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Effect of habitat loss and anthropogenic activities on butterflies survival: A review

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Abstract
Lepidoptera is beneficial insects group as a pollinators, silk producers and bio-indicator towards environmental changes and recognizable as an aesthetic value. It's diversity and abundance changes as environment changes. Now a day's people are using organic farming and poly culture corps it increases butterfly diversity and density. In present time global warming and urbanization are two main key factors responsible for declining biodiversity worldwide.

Keywords: butterfly, bio indicator, organic farming, urbanization

Introduction

The world is currently going through the largest rash of cities grown in its history. Almost half of total human populations live in cities in present time; up to 2030 it will reach approx five billion population in cities. Rapid development of cities and town are taking places in developed and developing countries like America, Asia, and bringing large number of changes in environment (UN, DESAPD, 2015) [1]. Urbanization largely affects on biochemical cycle and local climatic condition, thus results of urbanization leads to increase risk of biodiversity declining on earth (Kaye *et al.,* 2006; Mc Kinney, 2008) [2, 3]. Lepidopteron insect group are good bio-indicator taxa for the non-target species of pesticides, lepidopteron insects and plant relationship are more complex; Butterfly abundance and diversity play crucial role in ecological community and their existence express good aspect of environment (Kunte 2000; Aluri and Rao, 2002; Thomas, 2005) [4, 5, 6]. Butterflies helps in pollinating wild and cultivated crops. The butterflies induce genetic viability and variation among crops with the help of cross pollination (Proetor *et al.,* 1992) [7]. It also contributes to maintained community structure of flora in tropical zone (Samanta *et al.,* 2017) [8]. Use of Pesticides plays dual role in ecosystem one side they decrease agricultural pests and harmful insect's other side they biomagnifying among soil and food chain. This results into increase risk of biodiversity loss in worldwide (Aktar *et al.,* 2009; Potts *et al.,* 2016) [9, 10]. Butterflies larval stage need host plant to developing and completing life cycle, adult's stage of butterfly is fully dependent on flowering plant for obtained nectar and food materials. In present time, anthropogenic disturbance is commonly increased in urban and rural area and cultivated land, this leads to extinction of animal and plant diversity due to depletion in natural habitat and diminutions of food sources (Grimm *et al.,* 2008) [11]. The parallel evolution of butterfly and specific host plant play important role in to understand the health and quality of the ecosystem as well as a planning of conservation strategies (Sparks *et al.,* 1996; Ferrer-Paris *et al.,* 2013) [12, 13]. Use of pesticide in agriculture recorded as a main cause of pollinator population decline, especially chemical spray in flowering season (Johansen, 1977) [14]. Pollination is one of the main important type of interaction between flora and fauna in nature because it's a key factor in the sexual reproduction in almost all angiosperms plant and animals directly affects reproductive success in plants (Arun, 2003) [15]. The adjacent link between butterfly and their environment create suitable habitat for biodiversity sustainable (Saikia *et al.,* 2009) [16]. By spoiling of larval food resources and nesting sites, herbicides can also badly affected pollinator including insect population (Keven *et al.,* 1997) [17]. Butterfly complete life cycle in four stages namely- egg, caterpillar, pupa and adult, butterfly larval stage known as caterpillar. When metamorphosis is complete, the pupas strain is break down outer coat and adults insect starts crawling and come outside the coat, after this process wings development process complete. Butterflies life cycle vary according to species specific, some butterfly complete two and three life cycle throughout years.

In this review, a compressive overview that factors are affecting butterflies distribution, diversity and abundance in present time

1. Food and habitat preference by butterflies

Butterfly need a good quality habitat for completing life cycle, they required high abundance of host plant for egg laying and developing stages. They obtain nectar from host plant as a food sources (Thomas *et al.,* 2001) [18]. The consumption of plants as nectar sources by butterfly depends on numerous numbers of factors including colour, appearance of flower, depth of corolla and density of nectar in flower (Porter *et al.,* 1992) [7]. The flower fragrance plays as an important signal work for butterflies to attract and identification of host plant during egg lying. Plants are an important main source of food of many insects including animals, some plants plays significant role and co-evolutionary evolution with animals, if one species declined and facing threats other species becomes vulnerable and move towards extinction. The chemical composition of flower like nectar play significant role in survival of egg laying and caterpillar developmental rate (Molleman *et al.,* 2004; Medley and Eisner, 1996) [19, 20]. Various butterfly species are classified according to basis of their food preference. Some species does not required specific host

plant for egg laying and development of caterpillar categorized in generalist, while some species required host specific plant during development; without host plant would not able to complete life cycles, species are considered specialist (Tudor *et al.,* 2004) [21]. Specialist species are more vulnerable to risk of extinction as compare to generalist species.

2. Role of butterflies in ecosystem

A butterfly is a bio indicator species and very sensitive fauna towards changes among habitat and ecosystem (Pollard, 1991) [22]. They are an important part of the food chain of birds, reptiles, amphibians, spider and predatory insects. They are very sensitive towards changes in environmental condition and habitat quality; butterfly studies is generally used to asses' quality of ecosystem (Kocher and Williams, 2000) [23]. Butterfly also sensitive towards urban development and metro politicized in urban area, because they have highly selective diet and host specific plant relationship during developmental stages and most of species mainly depends upon fitness of surrounding areas (Thomas *et al.,* 2001; Eichel and Fartmen, 2008; Garcia-Barros and Fartmann, 2009) [18, 24, 25]. Due to these complicated and specific requirements, number of butterfly declining day by day in cities and polluted areas (Thomas *et al.,* 2005) [6] and they are important bio indicator in ecology and conservation (Watt and Boggs, 2003; Ehrlich and Hanski, 2004) [26, 27]. The study of butterfly in relation to the urban area is very important from the ecological point of view as such type of alteration in habitat often negatively affect the distribution and population dynamics of butterflies (Gascon *et al.,* 1999; Rickets *et al.,* 2001) [28, 29]. The butterfly taxa can be also used an umbrella species for conservation planning and forest management (Betrus *et al.,* 2005) [30].

3. Effect of habitat loss and deforestation

Habitat fragmentation and habitat loss are major threatened factor responsible for biodiversity decline on earth (Harrison *et al.,* 2012; Foley *et al.,* 2005) [31, 32]. Butterflies is a popular group of insect, they are widely distributed throughout world and very sensitive towards habitat and climatic changes (Warren and Dennis, 2004) [33]. An anthropogenic activity is a main factor cause a loss of biodiversity mainly through the alteration of natural habitat (Walker, 2012) [34]. Forest degradation due to development and construction activities in city areas and destroy forest habitat leads to biodiversity worldwide (Houlihan *et al.,* 2013; Fiedller and Schulze, 2004) [35, 36]. They quickly responds to environment changes because of their short life cycle, high mobility and specific habitat preference (Dennis, 1972; Thomas, 1995) [37, 38]. They are also known to susceptible towards changes among habitat *i.e.* grassland, silviculture, deserted land, clear cutting of forest and trees and land conversion (Nakamura 2011; Lee and Kwon, 2012) [39, 40]. Globally, deforestation is one of the main cause for biodiversity loss (Geist and Lambin, 2002) [41] and reforestation & plantation is good alternative practices to conserve biodiversity. Positive relationships have been found between lepidopteron fauna and flora diversity. Maximum species richness of flora and fauna were recorded in tropical regions, the results of high richness of plant in tropical regions hold greatest biodiversity of insects (Price, 1997) [42]. The abundance and diversity of butterflies will be depends upon the heterogeneity of habitat with plant varieties.

4. Effect of urbanization on butterflies

In past few decades biodiversity continuously declined due to expansion of urban area and increasing number of buildings, residential colonies, highways, flyover and bridge leads to increase techno ecosystem and reduce natural habitats for other species survival and increase environment pollution (Mc Kinney 2002; Mc Kinney, 2006; Pocewicz *et al.,* 2009) [43, 44, 45]. Rapid extension of city areas are responsible for habitat alteration, habitat loss and increase various types of environment pollution like- soil, water, air, noise pollution, these pollutions and anthropogenic factors cause adverse effect on plant and animal community (Rathcke and Jules, 1997) [46]. The floral & faunal diversity and abundance continuously declining in urban area due to high pressure of human population on ecosystem, high human population leads to vanishing of natural habitat (Blair R B, 1997) [47]. Butterflies are useful ecological indicators in urbanization/ civilization because they are widely served and susceptible to changes in microclimate, temperature, solar radiation and availability of host plants for egg laying and larval development (Fordye, 2003; Thomas *et al.,* 1998) [48, 49]. Habitat alteration and modification due to reduction and declined in floral diversity, water quality and soil & air pollution (Malagrino *et al.,* 2008) [50]. The civilization results in desertion and decentralization of natural and semi natural habitats, where small and isolated green patches habitat surrounded by human residential areas (Mc Kinney, 2002 and 2006) [43, 44]. Expansion of urbanization leads to fragmentation of habitat create small strips of greenery and large area of techno ecosystem, they adversely affect biodiversity at genetic and species levels (Hanski, 1999) [51]. Urban sprawl is negatively influence biodiversity and ecosystem functioning with a large scale of human interruptions activities such as agricultural land expansion, vanishing of natural habitat due to cutting of forest and grassland (Grimm *et al.,* 2008; Shochat *et al.,* 2010) [11, 52].

5. Effect of organic farming on butterflies

Organic farming is most suitable and alternative technique for butterfly conservations; they are also good sign for environment and health's of humans. Organic farming technique reduces ecological damage by promoting evenness among natural and predatory enemies on pests (Vandermeer *et al.,* 1995) [53]. Organic farming play role in ecological balance between prey and predator relationship in food chain (Crowder *et al.,* 2010) [54] reported high species evenness of predatory insects in organic farming as compare to pesticide contaminated/ polluted agro ecosystems.

6. Effect of vegetation simplification on butterflies diversity

Butterfly and their caterpillar are usually depends upon host specific plant for obtained food in developmental stages. The diversity of butterfly depends upon overall floral diversity especially in forest and grassland (Padhye *et al.,* 2006) [55]. Cultivation of signal crops reduces floral diversity and food preference of butterfly, therefore floral diversity is necessary for butterfly richness in ecosystem. The land conversion also leads to net loss of wild vegetation in ecosystem. Wild vegetation support wide variety of pollinating and other insect's diversity to provides microhabitat for egg laying and larval development. A monoculture crop creates less suitable habitats for egg laying and larval developmental stages of insects (New, 2005) [56].

7. Effect of use of pesticides and insecticides

Inordinate use of pesticides and insecticides in agricultural land, they posses sever threats of insects survival specially bees and butterflies. Pollinator insect's populations are harshly affected by change among habitats, introduction of exotic species and excessive use of chemical are responsible (Steffan- Dewenter *et al.,* 2005) [57]. Losses of complicity in agricultural lands and nearest ecosystem of urban habitats are responsible for butterflies decline. Inordinate use of chemical in form of spray and solid stage in agriculture has been directly linked to reduction in beneficial arthropods population in worldwide (Kevan, 1999) [58]. Butterfly is sensitive fauna and quickly responds to pesticide exposure and it is also helpful to assess the overall risk of pesticide use in agriculture field (Pisa *et al*., 2015) [59]. Butterfly resides in its natural habitat; they are very susceptible towards urbanization and pesticide pollution (Kjaer *et al*., 2014) [60]. Overall population and number of butterfly continuously are declining from 2000 to 2009; almost 58% butterflies species declined due to excess use of pesticide in agriculture farming and numerous species currently facing risk of local or global extinction (Brereton *et al.,* 2011) [61]. Many pesticides applied in the form of coating and outer protection of seeds, the coating leaves a residue in soil during germination, if coating chemicals are water soluble they can be easily enter in soil and ground drainage system (Bonmatin *et al.,* 2015) [62]. Non targeted pests such as butterfly show mud pudding behavior can also be exposed to pesticide residue run off in soil water (Still *et al.,* 2015) [63]. Pesticide, such as neonicotinoides, they affects various plant parts and can be trans-locate in pollen, nectar, flower, leaves and even in water droplets, and become potential routes of exposure in next tropic levels, results of these exposure negatively affect biodiversity on global level (Sluijs *et al.,* 2013) [64].

8. Effect of Geographical and environmental factors on butterfly distribution

Large amount of floral diversity, abundance and richness create suitability and favorable climatic conditions for butterfly survival, the results of high floral diversity Indian subcontinent hold numerous number of butterflies species. Almost fifty eight percent of the butterflies found in eastern Himalayas and north-eastern Indian region (Evans, 1932) [65]. The tropical region is important for the butterflies diversity and density due to availability of high density and diversity of green vegetation including herb, shrub & trees (Farhat *et al.,* 2014) [66]. Seasonal variation in butterflies abundance and diversity are largely influence by meteorological parameters- temperatures, day length, rainfall, humidity and variation in availability of food resources, also affected by vegetation structure and types of plants in surrounding habitat (Anu, 2006; Anu *et al.,* 2009; Shanthi *et al.,* 2009) [67, 68, 69]. Minute changes in habitat may leads to mass migration of butterflies one place to another place, results of mass migration caused local extinction of butterfly (Schtickzelle and Baguette, 2003) [70]. Rainfall and vegetation composition of trees, two complementary factors influence the life of phytophagous and herbivorous butterflies. Butterfly is classical animal taxa for ecological point of view; they are studied specially related to seasonality variation (Barua *et al*., 2010) [71]. It is now know that the population dynamics of many species of butterfly are closely associated with seasons and climatic conditions (Pollard, 1979; Pollard, 1988; Kunte 1997) [72, 73, 74]. Various anthropogenic activities and sudden changes in meteorological conditions have leads to alteration in natural habitat, habitat alteration and modification leads to negative impact on butterfly diversity (Clark *et al.,* 2007) [75]. In present time global warming and pollution also may be affects butterfly distribution, abundance and diversity among all habitats.

Conclusion

We found that undisturbed ecosystem support diversity of butterflies and disturbed ecosystem leads to migration, elimination and less diverse population and even no butterflies in area. They are very good pollinator and create various plant species thrive without them plant species will eliminate so indirectly human race also. Educate people specially farmer for the need and importance of butterflies as a pollinators in different cultivated and wild plant for enhancing genetic variation.

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