Journal of Research in Forestry, Wildlife & Environment Vol. 10(1) March, 2018
http://www.ajol.info/index.php/jrfwe
jfewr ©2018 - jfewr Publications
E-mail:jfewr@yahoo.com
ISBN: 2141 – 1778
Ishaya et al., 2018

COMPARATIVE STUDY ON COMPOSITION OF INSECT IN CLOSE AND OPEN NURSERY OF FEDERAL COLLEGE OF FORESTRY JOS, PLATEAU STATE, NIGERIA

Ishaya, M.[1], Ombugadu, A.*[2], Daniel D. G.[1], Akemien, N.[1], Madaki, D.[1], Adejoh, V. A.[2], Lapang, M. P.[3], Ahmed, H. O.[2]

[1]Department of Pest Management Technology, Federal College of Forestry, Jos-Nigeria.
[2]Department of Zoology, Faculty of Science, Federal University of Lafia, Nasarawa State, Nigeria.
[3]Department of Zoology, Faculty of Natural Sciences, University of Jos, Jos-Nigeria.

*C**orresponding author:** *akwash24@gmail.com*

ABSTRACT

Nursery being an area where young plants are raised before sowing or transplanting in gardens or field contains rich insect assemblages whose composition and abundance is under researched even in research institutes. Thus, the comparative study on the composition of insect in close and open nursery of Federal College of Forestry Jos, Plateau State, Nigeria was carried out in May 2015 in relation to the abundance and diversity of insect using pitfall trap and hand-picking sampling techniques. A total of 2,052 individuals distributed into 13 orders, 39 families, 50 genera and 55 species were collected. 1,557 (75.9%) individuals were collected from the open nursery (with: 13 orders, 39 families, 41 genera and 46 species) while, 495 (24.1%) individuals were found in the close nursery (with: 11 orders, 27 families, 38 genera and 47 species). Five individuals could not be identified beyond class and order levels. The distribution of insect taxa in descending order showed that Hymenoptera (62.8%), Coleoptera (11.1%) and Orthoptera (10.1%) are the most dominant, with Hymenoptera occurring the most in both sites. There was no significant difference ($P > 0.05$) in the pooled abundance of insect from both sampling techniques between the two nursery types. Although, insect abundance from pitfall trap collection between the two nursery types showed a significant difference ($t = -2.494$, $df = 8$, $P = 0.03729$) while, no significant difference ($t = 1.0263$, $df = 8$, $P = 0.3348$) for hand-picked insect between the two nursery types. To this end, this study shows that the nursery of Federal College of Forestry Jos is healthy due to the abundant and diverse insect species recorded in which the phytophagus individuals are the most dominant group, but are kept under check by the predaceous ones. The pitfall trap was a more efficient collection technique and should be used by insect collectors.

Keywords: Close and open nursery, insect, pitfall trap, hand-picking

INTRODUCTION

A plant nursery is an area where young plants are raised before sowing or transplanting in gardens or field (Singh, 2002; Hazra *et al*., 2006). They are used for the artificial regeneration of plants through the use of planting materials like seeds, stem cutting, budding, grafting and layering. The establishment of nurseries has become a major feature of the urban landscape settlement. They are an economic activity creating viable employment for a number of families in the country and providing invaluable service in fast growing landscapes and horticultural industries (Bota, 2008). Although, nurseries are associated with residential homes, contain rich insect assemblages (Owen, 1991; Miotk, 1996; Saville, 1997) and are widespread across most urban locations, they tend to be under researched (Colding *et al.*, 2006). The diverse classification of nurseries as outlined by Opeke (1987) and Singh (2002) are peasant, temporary and standard or permanent nurseries. Bota (2008); Dives and Greer (2008) also identified production nursery or whole sale nursery, retail nursery, landscape nursery, and general purpose nursery.

Insect play an important role in the delivery of eco-system services which are important for some aspects of human livelihood such as agriculture, tourism and natural resource. However, they are also disease vectors to many other organisms, including humans (Turnock, 2012), and they have the capacity to alter the rates and directions of energy and matter fluxes in an ecosystem (Ramesh *et al.*, 2005; Tscharntke *et al.*, 2005; Choi and Miller, 2013). These insect do not only harm plants in but also deteriorate the quality of the produce thus hampering the medicinal value of medicinal plants (Sharma *et al.*, 2014). The agricultural significance of insect pests on crop plant is the damage they cause which reduces the quality and/or quantity of yield. Hence, this study surveyed insect found in close and open nursery of Federal College of Forestry Jos in relation to their abundance and diversity using two sampling techniques.

MATERIALS AND METHODS

Study Area

The experiment was carried out on the nursery of Federal College of Forestry Jos Plateau State Nigeria located in Northern guinea savannah between longitude 8º 20′N and latitude 9º 30′E. it has an average elevation of about 1,250 m above the sea level and stands at height of about 600m above the surrounding plains. The average temperature ranges between 21ºC to 25ºC. The climate of Jos is cool due to its high altitude with an annual rainfall of 1,260 mm. Relative humidity increases gradually from November to April.

Sample Collection

The study area was divided into two portions of experimental treatments open and close nursery types as shown in Plates 1 and 2. Three plots were selected from close and open nursery respectively with a distance of three beds in between them which is equivalent to 10 m. Three pitfall traps were set in each plot (nursery bed) made from bottle measuring 7cm in height were filled up with formalin so as to immobilize trapped insect and thereafter a funnel placed at the top. The traps were placed 2m apart and observed after every 24 hours (Bater, 1996; Zimmer *et al.,* 2000; Sfenthourakis *et al.,* 2005; Santos *et al.,* 2007). Additionally, hand-picking technique as adopted by Ellis (2013); Tuf (2015) was used to collect insects that were seen within the experimental plots. The collected insect from hand-picking technique were placed in separate collecting jars containing chloroform so that the active insect were immobilized and preserved in formalin for identification (Imam *et al*., 2010).

Plate 1: A close nursery

Plate 2: An open nursery

Identification of Insect

After sample collection, all the preserved insect in formalin were emptied into petri dishes, identified and counted at the Biology laboratory of Federal College of Forestry Jos with the aid of electric microscope, insect identification keys and illustration guides provided by Skaife *et al.* (1979); Castner (2000); Shattuck (2000) was used. Identified insect were then grouped into, Orders, Families, Genus, Species and common names based on the date of collection, technique used and total numbers presented in the sample container.

Statistical Analysis

The data obtained was analyzed using R Console software version 2.9.2. T-test was used to compare the mean number of insect collected between the close and open nursery sections for hand-picking and pitfall trapping collection techniques. Significant level was achieved if $P < 0.05$.

RESULTS

Composition of Insect Collected in the Nursery Sections of Federal College of Forestry Jos, Plateau State

A total of 2,052 individual insect (55 insect species were identified which spread across 13 orders, 39 families and 50 genera) were collected from Federal College of Forestry nursery (Table 1). Of which 495 individuals (24.12%) were collected from the close section with 11 orders, 27 families, 38 generals and 47 species accounted for while, the open section had 1,557 (75.88%) with 13 orders, 39 families, 41 generals and 46 species. Hymenoptera had the highest abundance followed by Coleoptera and the least was Mecoptera. Five individuals could not be identified beyond the level of Class and Order. The most abundant insect species identified were members of the Order Hymenoptera having 1,289 individuals (62.8%) followed by the Coleoptera with 228 individuals (11.11%) and Orthoptera with 209 Individuals (10.1%). Out of the 39 families identified, 8 contain predaceous insects and these families include Mantidae, Nabidae, Coccinellidae, Cantheridae, Staphylinidae, Lygaeidae, Pentatomidae, Tachinidae. On the other hand, phytophagous (plant feeding) insect belonging to 31 families were identified such as Tettigoniidae, Formicidae, Gryllidae, Tabanidae, Curculionidae, Meloidae, Nitidulidae, Chrysomelidae.

Comparison on the Mean Abundance of Insects Collected Between Close and Open Nursery Sections

The mean number of insects collected between close and open nursery sections using pitfall trapping technique showed no significant difference ($t = -1.909$, $df = 10.292$, $P = 0.0845$, Figure 1).

Comparison on the Mean Number of Insect Collected Between Close and Open Nursery Sections Using Hand Picking Technique

The mean number of insect collected between close and open nursery sections using the hand picking technique showed no significant difference ($t = -1.0263$, $df = 8$, $P= 0.3348$, Figure 2).

Comparison on the Mean Number of Insect Collected Between Close and Open Nursery Sections Using Pitfall Trapping Technique

The mean number of insect collected between close and open nursery sections using pitfall trapping technique showed significant difference ($t = -2.494$, $df = 8$, $P = 0.03729$, Figure 3).

Table 1: Checklist of Insect Collected in Federal College of Forestry, Jos

Order	**Family**	**Genus**	**Species**	**Open**	**Close**	**Total (%)**
Blattodae	Blattidae	*Blatta*	*B. orientalis*	3	6	9(0.43)
Blattodae	Blattellidae	*Blattella*	*B. germanica*	1	3	4(0.19)
Cicadas	Cicadidae	*Cicadetta*	*C. calliope*	4	0	4(0.19)
Coleoptera	Cleridae	*Trichodae*	*T. creticus*	1	1	2(0.09)
Coleoptera	Tenebrionidae	*Alobate*	*A. Pensylvanica*	0	8	8(0.39)
Coleoptera	Silphidae	*Necrophila*	*N.americana*	14	3	17(0.82)
Coleoptera	Lycidae	*Calopteron*	*C. terminale*	0	1	1(0.04)
Coleoptera	Staphylinidae	*Creophilus*	*C. maxillosus*	5	0	5(0.24)
Coleoptera	Curculionidae	*Scolytus*	*S. multistriatus*	2	1	3(0.14)
Coleoptera	Meloidae	*Epicauta*	*E. funebris*	12	18	30(1.46)
Coleoptera	Curculionidae	*Austroplatypus*	*A. incompertus*	82	20	102(4.97)
Coleoptera	Curculionidae	*Phyllobius*	*P. virideaeris*	1	0	1(0.04)
Coleoptera	Nitidulidae	*Stelidota*	*S. geminate*	6	4	10(0.48)
Coleoptera	Staphylinidae	*Osorius*	*O. latipes*	15	16	31(0. 92)
Coleoptera	Leiodidae	*Gelae*	*G. donut*	4	1	5(0.24)
Coleoptera	Latridiidae	*Corticaria*	*C. elongate*	4	2	6(0.29)
Coleoptera	Mordellidae	*Hoshihananomia*	*H. octopunctata*	1	0	1(0.04)
Coleoptera	Anthicidae	*Omonadus*	*O. bifasciatus*	1	4	5(0.24)
Coleoptera	Erotyllidae	*Gibbifer*	*G. californicus*	1	0	1(0.04)
Coleoptera	Scarabaeidae	*Coleomegilla*	*C. maculate*	1	1	2(0.09)
Collembola	Oncopoduridae	*Ceratophysella*	*C. denticula*	2	3	5(0.24)
Diptera	Sarcophagidae	*Sarcophaga*	*S. haemorrhoidalis*	4	1	5(0.24)
Diptera	Muscidae	*Musca*	*M. domestica*	8	11	19(0.92)
Diptera	Syrphidae	*Syrphus*	*S. opinator*	0	2	2(0.09)
Diptera	Tabanidae	*Chrysops*	*C. caecutiens*	2	0	2(0.09)
Hemiptera	Nabidae	*Nadidae*	*N. nabis*	9	4	13(0.63)
Hemiptera	Phyllidae	*Phyllium*	*P. giganteum*	1	1	2(0.09)
Hemiptera	Apidae	*Apis*	*A.* species	1	0	1(0.04)
Hemiptera	Lygaeidae	*Oncopeltus*	*O. fasciatus*	1	0	1(0.04)

Table 1 continues

Order	Family	Genus	Species	Open	Close	Total (%)
Hemiptera	Pentatomidae	*Chinavia*	*C. halaris*	13	9	22(1.07)
Hemiptera	Alydidae	*Alydus*	*A. calcaratus*	2	1	3(0.14)
Hemiptera	Scutelleridae	*Calliphera*	*C. excellens*	0	1	1(0.04)
Hemiptera	Reduviidae	*Redudius*	*R. personatus*	1	1	2(0.09)
Heteroptera	Cydnidae	*Thyreocoris*	*T. pulicarius*	1	1	2(0.09)
Hymenoptera	Formicidae	*Pogonomyrmex*	*P. Maricopa*	201	10	211(10.28)
Hymenoptera	Formicidae	*Pseudomyrmex*	*P. gracilis*	0	5	5(0.04)
Hymenoptera	Formicidae	*Campontus*	*C. pennsylvanicus*	50	8	58(2.82)
Hymenoptera	Formicidae	*Lasius*	*L. niger*	0	4	4(0.19)
Hymenoptera	Formicidae	*Solenopsis*	*S. invicta*	882	103	985(48.00)
Hymenoptera	Formicidae	*Tapinoma*	*T. sessile*	25	1	26(1.26)
Isoptera	Oniscidae	*Oniscus*	*O. asellus*	0	43	43(2.09)
Isoptera	Termidae	*Nanotermes*	*N. isaaae*	3	2	5(0.24)
Lepidoptera	Nymphalidae	*Argynnini*	*A. aglaja*	0	1	1(0.04)
Lepidoptera	Satyridae	*Pararge*	*P. aegeria*	2	0	2(0.09)
Mantodae	Mantodae	*Spodromatid*	*S. viridis*	1	6	7(0.34)
Mantodae	Mantidae	*Archimatis*	*A. latistyla*	1	0	1(0.04)
Mecoptera	Choristidae	*Taeniochorisca*	*T. bifurcate*	1	1	2(0.09)
Orthoptera	Tettigoniidae	*Conocephalus*	*C. discolor*	1	1	2(0.09)
Orthoptera	Tettigoniidae	*Scudderia*	*S. curvicauda*	3	0	3(0.14)
Orthoptera	Nymphalidae	*Speyeria*	*S. Cybele*	0	11	11(0.53)
Orthoptera	Gryllidae	*Allonemobius*	*A. fasciatus*	4	3	7(0.34)
Orthoptera	Acrididae	*Chorthippus*	*C. parallelus*	1	0	1(0.04)
Orthoptera	Tettigoniidae	*Belocephalus*	*B. sabalis*	3	0	3(0.14)
Orthoptera	Gryllidae	*Gryllus*	*G. assimillis*	64	45	109(5.31)
Orthoptera	Acrididae	*Camnula*	*C. pellucid*	24	51	75(3.65)
Unidentified larvae				88	76	164(7.99)
Total						**2052**

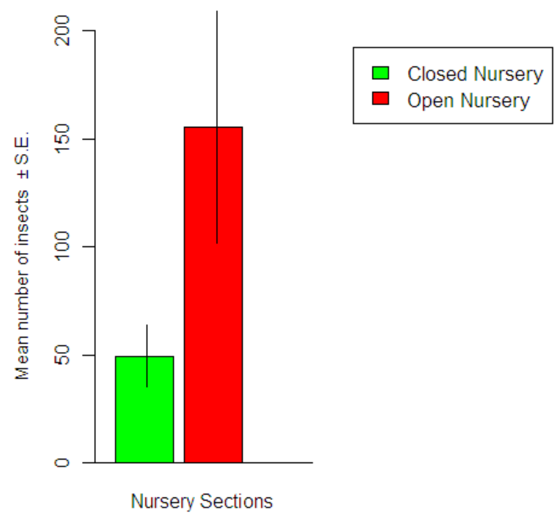

Figure 1: The mean abundance of insect collected between the close and open nursery

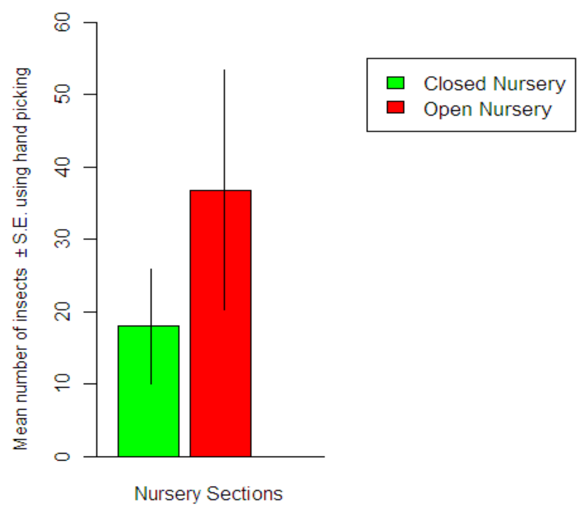

Figure 2: The mean abundance of insect collected from both nursery sections using the hand picking technique

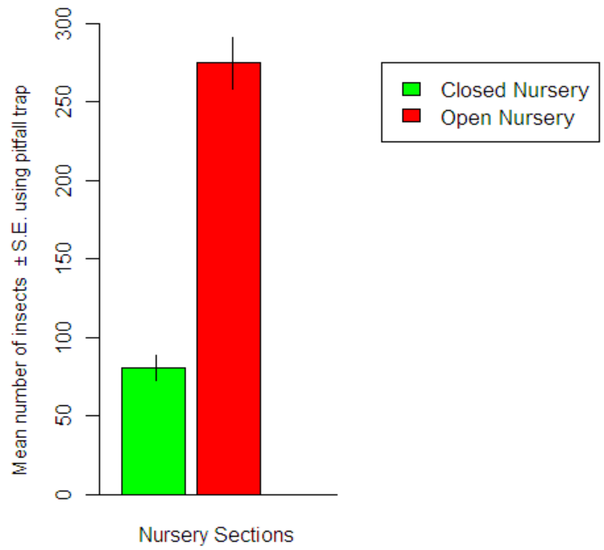

Figure3: The mean abundance of insect collected from both nursery sections using pitfall trap technique

DISCUSSION

Composition of Insect in Nursery

The pooled high abundance and diversity of insects recorded in this study (13 orders, 39 families, 50 genera and 55 species) clearly shows that the two nursery types are healthy environment. The lack of variation in the composition and abundance of insect across the two nursery types possibly suggests that they are home to a lot of insects which may be subject to a population boom or crash in seedlings growth dependent on whether the insect populations present are either good ecosystem engineers or pests. This can be attributed to the availability of resources, principal of which is food (plants which are the primary producers for every food chain), agrees with the findings of Seastedt and Crossley (2004) who reported that in the presence of abundant resources, arthropods population can grow geometrically or exponentially and when the resources become depleted, the population growth rate slows down and reproductive output by adults become reduced. Also, the insignificance in the abundance between the open and close nursery types may be due to the fact that the close nursery wasn't built to restrict insect but rather to regulate temperature. In addition, soil medium and seedlings brought into the close nursery may harbour insect, larvae and/or eggs. Furthermore, the entrance into the close nursery is usually left open for hours while gardeners go to and fro, tending (weeding, watering etc.) the garden.

The most dominant groups of insects observed in the study were Hymenoptera (1,289), Coleoptera (228) and Orthoptera (209). The abundance of Hymenoptera followed by Coleoptera is in line with studies by Liao *et al.* (2002) and Ombugadu *et al.* (2017) who reported that Hymenoptera and Coleoptera are the dominant groups in the tropical rainforest in China and the Amurum Forest Reserve and surrounding farmlands in Jos-Nigeria respectively. Similarly, the abundance of Hymenoptera, mostly members of the family Formicidae is similar to the work of Frouz and Ali (2004) who found Formicidae to be the dominant group of soil macro arthropods in Florida upland habitats. This could probably be linked with their burrowing habit which enables them to escape natural enemies and effects of insecticides. This also agrees with the findings of Hickman *et al.* (2001) who reported high number of ants of the family Formicidae in a study carried out in Aldabra rainforest of India where dominance was linked to their foraging and feeding habits.

Abundance of Insect in Relation to Sampling Techniques

The high variation between sampling techniques possibly suggests that pitfall trapping system may probably be connected with the time the traps were left to stand. This is in agreement with the work of Topping and Sunderland (1992) that catches by pitfall trap may be influenced by timing and placement of the traps. Animal that enter pitfall trap are unable to escape is a form of passive collection, as opposed to active collection where the collector catches each animal with hand (Ellis, 2013). It may also be that because the trap works throughout the time of stands, the number of catches may exceed that of the handpicking or it may possible be that some of the insects are more active in the night and it is difficult for them to detect the traps.

CONCLUSION AND RECOMMENDATION

The abundance of insect often serves as indicators of presence of good agricultural soil. There was high number of phytophagus (plant feeding) species encountered which may constitute pest problems to the nursery crops in addition to a good number of predaceous species which may help keep some of the pest species in check. Knowledge and detailed study on the various insect species that exist in both the open and the closed nursery will go along way solving great problems as most insect at their larval and adult stages are serious pest to agricultural crops.

REFERENCES

Bater, J. E. (1996). Micro and Macro-arthropods. G. S Hall (Ed). Methods for the examination of Organismal Diversity in soil Sediments.CAB International, Wallingford. 96 Pp.

Bota, M. G. (2008). Potential of horticultural nurseries inGhana: A case study in the Ghana North district of the GreaterAccra region. B.Sc. Thesis. University of Cape Coast, Ghana. Pp. 6-8, 24.

Castner, J. L. (2000). Photographic Atlas of Entomology and guide to Insects identification.

Choi, S. W. and Miller, J. C. (2013). Species richness and abundance among macro moths: A comparison of taxonomic, temporal and spatial patterns in Oregon and South Korea. The Entomological Society of Korea and Wiley Publishing Asia Pty Ltd.

Colding, J., Lundberg, J. and Folke, C. (2006). Incorporating green-area user groups in urban ecosystem management. *AMBIO,* **35*:*** 237–244.

Diver, S. and Greer, L. (2008). Sustainable small scale nursery production. ATTRA National Sustainable Agriculture Information Service. 1-800-346-9140.

Ellis, M. V. (2013). Impacts of pit size, drift fence material and fence configuration on capture rates of small reptiles and mammals in the new South Wales rangelands. *Australian Zoologist*, **36**: 404-412. Doi: 10.7882/AZ.2013.005.

Frouz,J and Ali, A. (2004) Soil macro-invertebrates along a successional gradient in central Florida. Fla Entomol. 1290 Pp.

Hazra, P., Ghosh, S. K., Maity, T. K., Pandit, M. K. and Som, M. G. (2006).*Glossary of Horticulture*. Kalyani Publishers, New Delhi, India. Pp. 126-136.

Hickman, C, P., Roberts, L. S. and Larson, A. (2001). Integrated principles of Zoology. MC Graw Hill (11thEdition). 908 Pp.

Imam T.S., Yusuf, A. U. and Mukhtar, J. (2010). Department of biological science BayeroUniversity. *Int. J. Biol. Chem. Sci.*, **4**(2): 400-406.

Liao, C., Li J. and Yueping, Y. (2005). The Community of soil animals in the tropical rain forest in Jianfeng Mountain, Hainan Island, China: Composition and characteristics of community. *Acto Ecologica Sinica,* **22**(11): 1866-1872.

Miotk, P. (1996). The naturalized garden- a refuge for animals?—First results. *Zool. Anz.*, **235**: 101–116.

Ombugadu, A., Mwansat, G. S., Chaskda, A. A. and Njila, H. L. (2017). Comparative Insect Abundance and Diversity in Amurum Forest Reserve and Surrounding Farmlands, Jos, Nigeria. *Ethiopian Journal of Environmental Studies & Management*, **10**(9): 1200 – 1210, ISSN:1998-0507, doi: https://ejesm.org/doi/v10i9.8

Opeke, L. K. (1987). Tropical Tree Crops.Woye and Sons Ltd., Ilorin. Pp. 9-20.

Owen, J. (1991).The Ecology of a Garden: the First Fifteen Years. Cambridge University Press: Cambridge, UK.

Ramesh, T., Hussain, K. J., Selvanayagam, M., Satpathy, K. K. and Prasad, M. V. R. (2010). Patterns of diversity, abundance and habitat association of butterflies communities in heterogeneous landscapes of Department of Atomic Energy (DAE) Campus at Alpakkam, South India. *International Journal of Biodiversity and Conservation*, **2**: 75-85.

Santos, S. A. P., Enduardo, C. J., and Alberto, P. J. (2007). Abundance and diversity of soil arthropods in olive grove ecosystem (Portugal): Effects of pitfall trap type. *European Journal of Soil Biology*, **43**: 77-83.

Saville, B. (1997). The Secret Garden: Report of the Lothian Secret Garden Survey; Lothian Wildlife Information Centre: Edinburgh, Scotland.

Seastedt, T. R. and Crossley, D. A. (2004). The influence of Arthropods on Ecosystem. *Bioscience,* **34**: 157-161

Sfenthourakis, S., Anastasiou, K., and Strutenschi, T., (2005). Altidunal terrestrial isopod diversity. *European Journal of Soil Biology*, **41**: 91-98.

Sharma, P. C, Kumar, A., Mehta, P. K., and Singh, R. (2014). Department of Entomology, College of Agriculture, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176062, Himachal Pradesh, India Himalayan Forest Research Institute, Panthaghati, Shimla, Himachal Pradesh, India.

Shattuck, S.O. (2002). Australian ants, their Biology and Identification CSIRO Publishing. 226 Pp.

Singh J. (2002). Basic Horticulture. Kalyani Publishers, New Delhi, India. P 65.

Skaife, S. H., Ledger, J. and Bannister, A. (1979). African Insects Strulk Publishers. 354 Pp.

Topping, C. J. and Sunderland, K. D. (1992). Limitations to the use of pitfall traps in Ecological studies exemplified by a study of spiders in a field winter wheat. *Journal of Applied Ecology*, **29**: 485-491.

Tscharntke, T., Klein, A. M., Kruess, A., Steffan-Dewenter, I. and Thies, C. (2005). Landscape perspectives on agricultural intensificationand biodiversity: Ecosystem service management. *Ecology Letters*, **8**: 857-874.

Tuf, I. H. (2015). Different collecting methods reveal different ecological groups of centipedes (Chilopoda). *Zoologia*, **32**(5): 345-350.

Turnock, W.J. (2012). Zoology Historica Canada blog.

Zimmer, M., Brauckmann, H. J., Broll, G.and Topp, W. (2000). Correspondence analytical evaluation of factors that influence soil macroarthropod distribution in abandoned grassland. *Pedobiologia*, **44**: 695-704