



Exploration of Indigenous Flora in Ede: Identifying Native Nigerian Plants as Alternatives to Exotic Species for Ornamental Use.

*OGUNSUMI, Akintunde Israel^{1,2}, OWONIBI, Sustain Kehinde¹, IGBOAMA, Magdalene C.³, OLUFADE, Ikeolu Idowu¹, ADAMU, Jacob Eshimokhai¹, AWOYEMI, Olakunle Kolawole⁴, AJAO, Idowu Taoheed¹

¹Department of Biological Science, School of Science and Technology, Federal Polytechnic, Ede, Osun state, Nigeria.

²Department of Botany, University of Ibadan, Ibadan, Nigeria

³Department of Science Laboratory Technology, Federal Polytechnic, Ede, Osun state, Nigeria

⁴Department of Geography, University of Ilorin, Ilorin Nigeria

Corresponding author: ayobamidele.israel@gmail.com , ogunsumi.israel@gmail.com 08032321916.

ABSTRACT: This study explored the indigenous flora of Ede, Osun State, Nigeria, to identify native plant species with potential as ornamental alternatives to exotic species. Despite the ecological and economic benefits of native species, ornamental horticulture in Nigeria has historically emphasized exotic plants, often leading to biodiversity loss and increased maintenance costs. Recognizing the adaptability and resilience of native flora, this research aims to provide sustainable landscaping solutions while promoting the conservation of Nigeria's plant biodiversity. The study involved a systematic field survey in various habitats across Ede to identify aesthetically appealing, hardy, and versatile native species suitable for ornamental use. Plants were selected based on visual attributes, such as flower colour, leaf texture, and growth form, and their adaptability to local environmental conditions. Specimens of identified species were collected for taxonomic identification at the Forestry Research Institute of Nigeria (FRIN) herbarium. Results revealed that the native plant species such as *Cnestis ferruginea*, *Gloriosa superba*, *Sansevieria liberica*, *Ehretia cymosa*, *Anthocleista vogelii*, and *Leucaena leucocephala* among others, exhibited strong aesthetic and functional qualities for various landscape settings, from formal gardens to urban green spaces. These plants would not only enhance environmental beauty but also support biodiversity. Also, they would be resilient to local pests and diseases, thus reduced maintenance needs. *C. ferruginea*, *G. superba*, *S. liberica*, *E. cymosa*, *A. vogelii*, and *L. leucocephala* are hereby recommended as alternatives to exotic species for ornamental use.

Keywords: Indigenous flora, Native plants, Ornamental horticulture, Biodiversity conservation, Sustainable landscaping

1.0 INTRODUCTION

1.1 Background of the Study

Ornamental plants are integral to urban landscaping, gardening, and urban beautification, offering a multitude of benefits ranging from aesthetic enhancement to ecological and environmental improvements. They support mental and physical health, contribute to biodiversity, aid in pollution mitigation, and provide habitats for pollinators. The strategic use of native and well-adapted species can ensure sustainable and low-maintenance urban green spaces, while certain ornamental plants also offer phytoremediation capabilities (Arslan and Yanmaz, 2009; Liu, *et al.*, 2018; Sumangala, 2019; Cong, L., and Han, 2020; Rudnyk-Ivashchenko *et al.*, 2021; Francini *et al.*, 2023; Palmersheim *et al.*, 2022; Orlóci and Fekete, 2023;).

Globally, the demand for exotic species in horticulture has been substantial due to their perceived beauty, variety, and resilience under controlled environments. However, the introduction, cultivation and heavy reliance on non-native, exotic plant species for ornamental purposes comes with certain ecological, economic, and environmental implications. The key factors influencing these invasions include the role of horticulture; which comes with the risk of invasive species outcompeting native flora, loss of biodiversity, increased maintenance costs due to the need for specialised care for foreign species, soil nutrient dynamics, plant-soil feedback mechanisms, and land use practices (Callaway *et al.*, 2004; Parker *et al.*, 2006; Besaw *et al.*, 2011; Heckman *et al.*, 2016; Heckman *et al.*, 2017; Van

Kleunen *et al.*, 2018; Ennos *et al.*, 2019; Pellegrini *et al.*, 2021). Invasive alien species in Nigeria compete with indigenous plants for space, nutrients, and sunlight, affecting their potential yield and biodiversity conservation (Borokini, 2011).

In Nigeria, ornamental horticulture has predominantly focused on the importation and cultivation of exotic plants, often overlooking the country's rich native biodiversity. Native plants, which are well-adapted to local climate and soil conditions, present a largely untapped resource for ornamental use. Additionally, there is a significant lack of interest and research in the field of ornamental horticulture in Nigeria, particularly concerning native plant species. This neglect is partly due to difficulties in plant identification and a general lack of awareness about the value of ornamental plants (Oloyede *et al.*, 2007)

Native ornamental plants in Nigeria are naturally adapted to the ecological conditions of their native regions and they demonstrate significant resilience to local pests, diseases, and climate fluctuations. This resilience is supported by their effective use as biopesticides, their adaptation to local climatic conditions, and their co-evolved relationships with other native species. These attributes make them valuable for sustainable agriculture and environmental sustainability by preserving local ecosystems and supporting biodiversity (Sambo, 2014; Imarhiagbe and Aigbokhan, 2019; Ali *et al.*, 2022).

The Nigerian flora is characterised by a rich diversity of plant species with about 7,895 recorded and 128 endemic species (Osawaru *et al.*, 2019) many of which have yet to be explored for their ornamental potential due to lack of information and poor research attention (Amonum *et al.*, 2019; Omonhinmin *et al.*, 2021).

Indigenous plants in local bushes, savannas, forests, and wetlands often possess aesthetic qualities such as unique foliage, vibrant flowers, or structural form, visual beauty, seasonal aspects, fragrance, and charm, which could make them suitable for landscaping and horticultural design due to their distinctive cultural characteristics, regional attributes, good ecological adaptability, and correct management cost performance (Wu and Lin, 2014; Sangma and Chaurasiya, 2021; Liu *et al.*, 2024). Unfortunately, the horticultural potential of many native species remains largely underutilized (Hamadina, *et al.*, 2018) overshadowed in Nigeria, by the widespread adoption of exotic plants imported from other regions, particularly temperate zones (David *et al.*, 2021). In their studies, [Pergl *et al.*, 2016; Van Kleunen *et al.*, 2018) reported that ornamental horticulture plays a prominent role in plant invasions, with at least 75% and 93% of the global naturalised alien flora grown in domestic and botanical gardens, respectively.

In recent years, there has been growing global awareness of the importance of conserving native flora and incorporating indigenous plants into ornamental horticulture, as this really helps conserve plant biodiversity by spreading rare and endemic species, enhancing their survival chances, significantly strengthen plant conservation by expanding the capacity for ex situ living collections and raising awareness among gardeners and plant collectors. This trend is driven by a desire to restore ecological balance, reduce water usage, and promote sustainable gardening practices. The use of native plants is especially important in regions like Nigeria, where climate change, habitat degradation, and urban expansion threaten the survival of local plant species (Di Martino *et al.*, 2020; Ismail *et al.*, 2021).

This study aims to explore the indigenous flora of Ede town and its environs in Osun state, Nigeria, to identify wild native plants that can serve as alternatives to exotic species for ornamental purposes, and ensuring budding propagation of the plant species.

2.0 MATERIALS AND METHODS

2.1. Study Area

The field exploration and plant collection were conducted in various locations within Ede, and its environs, in Osun State, Nigeria, between the geographic coordinates 7.6988°N to 7.7021°N and 4.4588°E to 4.4602°E. Key collection points included 7.6997°N, 4.4644°E; 7.6988°N, 4.4610°E; 7.7021°N, 4.4602°E; 7.7015°N, 4.4588°E; 7.7016°N, 4.4594°E; and 7.7021°N, 4.4586°E. The area is bounded to the South by Ayedade, to the East by Atakumusa and Osogbo, to the North by Egbedore and to the West by Ejigbo and Ayedire Local Governments Areas of Osun State.

2.2. Field Exploration and Plant Identification

The field exploration involved systematic plant surveys in different habitats, including forests, grasslands, and disturbed bushlands around Ede. Transect walks and random sampling techniques were employed to identify and

select aesthetically pleasing, hardy, and versatile native plant species that could be suitable for ornamental use. The selection criteria included plants that exhibit visual appeal (flower colour, leaf texture, growth form) and are resilient to local environmental conditions, as recommended by (Schutzki, 2005). Initial identification of plants in the field was done using local floras and guides by "Flora of West Tropical Africa" (Dalziel, 1938; Hutchinson and Dalziel, 1954). Plants with ornamental potential, especially herbs and shrubs, were tagged for further study.

2.3. Specimen Collection for Taxonomic Identification

Plant specimens were carefully collected from identified species. For each species, segments of the plant were cut, ensuring that the samples included the following key structures including; fully developed leaves for assessing leaf morphology, flowers and fruits to study reproductive structures critical for taxonomic classification (de Souza, *et al.*, 2022) as well as roots or underground structures (where applicable) to include rhizomes or tubers. The plant specimens were cut using sterilised pruning shears, with each segment approximately 4-6 inches in length. Each cutting was labeled with the plant's location, date of collection, and temporary identification notes. Specimens were transported in breathable plastic bags to prevent wilting during transport (Asher and Eckert, 1973).

2.4. Taxonomic Identification at FRIN Herbarium

The collected specimens were submitted to the Forestry Research Institute of Nigeria (FRIN) herbarium for detailed taxonomic identification. In the herbarium, taxonomists cross-referenced the specimens with their existing collections and utilised dichotomous keys for species confirmation. Proper documentation of each species was carried out, following standard protocols to ensure precise identification and classification.

2.5. Preparation of Plant Cuttings for Propagation

Healthy plant cuttings were selected from the identified species, focusing on stems or buds with several nodes and fully developed leaves. A 4-6 inch cutting was made from the parent plant using a sterilised, sharp knife at a 45-degree angle. The angled cut helps increase the surface area for rooting.

2.6. Aloe Vera Application to Promote Rooting

To encourage faster root development, the cut sections of the plant stems were treated with aloe vera gel. Aloe vera is known for its ability to stimulate root growth due to its auxins, amino acids, and antiseptic properties (Hendi, 2021). The gel was applied directly to the base of each cutting, where it serves to promote rooting and protect against microbial infections during the propagation period (Radha and Laxmipriya, 2015).

2.7. Planting in Nursery Bags

The treated cuttings were inserted into nursery bags filled with a well-draining soil mixture of sandy loam and perlite in a 2:1 ratio. This mixture ensures proper aeration, draining, insulation, and prevents waterlogging in potting mixes, all critical for rooting success (Promdee *et al.*, 2015). A small hole was made in the soil to insert the cutting, ensuring that at least one or two nodes were buried beneath the soil surface for optimal rooting.

2.8. Maintenance of the Nursery Environment

The nursery bags containing the cuttings were placed in a shaded area with indirect sunlight. Regular watering was performed to keep the soil consistently moist but not waterlogged. Watering frequency was adjusted to suit the environmental conditions, ensuring the soil remained conducive to root development. Root development was monitored over a period of 2-4 weeks this is because literature suggest that rooting typically occurs within this period, depending on the plant species and environmental conditions (Yadav and Singh, 2018; Awotedu, 2021). Root growth was checked by gently tugging on the cuttings after two weeks to assess resistance, an indication of successful rooting (Haling *et al.*, 2013).

2.9. Acclimatisation and Transition to Mature Care

Once healthy root systems were observed, the cuttings were gradually exposed to increased sunlight by moving them from shaded to partially sunny areas (Schroeter-Zakrzewska and Pradita, 2021) over the course of one week. This acclimatisation helps the young plants adjust to direct light and prevents stress or sunburn. After successful acclimatisation, the rooted plants were transitioned to regular care, with further watering, feeding, and monitoring

for pests or diseases. The goal was to treat these newly established plants as mature specimens, following standard horticultural practices for long-term maintenance.

3.0 RESULTS AND DISCUSSION

The result of the list of the plant species collected from the study are presented in Table 1 while the cross section of some of the plants are presented in Plate 1. The plants exhibited significant aesthetic appeal, making them highly suitable for various ornamental purposes. Their diverse forms, colors, and textures enhance their potential for use in a range of landscape designs, from formal gardens to urban green spaces. These species not only contribute to the beauty of the environment but also offer versatility in different landscape settings.

Table 1: List of native plants found in Ede and its environs that can serve as alternatives to the exotic ornamental plants

Label ID	Scientific name	Family	Common Name
A	<i>Cnestis ferruginea</i>	Connaraceae	Horn-of-plenty
B	<i>Combretum platypterum</i>	Combretaceae	Hakpa-namu
C	<i>Gloriosa superba</i>	Colchicaceae	Flame lily
D	<i>Sansevieria liberica</i>	Dracaenaceae	African bow-string hemp
E	<i>Anthocleista vogelii</i>	Gentianaceae	Murderer's Mat,
F	<i>Antiaris africana</i>	Moraceae.	Antiaris, Bark cloth tree, False iroko, and Upas tree.
G	<i>Blighia sapida</i>	Sapindaceae	Ackee or Akee
H	<i>Ehretia cymosa</i>	Koda Tree, Puzzlebark, Carribean Raintree	Boraginaceae
I	<i>Alstonia boonei</i>	Cheese wood, pattern wood or stool wood	Apocynaceae
J	<i>Leucaena leucocephala</i>	Lead Tree, Reuse Wattel, White Popinac, Horse Tamarind, Wild Tamarind, Leucaena, Jumbie Bean, Jumbay, Ipil-ipil, Petai Jawa,	Fabaceae
K	N/A	N/A	Treated stem cuttings planted in nursery bags



Cnestis ferruginea



Combretum platypterum



Gloriosa superba



Sansevieria liberica



Anthocleista vogelii



Antiaris africana



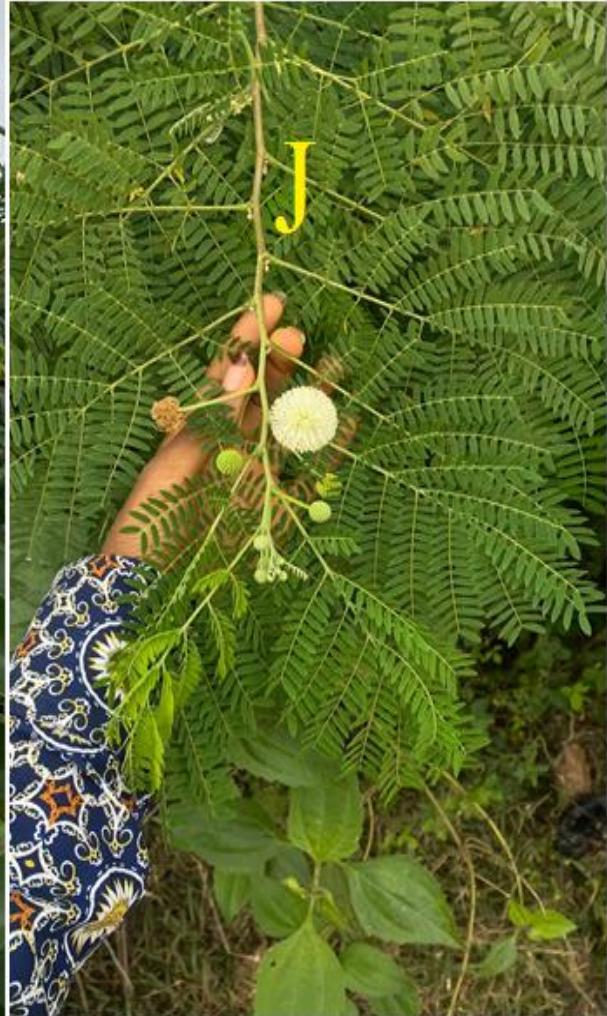
Blechnia savida



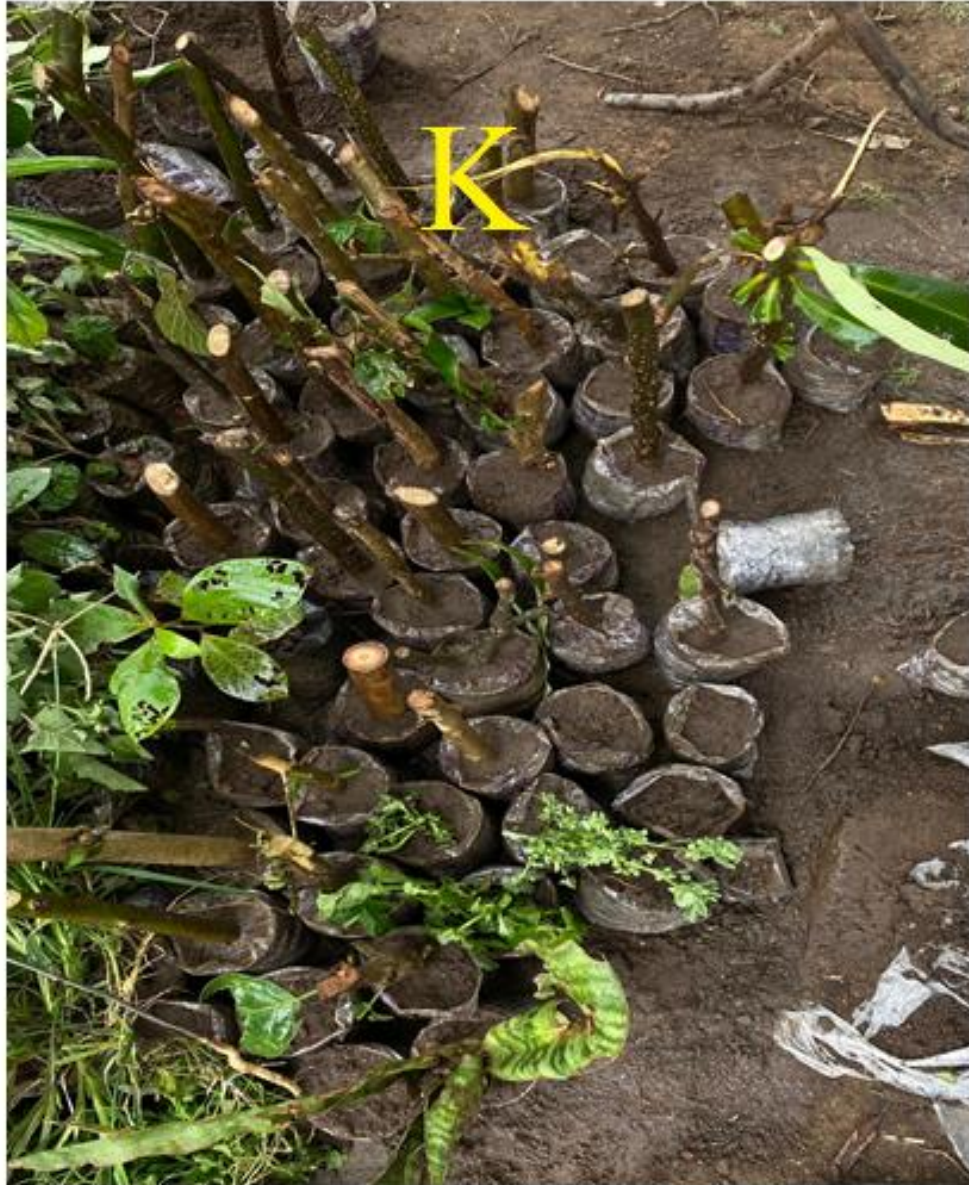
Ehretia cymosa



Alstonia boonei



Leucaena leucocephala



Treated stem cuttings planted in nursery bags

Plate1: Cross-Section of Native Plants found in Ede and its environs that can serve as alternatives to the exotic ornamental plants

After the budding process, here are some images of plants with attractive ornamental qualities that can serve as alternatives to exotic species:







Plate 2 shows some of the images of plants with attractive ornamental qualities that can serve as alternatives to exotic species.

4.0 CONCLUSION

From the literature and the findings of this research, it has been revealed that native plants can serve as ornamental species. In Nigeria and Africa as a whole, there exists a vast wealth of native plants with significant ornamental potential. However, there remains an overreliance on exotic species. This study, focusing on the flora of Ede and its environs, has identified numerous wild native plants, such as *Cnestis ferruginea*, *Gloriosa superba*, *Sansevieria liberica*, *Ehretia cymosa*, *Anthocleista vogelii*, and *Leucaena leucocephala*, that demonstrate strong potential as ornamental alternatives. These findings represent just a fraction of the untapped botanical resources available in the region.

By employing herbarium standardization for accurate species identification and exploring propagation techniques like budding for commercial production, a sustainable approach to ornamental horticulture can be established. Furthermore, addressing the threat posed by invasive alien species, which compete with indigenous flora and threaten biodiversity, underscores the importance of promoting native plants. By utilizing species naturally adapted to local climates and soils, Nigeria can enrich both its national and global horticultural landscapes, paving the way for sustainable and diverse ornamental practices.

References

- Ali, A. D., Ior, L. D., Dogo, G. A., Joshua, J. I., and Gushit, J. S. (2022). Ethnobotanical survey of plants used as biopesticides by indigenous people of plateau state, Nigeria. *Diversity*, 14(10), 851.
- Amonum, J. I., Ikyaagba, E. T., and Dawaki, S. A. (2019). Flora Diversity and Distribution in Falgore Game Reserve, Kano State, Nigeria. *Journal of Applied Life Sciences International*, 20(3), 1-13.
- Asher, J. E., and Eckert, R. E. (1973). Development, testing, and evaluation of the deep furrow drill arm assembly for the rangeland drill. *Rangeland Ecology & Management/Journal of Range Management Archives*, 26(5), 377-379.

- Arslan, M., and Yanmaz, R. (2009). Use of ornamental vegetables, medicinal and aromatic plants in urban landscape design. In *II International Conference on Landscape and Urban Horticulture 881* (pp. 207-211).
- Awotedu, B. F., Omolola, T. O., Akala, A. O., Awotedu, O. L., and Olaoti-Laaro, S. O. (2021). Vegetative propagation: A unique technique of improving plants growth. *World News of Natural Sciences*, 35, 83-101.
- Besaw, L. M., Thelen, G. C., Sutherland, S., Metlen, K., and Callaway, R. M. (2011). Disturbance, resource pulses and invasion: short-term shifts in competitive effects, not growth responses, favour exotic annuals. *Journal of Applied Ecology*, 48(4), 998-1006.
- Borokini, T. I. (2011). Invasive alien plant species in Nigeria and their effects on biodiversity conservation. *Tropical Conservation Science*, 4(1), 103-110.
- Callaway, R. M., Thelen, G. C., Rodriguez, A., and Holben, W. E. (2004). Soil biota and exotic plant invasion. *Nature*, 427(6976), 731-733.
- Cong, L., and Han, D. (2020). Ecological characteristics of high quality wild ornamental plants in South China. *Israel Journal of Ecology and Evolution*, 67(1-2), 98-105.
- Dalziel, J. M. (1938). The Useful Plants of West Tropical Africa. *The Geographical Journal*, 91(3), 279.
- David, O. A., Akomolafe, G. F., Onwusiri, K. C., and Fabolude, G. O. (2021). Predicting the distribution of the invasive species *Hyptis suaveolens* in Nigeria. *European Journal of Environmental Sciences*, 10(2), 98-106.
- de Souza, L. A., Lemos, G. F., Bortolato, A. R., & de Oliveira, J. H. G. (2022). Flower structure and fruit ontogeny of *Richardia brasiliensis* Gomes and *Diodia radula* (Willd.) Cham. and Schltdl. (Rubiaceae). *Concilium*, 22(4), 867-874.
- Di Martino, L., Di Cecco, V., Di Cecco, M., Di Santo, M., Ciaschetti, G., and Marcantonio, G. (2020). Use of native plants for ornamental purposes to conserve plant biodiversity: Case of study of Majella National Park. *Journal for Nature Conservation*, 56, 125839.
- Ennos, R., Cottrell, J., Hall, J., and O'Brien, D. (2019). Is the introduction of novel exotic forest tree species a rational response to rapid environmental change? –A British perspective. *Forest ecology and management*, 432, 718-728.
- Francini, A., Toscano, S., Ferrante, A., and Romano, D. (2023). Method for selecting ornamental species for different shading intensity in urban green spaces. *Frontiers in Plant Science*, 14, 1271341.
- Haling, R. E., Brown, L. K., Bengough, A. G., Young, I. M., Hallett, P. D., White, P. J., and George, T. S. (2013). Root hairs improve root penetration, root–soil contact, and phosphorus acquisition in soils of different strength. *Journal of experimental botany*, 64(12), 3711-3721.
- Hamadina, E. I., Hamadina, M. K., and Solomon, T. B. (2018). Food security in the face of climate change: potential roles of underutilised plant species around some rural homesteads in the Niger Delta. *Natural Resources*, 9(3), 55-72.
- Heckman, R. W., Halliday, F. W., Wilfahrt, P. A., and Mitchell, C. E. (2017). Effects of native diversity, soil nutrients, and natural enemies on exotic invasion in experimental plant communities. *Ecology*, 98(5), 1409-1418.
- Heckman, R. W., Wright, J. P., and Mitchell, C. E. (2016). Joint effects of nutrient addition and enemy exclusion on exotic plant success. *Ecology*, 97(12), 3337-3345.
- Hendi, D. M. (2021). Utilization of Aloe vera gel as growth enhancer on micropropagation of *Eucalyptus citriodora* hook plant. *Scientific Journal of Flowers and Ornamental Plants*, 8(1), 55-63.

- Hutchinson, J., and Dalziel, J. M. (1954). Flora of West Tropical Africa.
- Imarhiagbe, O., and Aigbokhan, E. I. (2019). Studies on *Thonningia sanguinea* Vahl. (Balanophoraceae) in southern Nigeria. Range and host preference. *International Journal of Conservation Science*, 10(4), 721-732.
- Ismail, S. A., Pouteau, R., van Kleunen, M., Maurel, N., and Kueffer, C. (2021). Horticultural plant use as a so-far neglected pillar of ex situ conservation. *Conservation Letters*, 14(5), e12825.
- Liu, X., Li, C., Zhao, X., and Zhu, T. (2024). Arid urban green areas reimaged: transforming landscapes with native plants for a sustainable future in Aksu, Northwest China. *Sustainability*, 16(4), 1546.
- Liu, J., Xin, X., and Zhou, Q. (2018). Phytoremediation of contaminated soils using ornamental plants. *Environmental Reviews*, 26(1), 43-54.
- Oloyede, F. M., Illoh, H. C., and Oloyede, F. A. (2007). Taxonomical studies of selected ornamental plants. *IFE Journal of Science*, 9(2), 167-171.
- Omonhinmin, A. C., Popoola, J. O., Ejoh, S. A., and Mordi, R. (2021, March). Sustainability and genetic diversity of under-exploited African plants: a collection expedition in Nigeria- facts, challenges and prospects. In *IOP Conference Series: Earth and Environmental Science* (Vol. 665, No. 1, p. 012070). IOP Publishing.
- Orlóci, L., and Fekete, A. (2023). Ornamental plants and urban gardening. *Plants*, 12(24), 4096.
- Osawaru, M. E., Ogwu, M. C., and Ahana, C. M. (2013). Current status of plant diversity and conservation in Nigeria. *Nigerian J Life Sci*, 3(1), 168-178.
- Palmersheim, M. C., Schürch, R., O'Rourke, M. E., Slezak, J., and Couvillon, M. J. (2022). If you grow it, they will come: Ornamental plants impact the abundance and diversity of pollinators and other flower-visiting insects in gardens. *Horticulturae*, 8(11), 1068.
- Parker, J. D., Burkepile, D. E., and Hay, M. E. (2006). Opposing effects of native and exotic herbivores on plant invasions. *Science*, 311(5766), 1459-1461.
- Pellegrini, E., Buccheri, M., Martini, F., and Boscutti, F. (2021). Agricultural land use curbs exotic invasion but sustains native plant diversity at intermediate levels. *Scientific reports*, 11(1), 8385.
- Pergl, J., Sádlo, J., Petřík, P., Danihelka, J., Chrtěk Jr, J., Hejda, M., ... and Pyšek, P. (2016). Dark side of the fence: ornamental plants as a source of wild-growing flora in the Czech Republic. *Preslia*, 88(2), 163-184.
- Promdee, K., Wathanakul, P., and Kheoruenromne, I. (2015). Suitability of fine perlite for conditioning some physical properties of soils for multiply onion. *Journal of Natural Sciences Research*, 5(1), 122-128.
- Radha, M. H., and Laxmipriya, N. P. (2015). Evaluation of biological properties and clinical effectiveness of *Aloeávera*: áAásystematic review. *Journal of traditional and complementary medicine*, 5(1), 21-26.
- Rudnyk-Ivashchenko, O., Schwartz, V., and Mykhalska, L. (2021). Розвиток декоративного садівництва для селітебних територій. *Journal of Native and Alien Plant Studies*, (17), 198-205.
- Sambo, B. E. (2014). Endangered, neglected, indigenous resilient crops: a potential against climate change impact for sustainable crop productivity and food security. *IOSR Journal of Agriculture and Veterinary Science*, 7(2), 34-41.
- Sangma, L. B., and Chaurasiya, A. K. (2021). Indigenous orchids and zingiberaceous taxa of Garo hills, Meghalaya. *The Journal of Indian Botanical Society*, 101(1and2), 66-73.
- Schutzki, R. E. (2005). *A Guide for the Selection and Use of Plants in the Landscape*. East Lansing, MI, USA: Michigan State University Extension.

- Schroeter-Zakrzewska, A., and Pradita, F. A. (2021). Effect of colour of light on rooting cuttings and subsequent growth of chrysanthemum (*Chrysanthemum × grandiflorum* Ramat. /Kitam.). *Agriculture*, 11(7), 671.
- Sumangala, H. P. (2019). Native ornamentals for minimal maintenance of landscape gardening. *Indian Horticulture*, 64(4).
- Van Kleunen, M., Essl, F., Pergl, J., Brundu, G., Carboni, M., Dullinger, S., ... and Dehnen-Schmutz, K. (2018). The changing role of ornamental horticulture in alien plant invasions. *Biological Reviews*, 93(3), 1421-1437.
- Wu, Y. N., and Lin, L. (2014). Morphological and molecular studies on *Garra imberba* and its related species in China Wei-Ying WANG, Wei ZHOU, Jun-Xing YANG, Xiao-Yong CHEN (20) Effects of temperature acclimation on body mass and energy budget in the Chinese bulbul *Pycnonotus sinensis*. *Zoological Research*, 35(1).
- Yadav, D., and Singh, S. P. (2018). Vegetative methods of plant propagation: I-cutting layering and budding. *Journal of Pharmacognosy and Phytochemistry*, 7(2), 3267-3273.