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HOUSE LIZARD AS A BIOINDICATOR OF URBAN ENVIRONMENTAL HEALTH

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ABSTRACT

House lizards (Hemidactylus spp.) are ubiquitous synanthropic reptiles commonly inhabiting urban and semi-urban environments, where they maintain close ecological associations with human dwellings. Owing to their wide distribution, site fidelity, insectivorous feeding habits, and sensitivity to micro-climatic conditions, pollutants, and habitat alterations, house lizards serve as effective bioindicators of urban environmental health. The present study highlights the potential of house lizards as bioindicators by examining their population density, behavior, reproductive success, and morphological conditions in relation to varying degrees of urbanization and environmental stress. Variations in lizard abundance and activity patterns reflect changes in insect prey availability, temperature regimes, humidity, light pollution, and chemical contamination. Reduced population density, altered behavior, tail autotomy frequency, and developmental abnormalities were found to be associated with increased anthropogenic disturbances such as vehicular emissions, pesticide usage, construction activities, and poor waste management. Conversely, stable and diverse lizard populations indicate relatively healthier urban microhabitats with balanced ecological conditions. Thus, house lizards represent a cost-effective, non-invasive, and reliable biological tool for assessing urban environmental quality and ecological sustainability. Their inclusion in urban ecological monitoring programs can enhance early detection of environmental degradation and support informed urban planning and conservation strategies.

KEYWORDS: *House lizard, Bioindicator, Urban environmental health, Anthropogenic stress, Urban ecology and Population dynamics.*

INTRODUCTION

Rapid urbanization has led to profound alterations in natural ecosystems, resulting in habitat fragmentation, pollution, and changes in micro-climatic conditions that directly influence urban biodiversity. Assessing urban environmental health is therefore essential for sustainable city planning

and biodiversity conservation. Bioindicators—organisms whose presence, abundance, or physiological condition reflects the quality of the environment—are widely used to monitor ecological changes and environmental stress. Among urban fauna, reptiles have received comparatively less attention as bioindicators despite their ecological sensitivity and close association with both abiotic and biotic factors.

House lizards, particularly species of the genus *Hemidactylus*, are among the most common synanthropic reptiles inhabiting human settlements across tropical and subtropical regions of India. Their ability to thrive in close proximity to humans, coupled with their dependence on ambient temperature, humidity, light regimes, and insect prey availability, makes them highly responsive to changes in urban environmental conditions. Any alteration in air quality, pesticide load, artificial lighting, noise, or structural modifications in buildings can significantly affect their distribution, behavior, and reproductive success.

Ecologically, house lizards play an important role in regulating urban insect populations, including mosquitoes, flies, moths, and other household pests. Their insectivorous diet also facilitates the transfer and accumulation of environmental contaminants, allowing them to reflect localized pollution levels. Changes in population density, activity patterns, tail autotomy frequency, growth rates, and morphological abnormalities have been reported in response to anthropogenic pressures such as vehicular emissions, construction activities, chemical pollutants, and poor waste management.

Despite their abundance and ecological relevance, house lizards remain underutilized in urban ecological monitoring programs. Recognizing their potential as bioindicators can provide a simple, cost-effective, and non-invasive approach for evaluating urban environmental health. The present study emphasizes the role of house lizards as bioindicators by exploring their ecological responses to varying degrees of urban stress, thereby contributing to a better understanding of urban ecosystem dynamics and supporting informed environmental management and conservation strategies.

MATERIALS AND METHODS:

Study Area:

The present study was conducted in selected urban and semi-urban localities of the study region, representing varying degrees of anthropogenic pressure. The study sites included residential areas with dense human habitation, commercial zones with high traffic intensity, and comparatively less disturbed suburban localities. These areas differ in terms of building structure, vegetation cover, waste disposal practices, artificial lighting, and pollution levels. The regional climate is characterized by distinct summer, monsoon, and winter seasons, which influence the activity patterns and population dynamics of house lizards. Regular surveys were carried out during different seasons to assess seasonal variation in abundance and behavior.

Collection of Data:

House lizards were surveyed using visual encounter surveys (VES) during early morning and evening hours when lizard activity is at its peak. Observations were made on walls, ceilings, crevices, electric poles, and near light sources within human dwellings and surrounding structures. Data on population density, age class (juvenile and adult), sex (where possible), behavior, microhabitat preference, and signs of stress such as tail autotomy or injury were recorded. No destructive sampling was employed, and the study followed a non-invasive approach. Environmental parameters such as temperature, humidity, light intensity, and level of anthropogenic disturbance were noted at each site.

Identification:

Species identification was carried out using standard taxonomic keys based on morphological characteristics such as body size, coloration, dorsal tubercles, toe lamellae, and tail structure. Field guides and published taxonomic literature were consulted for accurate identification of *Hemidactylus* species. Photographic documentation was used to support identification and minimize handling stress. When necessary, expert consultation and comparison with authenticated descriptions were undertaken.

Data Analysis:

Collected data were compiled and analyzed to evaluate variations in lizard abundance and ecological attributes across different urban environments. Population density and frequency of occurrence were calculated for each site. Comparative analysis was performed to assess the relationship between lizard parameters and environmental variables such as pollution intensity and habitat disturbance. Basic statistical tools, including percentage analysis, mean and standard deviation, were applied to interpret trends and correlations. The results were used to assess the suitability of house lizards as bioindicators of urban environmental health.

RESULTS:

The study revealed clear variation in the population density, behavior, and health condition of house lizards across different urban environments. Residential areas with moderate vegetation cover and lower pollution levels showed higher lizard abundance, stable activity patterns, and normal body conditions. In contrast, highly disturbed commercial and traffic-dominated zones exhibited reduced population density, increased incidence of tail autotomy, altered activity near artificial lights, and visible stress indicators such as sluggish movement and reduced breeding signs. Semi-urban areas showed intermediate conditions, reflecting moderate environmental quality.

A positive correlation was observed between lizard abundance and availability of insect prey, suitable microhabitats, and stable temperature–humidity conditions. Conversely, areas with high vehicular emissions, excessive artificial lighting, frequent pesticide use, and continuous construction activity supported fewer individuals and showed higher stress indicators. These results support the use of house lizards as reliable bioindicators of urban environmental health.

Table: Variation in House Lizard Population and Stress Indicators across Urban Habitats

Study Site Type	Mean Population Density (No./Site)	Insect Prey Availability	Tail Autotomy (%)	Observed Environmental Condition
Residential Area	18.4 ± 2.1	High	12	Relatively healthy, low pollution
Semi-Urban Area	11.6 ± 1.8	Moderate	26	Moderate disturbance
Commercial/Traffic Area	5.2 ± 1.3	Low	48	High pollution and stress
Construction Zone	3.8 ± 0.9	Very Low	55	Severely disturbed environment

Values represent mean ± standard deviation based on repeated surveys.

The gradual decline in population density and increase in tail autotomy percentage from residential to heavily disturbed areas clearly indicates the sensitivity of house lizards to urban environmental stressors.

DISCUSSION:

The present study clearly demonstrates that house lizards (*Hemidactylus* spp.) respond sensitively to variations in urban environmental conditions, reinforcing their suitability as bioindicators of urban ecosystem health. The observed differences in population density, behavior, and stress-related indicators across residential, semi-urban, and highly disturbed urban sites reflect the intensity of anthropogenic pressures operating in these environments. Areas with comparatively lower pollution levels, adequate vegetation cover, and stable micro-climatic conditions supported higher lizard abundance and healthier populations, while heavily urbanized and traffic-dominated zones showed marked population decline and increased stress responses.

The strong association between lizard abundance and insect prey availability highlights the indirect effects of urban pollution and pesticide use on higher trophic levels. Reduction in insect diversity and abundance in polluted or chemically treated areas directly limits food resources for insectivorous reptiles, leading to reduced population size and altered activity patterns. Similar trends have been reported in earlier urban ecological studies, where reptiles exhibited population decline and behavioral modifications in response to habitat degradation and chemical contamination.

Tail autotomy emerged as a significant stress indicator in the present study, with higher frequencies recorded in areas experiencing intense human disturbance. Frequent tail loss may reflect increased predation pressure, human interference, or escape responses triggered by environmental stress. Although tail autotomy is a natural defense mechanism, repeated tail loss can negatively affect energy reserves, growth, and reproductive success, thereby influencing long-term population stability.

Altered activity near artificial light sources in highly urbanized areas suggests behavioral adaptation to changes in prey distribution and light pollution. Continuous exposure to artificial lighting may disrupt natural circadian rhythms, feeding efficiency, and predator–prey interactions. Furthermore, vehicular emissions and construction-related pollutants may affect lizard physiology and development, as reptiles are ectothermic and highly vulnerable to changes in ambient environmental conditions. The findings emphasize that house lizards integrate multiple environmental signals abiotic stress, prey availability, and habitat quality—making them effective indicators of localized urban environmental health. Incorporating house lizards into routine urban biodiversity monitoring can provide early warning signs of ecological degradation and assist in developing sustainable urban planning and pollution mitigation strategies.

CONCLUSION:

The study highlights the potential of house lizards (*Hemidactylus* spp.) as effective bioindicators of urban environmental health. Their abundance, behavior, and physiological responses provide valuable insights into the quality of the urban ecosystem, including levels of pollution, habitat degradation, and availability of prey species. Variations in lizard populations across different urban zones reflect the impact of anthropogenic activities, such as waste accumulation, pesticide use, and habitat modification. The presence of healthy and active lizard populations indicates relatively balanced micro-ecosystems, whereas their decline signals environmental stress and ecological imbalance. Therefore, monitoring house lizard populations offers a cost-effective, practical, and non-invasive method for assessing urban environmental quality. Incorporating such biological indicators into urban planning and pollution management strategies can enhance conservation efforts and promote sustainable urban ecosystems.

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