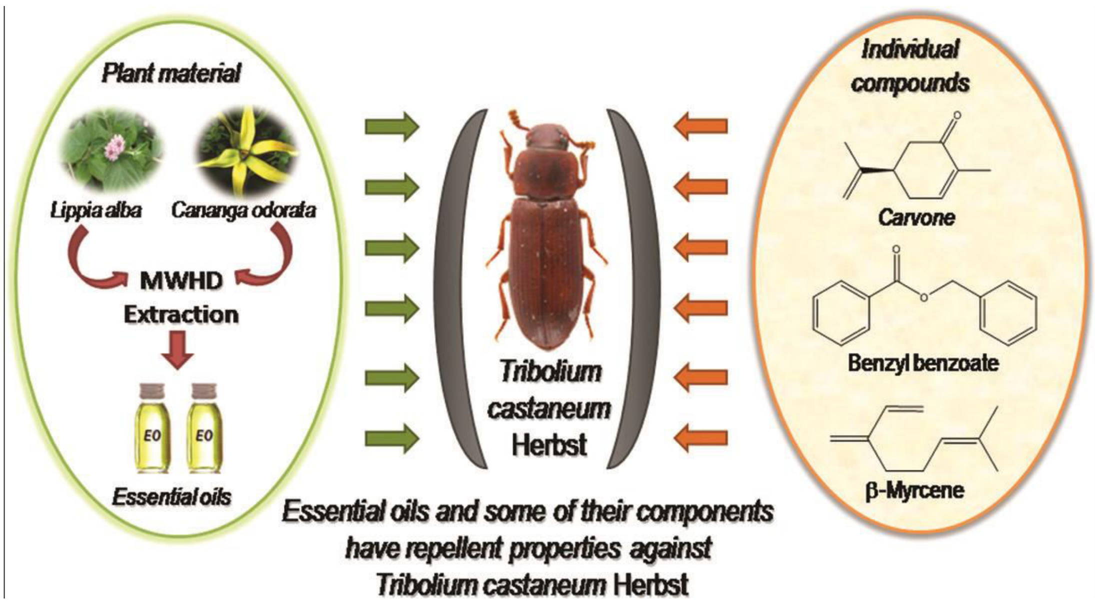
| DOI:10.15680/IJMRSET.2022.0511010 |



It is concluded that *L. alba* EO is a substance of broad spectrum of use, which is why industrial development is feasible based on this raw material. Nevertheless, it is necessary to establish within the SNIA research programs that prioritize the most consistent effects registered in this review, in accordance with national and global demands. Besides, progress is necessary on preliminary tests at pilot scale established by the Colombian norms to advance in the generation of commercial formulations.[7,8] One of the first steps in this respect corresponds to the methodological harmonization, given that in some studies there was no appropriate control of the variables interfering on the biological quality of the *L. alba* EO, no detailed phyto-chemical analyses were presented, nor were adequate controls involved to facilitate a subsequent meta-analysis that guides the prioritizing of investment resources in the most consistent application lines.[9,10]Another significant element is the generation of strategic alliances to elaborate protocols to standardize agro-economic management conditions of the plants in production zones, as well as articulation with the industry for scaling of the protocols formulated.[11,12]

II. DISCUSSION

Aromatic and medicinal plants produce essential oils in the form of secondary metabolites.



These essential oils can be used in diverse applications in food, perfume, and cosmetic industries. The use of essential oils as antimicrobials and food preservative agents is of concern because of several reported side effects of synthetic

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 11, November 2022 |

| DOI:10.15680/IJMRSET.2022.0511010 |

oils. Essential oils have the potential to be used as a food preservative for cereals,[13,14] grains, pulses, fruits, and vegetables. Essential oils of *L. alba* have pronounced antimicrobial and food preservative properties because they consist of a variety of active constituents (e.g., terpenes, terpenoids, carotenoids, coumarins, curcumins) that have great significance in the food industry. Thus, the various properties of essential oils offer the possibility of using natural, safe, eco-friendly, cost-effective, renewable, and easily biodegradable antimicrobials for food commodity preservation in the near future.[15,16]

Although some reviews on the potential of essential oils as repellents and/or insecticides have been published, there is no critical review about their use in stored products protection. One of the most important characteristics of essential oils, their phytotoxicity, may favor their use as herbicides, but at the same time limit their use in crop protection [14, 15]. Stored product sector seems to be a perfect candidate for the development of new EO-based alternative pest control strategies. A huge number of research studies aimed at assessing the insecticidal activity of EOs against crop pests as well as against disease vectors [1, 19], but less attention has been paid to stored product pests. Here, we briefly review the results achieved using EO treatments against stored product pests according to their application method (i.e., contact, fumigation, and ingestion) and insecticidal activity [17,18](i.e., toxicity and repellence). In detail, we empathize the most promising results for every insect family, highlighting, when possible, similarities or divergences between pest and/or EO plant species like *L. alba*. Furthermore, studies aimed at evaluating modifications of EOs activity attributable to geographic origin, EO-based formulations, synergism with other insecticidal compounds, and research studies reporting characteristic results were reported. Since many plants used for the EOs extraction often grow spontaneously in different natural habitats, their large-scale use should consider the cultivation of these essences to avoid negative impact in the ecosystems. Furthermore, many factors can influence the composition of essential oils. For example, the phenological stage and/or the part of the plant, the annual climatic variations, and the exposure can affect the relative amount of bioactive compounds constituting EOs. [20,21]Thus, to validate the insecticidal activity of EOs and their potential as active ingredients for commercial pesticides, several trials should be carried out testing essential oils produced in different years and geographical areas.[22,23]

III. RESULTS

Despite the promising results, there are few authorised commercial EO-based insecticide formulations available on the market obtained from *L. alba*.

Future research studies about the mechanisms of action of the *L. alba* EOs against insects are needed to develop effective EO-based insecticides. Indeed, deeper knowledge on this topic may be helpful to estimate the impact of EOs toward non target species and their safety for consumers. In addition, the effect on the sensory analysis of food treated with these compounds should be evaluated since, although this aspect is a main concern for costumers, it has been often disregarded. Therefore, a multidisciplinary approach, involving also chemists and food technologists, could be a route to develop new EO-based insecticide formulations, which could be successfully applied to different productive sectors.[24,25]

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 11, November 2022 |

| DOI:10.15680/IJMRSET.2022.0511010 |

IV. CONCLUSIONS

Among botanical extracts used as insecticides, essential oils (EOs) are promising alternatives to chemical insecticides. *L. alba* EOs are synthesized they play a key role in plant signaling processes including also attractiveness toward pollinators and beneficial insects. Plant species producing essential oils (over 17,000 species) are called aromatic plants and are distributed worldwide. Our review aims to evaluate research studies published in the last 15 years concerning the use of *L. alba* Eos[26,27] in stored product protection. More than 50% of the retrieved manuscripts have been published by authors from Eastern countries (Iran, China, India, and Pakistan), investigating different aspects related to insect pest management (exposure route, effect on the target pest, and mode of action). Coleoptera was the most studied insect order (85.41%) followed by Lepidoptera (11.49%), whereas few studies targeted new emerging pests (e.g., Psocoptera). Almost all the trials were carried out under laboratory conditions, while no experiments were conducted under real operating conditions. Future research studies concerning the use of EOs as insecticides should focus on the development of insecticide formulations which could be successfully applied to different production realities.[28,29]

REFERENCES

1) Agudelo-Gómez, L.S., Gómez, G.A., Durán, D.C., Stashenko, E., &Betancur-Galvis, L. (2010). Composición química y evaluación de la actividad antiherpética in vitro de aceites esenciales de *Lippia alba* (Mill) N.E. Brown y sus componentes mayoritarios. *Salud UIS*, *42*(3), 230-239.
2) Aldana, F., &Cruz, S. (2017). Larvicidal activity of essential oils of *Lippia alba* and *Lippia graveolens*, on *Aedes aegypti* L. *Revista Cientifica*, *26*(2), 36-48.
3) Almeida, A.P.G., Heinzmann, B.M., Val, A.L., &Baldisserotto, B. (2018). Essential oils and eugenol as anesthetics for *Serrasalmus rhombeus*. *Boletim Do Instituto de Pesca*, *44*(1), 44-50.
4) Anaruma, N.D., Schmidt, F.L., Duarte, M.C.T., Figueira, G.M., Delarmelina, C., Benato, E.A., … Sartoratto, A. (2010). Control of *Colletotrichum gloeosporioides* (penz.) Sacc. In yellow passion fruit using *Cymbopogon citratus* essential oil. *Brazilian Journal of Microbiology*, *41*(1), 66-73.
5) Armstrong, R., Hall, B.J., Doyle, J., &Waters, E. (2011). "Scoping the scope" of a cochrane review. *Journal of Public Health*, *33*(1), 147-150.
6) Aular, Y., Villamizar, M., Pérez, Y., &Pérez, V. (2016). Composición química y toxicidad aguda oral del aceite esencial de *Lippia alba* en ratones. *Salus*, *20*(1), 43-51.
7) Azambuja, C.R., Mattiazzi, J., Riffel, A.P.K., Finamor, I.A., Garcia, L.O., Heldwein, C.G., … Llesuy, S.F. (2011). Effect of the essential oil of *Lippia alba* on oxidative stress parameters in silver catfish (*Rhamdia quelen*) subjected to transport. *Aquaculture*, *319*(1), 156-161. DOI: https://DOI.org/10.1016/j.aquaculture.2011.06.002.
8) Baldissera, M.D., Souza, C., Mourão, R.H.V., Silva, L.V.F., &Monteiro, S.G. (2017). Trypanocidal action of *Lippia alba* and *Lippia origanoides* essential oils against *Trypanosoma evansi* in vitro and in vivo used mice as experimental model. *Journal of Parasitic Diseases*, *41*(2), 345-351. DOI: https://DOI.org/10.1007/s12639-016-0800-7.
9) Barrientos, J.C., Reina, M.L., &Chacón, M.I. (2012). Potencial económico de cuatro especies aromáticas promisorias para producir aceites esenciales en Colombia. *Revista Colombiana De Ciencias Hortícolas*, 6(2), 225-237.
10) Batista, E., Brandão, F.R., Majolo, C., Inoue, L.A.K.A., Maciel, P.O., Oliveira, M.R., … Chagas, E.C. (2018). *Lippia alba* essential oil as anesthetic for tambaqui. *Aquaculture*,*495*, 545-549. DOI: https://DOI.org/10.1016/j.aquaculture.2018.06.040.
11) Bersan, S.M.F., Galvão, L.C.C., Goes, V.F.F., Sartoratto, A., Figueira, G.M., Rehder, V.L.G., … Duarte, M.C.T. (2014). Action of essential oils from Brazilian native and exotic medicinal species on oral biofilms. *BMC Complementary and Alternative Medicine*, *14*(1), 1-12. DOI: https://DOI.org/10.1186/1472-6882-14-451
12) BIOinTropic, Universidad EAFIT, &Silo. (2018). *Estudio sobre bioeconomía como fuente de nuevas industrias basadas en el capital natural de Colombia. No. 1240667. Fase I: Anexo 4. Revisión de estudios previos y análisis de políticas de la Bioeconomía en Colombia*.Universidad EAFIT, Colombia. Retrieved from https://www.dnp.gov.co/Crecimiento-Verde/Documents/ejes-tematicos/Bioeconomia/informe%201/ANX4.%20An%C3%A1lisis%20estudios%20previos%20y%20%20pol%C3%ADticas%20relacionadas.pdf
13) Blanco, M.A., Colareda, G.A., Baren, C., Bandoni, A.L., Ringuelet, J., &Consolini, A.E. (2013). Antispasmodic effects and composition of the essential oils from two South American chemotypes of *Lippia alba*. *Journal of Ethnopharmacology*, *149*(3), 803-809. DOI: https://DOI.org/10.1016/j.jep.2013.08.007.

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 5, Issue 11, November 2022 |

| DOI:10.15680/IJMRSET.2022.0511010 |

14) Bouyahya, A., Guaouguaou, F.E., Dakka, N., &Bakri, Y. (2017). Pharmacological activities and medicinal properties of endemic Moroccan medicinal plant *Origanum compactum* (Benth) and their main compounds. *Asian Pacific Journal of Tropical Disease*, 7(10), 628-640. DOI: https://DOI.org/10.12980/apjtd.7.2017D7-31.
15) Caballero-Gallardo, K., Olivero-Verbel, J., &Stashenko, E.E. (2011). Repellent activity of essential oils and some of their individual constituents against *Tribolium castaneum* herbst. *Journal of Agricultural and Food Chemistry*, *59*(5), 1690-1696. DOI: https://DOI.org/10.1021/jf103937p
16) Cárdenas, C., Toni, C., Martos-Sitcha, J.A., Cárdenas, S., Heras, V., Baldisserotto, B., … Mancera, J.M. (2016). Effects of clove oil, essential oil of *Lippia alba* and 2-phe anaesthesia on juvenile meagre, *Argyrosomus regius* (Asso, 1801). *Journal of Applied Ichthyology*, *32*(4), 693-700. DOI: https://DOI.org/10.1111/jai.13048
17) Carvalho, P.M., Macêdo, C.A.F., Ribeiro, T.F., Silva, A.A., Silva, R.E.R., Morais, L.P., … Barbosa, R. (2018). Effect of the *Lippia alba* (Mill.) N.E. Brown essential oil and its main constituents, citral and limonene, on the tracheal smooth muscle of rats. *Biotechnology Reports*, *17*, 31-34. DOI: https://DOI.org/10.1016/j.btre.2017.12.002
18) Castillo, R.M., Stashenko, E., &Duque, J.E. (2017). Insecticidal and Repellent Activity of Several Plant-Derived Essential Oils Against *Aedes aegypti*. *Journal of the American Mosquito Control Association*, *33*(1), 25-35. DOI: https://DOI.org/10.2987/16-6585.1
19) Chagas, A.C.S., Oliveira, M.C.S., Giglioti, R., Santana, R.C.M., Bizzo, H.R., Gama, P.E., &Chaves, F.C.M. (2016). Efficacy of 11 Brazilian essential oils on lethality of the cattle tick *Rhipicephalus* (*Boophilus*) *microplus*. *Ticks and Tick-Borne Diseases*, 7(3), 427-432. DOI: https://DOI.org/10.1016/j.ttbdis.2016.01.001
20) Costa, D.C.M., Vermelho, A.B., Almeida, C.M., Dias, E.P.S., Cedrola, S.M.L., Arrigoni-Blank, M. F., … Alviano, D.S. (2014). Inhibitory effect of linalool-rich essential oil from *Lippia alba* on the peptidase and keratinase activities of dermatophytes. *Journal of Enzyme Inhibition and Medicinal Chemistry*, *29*(1), 12-17. DOI: https://DOI.org/10.3109/14756366.2012.743537
21) Cunha, M.A., Barros, F.M.C., Garcia, L.O., Veeck, A.P.L., Heinzmann, B.M., Loro, V.L., … Baldisserotto, B. (2010). Essential oil of *Lippia alba*: A new anesthetic for silver catfish, *Rhamdia quelen*. *Aquaculture*, *306*, 403-406. DOI: https://DOI.org/10.1016/j.aquaculture.2010.06.014
22) Cunha, M.A., Silva, B.F., Delunardo, F.A.C., Benovit, S.C., Gomes, L.C., Heinzmann, B.M., &Baldisserotto, B. (2011). Anesthetic induction and recovery of *Hippocampus reidi* exposed to the essential oil of *Lippia alba*. *Neotropical Ichthyology*, 9(3), 683-688. DOI: https://DOI.org/10.1590/S1679-62252011000300022
23) Célis, M. (2018). El último metaanálisis sobre antidepresivos: Nada nuevo bajo el sol. *Clínica Contemporánea*, 9(1), 1-5. DOI: https://DOI.org/10.5093/cc2018a7
24) Delgado, J., Sánchez, M.S., &Bonilla, C.R. (2016). Efecto del secado y la edad de las plantas en la composición de los aceites esenciales de *Lippia alba* (Mill.) N.E.Br. ex Britton & P. Wilson y *Lippia origanoides* Kunth. *Acta Agronómica*, *65*(2), 170-175. DOI: https://DOI.org/10.15446/acag.v65n2.47576
25) Duarte, M.C.T., Figueira, G.M., Sartoratto, A., Rehder, V.L., &Delarmelina, C. (2005). Anti-Candida Activity of Brazilian Medicinal plants. *Journal of Ethnopharmacology*,*97*(2), 305-311. DOI: https://DOI.org/10.1016/j.jep.2004.11.016
26) Duarte, M.C.T., Leme, E.E., Delarmelina, C., Soares, A.A., Figueira, G.M., &Sartoratto, A. (2007). Activity of essential oils from Brazilian medicinal plants on *Escherichia coli*. *Journal of Ethnopharmacology*,*111*(2), 197-201. DOI: https://DOI.org/10.1016/j.jep.2006.11.034
27) Durán, D.C., Monsalve, L.A., Martínez, J.R., &Stashenko, E.E. (2007). Estudio comparativo de la composición química de aceites esenciales de *Lippia alba* provenientes de diferentes regiones de Colombia, y efecto del tiempo de destilación sobre la composición del aceite. *Scientia et Technica*, 1(33), 435-438.
28) Escobar, P., Leal, S.M., Herrera, L.V., Martinez, J.R., &Stashenko, E. (2010). Chemical composition and antiprotozoal activities of Colombian *Lippia spp* essential oils and their major components. *Memórias do Instituto Oswaldo Cruz*, *105*(2), 184-190. DOI: https://DOI.org/10.1590/S0074-02762010000200013
29) Fauth, S., Campos, A.R., Silveira, E.R., &Rao, V.S. (2002). Efeitos de óleos essenciais de plantas no tempo de sono induzido por cetamina em camundongos. *Revista Brasileira de Farmacognosia*, *12*, 112-113. DOI: https://DOI.org/10.1590/S0102-695X2002000300052

INNO SPACE

SJIF Scientific Journal Impact Factor

Impact Factor

7.54

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com