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Role of Amphibians in Ecosystem Balance

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Abstract : Amphibians, a unique group of vertebrate, consisting of about 6,000 known species, are threatened globally. A recent survey indicates that about one third of the world's amphibians are threatened, responding 1,856 species about 32%. Amphibians are thought to exist on earth for the last 300 million years. During the last several decades it is believed that about 168 species have gone extinct and atleast 2469 species are declining in their population, indicating that the number of threatened species will probably continue to rise.

Keywords: Amphibians, tadpoles, mammals, Frogs

INTRODUCTION

Amphibians are important to the overall ecosystem balance. The large biomass of these amphibians makes the significant prey for other animals (Khan et al., 2007). The global loss of amphibian populations was first recognized in 1989 as a phenomenon that deserved worldwide attention (Barinaga, 1990; Wake, 1991; Blaustein, 1994; Alford and Richards, 1999). By 1993 more than 500 populations of frogs and salamanders were listed as declining or of conservation concern on six continents (Vial and Saylor, 1993; Alford and Richards, 1999). Over the last five years new research findings along with various conference, symposia and workshops have immensely improved our capacity to understand this global problem. The amphibians are more threatened and towards decline in comparison to birds and mammals. The threatened or declining phenomenon of amphibians are found occurring in rapid tune (Blaustein and Wake, 1994; Kuzmin, 1994; Waldman and Tocher, 1998).

Literature Review

The amphibians in general exposed to both aquatic and terrestrial stressors as they remain in close contact with water during larval stage and also remain in contact on land in their adulthood. They are exposed directly to the soil conditions, water qualities and sunlight for possessing unshelled eggs and permeable skin, consequently more affected by environmental pollutants or by the physical or chemical alterations in environmental conditions relating to seasonal variations like rains and temperature (Blaustein and Wake, 1990). Adult amphibians form important predators as well as prey and global problem. The amphibians are more threatened and towards decline in comparison to birds and mammals. The threatened or declining phenomenon of amphibians are found occurring in rapid tune (Blaustein and Wake, 1994; Kuzmin, 1994; Waldman and Tocher, 1998).

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The Red List (2004) of IUCN recorded 20 countries with the highest number of threatened amphibian species which include Columbia (208 species), Mexico (191 species); Ecuadov (163 species), Brazil (110 species), China (86 species); Peru (78 species), India (66 species); Costa Rica (61 species), Madagascar (55 species), Honduras (53 species), Panama (52 species), USA (51 species), Cameron (50 species), Phillipines (48 species), Australia (47 species), Cuba (47 species), Haita (46 species) and Malasia (45 species). Comprising the anurans (Frog and Toads), Salamanders and Newts and Gymnophiona Caecilians) totaling about 32.9 Percent of threatened or extinct.

India, a megadiverse nation, is one of the richest nations in terms of biological diversity. India owes this to its position in tropical and subtropical latitudes. India has a great latitude of natural ecosystems ranging from the cold and high Himalayan regions to the sea coasts, from the wet north-eastern green forests to the dry north-west and deserts, with different types of forests, wetlands, islands and the oceans.

Bihar is located in the eastern region of India between latitude 240-20'-10" N - 270-312-15” N and longitude 820-192-50" E 880-17-40” E. It is entirely land locked state, in a subtropical region of the temperate zone. Bihar lies mid between the humid West Bengal in the east and the subhumid Uttarpradesh in the West which provides it with a transitional position in respect of climate, economy and culture. The state is bounded by Nepal in the North and by Jharkhand in the South. Bihar plane is divided in to North Bihar and South by the river Ganges (A Bihar Area, maps of India, Com. Retrieved, June 2014). Bihar's land has average elevation above sea level is 173 feet. The state is in Indo-Gangetic plains having fertile soil. The indo-Gangetic plane in Bihar consists of a thick alluvial mantle of drift origin. The Siwalik and older tertiary rocks one prevalent along with mainly yound loan silt, clay and sand brought by floods. (Das, K.K.L, Das K.N. (1981). Bihar is divided into 37 districts. The important rivers are the Ganga, Gandak, Burhi Gandak, Kosi, Mahananda and their tributaries.

In Bihar, animals of various classes, orders and families out of vertebrates and invertebrates are prevalent during various regions and seasons including amphibians like frogs and toads. *Hoplobatrachus tigerinus (Daudin, 1802) an* Indian bull frog belongs to class- Amphibia, order – Anura and family- Dicroglossidae. This species is found throughout wetland areas of India, Bangladesh and much of northern Pakistan and recorded from the Southern parts of Nepal, and from upper and northern Central Myanmar (Smith, 1940; Zug et al., 1998). It has been reported from Afganistan close to the Khyber Pass (Kullmann, 1974), though this report still needs to be confirmed. The presence of this species population needs to be confirmed in Srilanka which are now believed belonging to a separate taxon and have not been included

in this account.

It has also been introduced to the Maldives and Madagascar, where it is expanding its range at low altitude in the north-west and on the island of Nosy Be. A principally lowland species, it is found at elevations between 25 and 800 m asl, over much of its range, although it might occurs upto 2000 m asl in Nepal (Dubois, 1976).

The species is mostly freshwater wetlands habitants, both natural and artificial, specially in paddy fields in the region of Bihar. It is mostly solitary and nocturnal inhabiting holes and bushes near permanent water courses and pools (Dutta, 1990). Its diet includes invertebrates, small mammals and birds. Breeding takes place during the monsoon season, when adults congregate at ephemeral rainwater pools. It produces large number of eggs but there are high mortality rates among tadpoles, froglets and adult frogs.

The major threats that focus is that the species being collected heavily for the international frog legs trade. Legal export of this species from the states of India and Bangladesh has been banned since the 1990's. The species is listed in Appendix 11 of CITES. In India it is included in schedule IV of the Indian Wildlife (Protection Act 1972, as amended in 1991).

H. tigerinus usually measure 6.5 inches from Snout to Vent. The head is moderate, snout more or less pointed. Nostril is little nearer to the end of the mouth than to the eye, inter orbital space narrower than the upper lid, tympanum distinct about two thirds the size of the eye. Fingers rather short first extending beyond second, toes moderate, obtuse, nearly entirely webbed, as much developed membranous fringe along the fifth toe; vomerine teeth in two strong oblique series commencing from the inner anterior angle. Lower jaw with two not very prominent bony processes in front, Tibio-tarsal articulation reaching the ear, the eyes or a little beyond, skin of back with longitudinal folds; strong fold above the tympanum, Green or olive above with dark spots. Male with two subjugular vocal sacs having blakish there regions (Baulenger, 1890) concern about the species is a large part along with other amphibians on account of their values as indicators of environmental stress (Blaustein, 1994; Blaustein and Wake, 1995). Apart from their high mortality and international trading the species faces acute stress due to the toxicity caused to their habitat by the agriculturists unqualified use of which wide range of contaminants which includes pesticides, herbicides, tengicides, fertilizers and numerous other pollutants.

These are found to be of detrimatal effect on various animals including amphibian populations (Sparking et al., 2000; Boon and Bridges, 2003). Pesticides destroy the natural biotic balance in agriculture soil and reduce the diversity and abundance of biodiversity with cascading effects at higher trophic levels (Larson et al., 1997). They can kill amphibians directly, affect their behavior, reduce their growth rates, act as endocrine disruptors or induce immune suppression (Bishop, 1992; Carey and Brayant, 1995, Alford and Richards, 1999). A diversity of pesticides and their residues are present in wide variety of aquatic habitats (Harris et al., 1998; Mc Connell et al., 1998; Le Noir et al., 1999; Kolbin et al., 2002). While pesticides have potential to affect many aquatic texa, the impacts on amphibians are of particular concern in the past decades because of the apparent global decline of many species (Blaustein and Wake, 1990; Alford and Richards, 1999;

Haulahan et al., 2000; Kiesecker et al., 2001).

The experiments based in laboratory environment have increased to assess the effects of pesticides or any other toxicants as the results show almost accurate in terms of their LC50. After the ban on organochlorine in most of the countries for agriculture purposes including our country India, the pesticides, organophosphate and carbamate are widely applied and a variety of lethal and sublethal effects on non target wild life species (Parsons et al., 2000, Khan et al., 2003) in comparison to organophosphate and carbamate, pyrethroid insecticides have gained reputation as "safe insecticides" and are widely applied in agricultural aquatic and household purposes product (Elliot et al., 1978; Smith and Stratton, 1986). However Jolly et al., 1978; Thyband, 1990; Berril et al., 1993 reported that the applications of these chemicals may cause deleterious to amphibians. Pyrethroids are found to voltage-dependent neuromuscular sodium channels, causing tremors, hyper excitation and convulsions (Van den Berken, 1977; Ruigt and Vander Berken, 1986).

In India, the GDP of agriculture sector has been estimated to be 17.0 in 2014 in comparison to 2012 i.e. 18.2, whereas agriculture has significant role in socio economic fabric of India. Today, India ranks second worldwide in term output. Agriculture and allied sector like forest and fisheries accounted for about 50% of the total work force. The economic contribution of agriculture in India's GDP is steadily declining with the country's broad-based economic growth. Still agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. India is the seventh largest agricultural exporter worldwide (Aab "FAO STAT, 2010 data, 2011). Hence the use of agricultural pesticides and agrochemicals has fastly increased in our country India. Consequently number of non-target species including amphibians are found to face detrimental effects so much so to bring some of them to the phenomenon of extinction. The enzyme system of such affected non target species show significantly affected. The pesticides are found to cause disruption in cholinesterase activity. The enzyme envisions occurs in a number of species and reduction can result in sublethal toxicity and even death (Cooper, 1991).

The pesticides have been found to reduce enzyme activity of cholinesterase in frog Rana tigrina (Khan et al., 2002a and b and in Rana cynophlytis (Khan and Yasmeen, 2005). Cholinesterase is one of various enzymes essential for proper functioning of nervous system of amphibians and other animals.

Alkaline phosphatase is a common enzyme present in many tissues including the liver and its excrescence in blood indicates liver disorder. The alkaline phosphatases have been postulated to be involved in various other processes including cell adhesion and cell signaling (Manara et al., 2000).

Bihar, as described above, where the undertaken *Indian bull frog Hoplobatrachus tirenium inhabitants in of* its parts where there is abundance agricultural fields applied with pyrethroid pesticides rampantly. Butting them into seven toxicants stress which may cause their populations reduced. Such reduction is a serious concern in the interest of biodiversity of nature.

Cholinesterase is a family of enzymes that catalyse the hydrolysis of the neurotrucusritters acetylcholine into choline and acidic acid, a reaction necessary to allow a cholinergic neuron to return to its resting state after activation. Synopsis called electrical switching centers are found throughout the nervous system. Nervous are stimulated or inhibited by the constant firing of signals aross these synapses.

Conclusion

Stimulating signals are usually carried by chemical called 'acetylcholine stimulating signals are discontinued by a **specific type acetylecholinesterase, of cholinesterase which breaks enzyme, down the** acetylcholine and it goes on at very fast rate. The presence of cholinesteran inhibiting **chemicals prevent the** breakdown of acetylcholine, causing "jam" in the nervous.

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