Review Article

Toxic Calendar for Predicting Toxicity, To Prepare Emergency Medical Services in Preventing Toxic Disasters: An Indian Society of Toxicology Initiative

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Abstract

It's popular Myth among medical professionals that All Poisonings are unpredictable, unpreventable and unsalvageable. But the Fact is we can predict the Seasons of Poisons, Environmental hazards, Toxic Disasters. And prepare our Emergency Medical Services for better management by stocking the relevant antidotes, thus preventing mortality and morbidity by public awareness prior to the season of poisons. And based on Toxic Calendar, we can Promote Safety Precautions for safely storing Household Poisons, Toxins, and Chemicals.

Keywords: Calendar; Toxic; Venomous; Poisonous; Detective; Safety; Security; Antidotes; Toxicity prediction.

Introduction

Indian Society of Toxicology has devised a Toxic Calendar according the incidence of common poisonings in India.

Seafood Poisoning: Algal Blooms and Red tide in India: Pre-monsoon Period

The reports of algal blooms indicate their predominance along the west coast of India especially the southern part. Majority of the blooms are reported along the western coastline of Indian subcontinent are caused by dinoflagellates, whereas diatom blooms prevail along the east coast. There have been thirty nine causative diatom species responsible for the toxic blooms, of which Noctilucascintillans and Trichodesmiumerythraeum are the most common. Reporting of massive fish mortality in Indian waters has been associated with the blooming of Cochlodiniumpolykrikoides, Kareniabrevis, Kareniamikimotoi, N scintillans, T erythraeum, Trichodesmiumthiebautii and Chattonella marina.[1] Most of the toxic blooms occurred during return of the southern-west monsoon and pre-monsoon shower. In Indian waters, this process is mainly influenced by seasonal upwelling and monsoonal forcing that causes high riverine discharge resulting in nutrient-enriched waters that provides a competitive edge for blooming of phytoplankton species.[2]

Toxic Calendar by Toxic Detective.

January (Extreme Cold)	February	March
• Toxic Mushroom Harvest • Carbon monoxide poisoning- Fireplace, Sigdi, Kangri, Gas Geyser • Antifreeze – Ethylene Glycol in Northern India.	Around Valentine Day- Suicidal attempts by youth after Breakups, consuming household poisons – PCM, vitamins, Corrosive Toilet cleaners • Pre-Harvest OPC Pesticide sprayed in Farms	Board Exam - Suicidal attempts by youth after failure, consuming household poisons –AlP PCM, vitamins, Corrosive Toilet cleaners शिवरात्रि -भांग toxicity Dhatura Blooms होली - Heavy Metal salts- Bright colours- Pb, Hg
April	**May (Spring)**	**June (Pre-Monsoon) Heat**
बैसाखी – Harvest Pesticides, Fungicides	Lily in the valley Bloom Opium flower bloom Honey Bee and Wasp Stings in flowers blooming in spring	Red-tide + algal Bloom in coastal India – Seafood poisoning- Ciguatera AC coolant Car (Ethylene glycol) due extreme hot Mad Honey flower Bloom
July (Monsoon in south)	**August (Monsoon in Centre)**	**September (Monsoon in North)**
Venomous Snake Bites and scorpion stings Arsenic floods in East Toxic Runoff in floods Fertiliser, Herbicides, Insecticides	Venomous Snake Bites and scorpion stings Floods- Arsenic floods CO poisoning – Burners for drying Flooded Flats	Venomous Snake Bites and scorpion stings Mosquito Bites Arsenic Floods
October	**November**	**December**
दिवाली Crop Pre-Harvest: Insecticides, Herbicides (Paraquat) poisoning	Crop Harvest: Fungicides to save the crop fruits from infestation	Post- Harvest drying grains (Rodenticides, Fumigants- AlP)अनाज घर क्रिसमस – Rumcakes and Alcohol intoxication

Toxic Flowers and Seasons of their Bloom

The various climatic changes that occur in cyclic patterns are termed as 'seasons'. There are four seasons occurring on our planet - Spring, Summer, Autumn and Winter. Seasons are intimately bound to each other with flowers. Most of the flowers are season - specific. Though some flora are found throughout the year, there are some not particularly affected by changing seasons, viz. Chrysanthemum, Gerbera Daisy, Lily, Asiatic Lily.[3]

Spring Flowers: Spring Time is the peak time of blooming and renewal of new plant and animal life. Spring comes at different times in the North and South Hemispheres. Spring time in the Northern region is from March to May, and from September to November in the Southern region. Most flower bloom during spring season. Therefore, flowers that bloom only during spring, Spring Flowers, bloom at different times in the two hemispheres.

Flowers Blooming in Spring are: Agapanthus, Amaryllis, Anemone, Apple blossom, Bird of Paradise, Brodea, Calla lily, Cherry Blossom, Corn flower, Cosmose, Dahlia, Delphinium, Delwood, Forsythia, Freesia, Gardenia, Heather, Helleborus, Hollyhock, Hyacinth, Larkspur, Casa Blanca Lily, Gloriosa Lily, Stargazer, Liatrus, Lilac, Lisianthus, Narcissus, Orchid, Peach blossom, Peony, Phlox, Poppy (Opium), Protea, Pussy willow, Ranunculus, Rose, Seeded Eucalyptus, Solidago, Statice, Stephanotis, Stock, Sweet Pea, Tulip, Viburnum, Wax flower, Zinnia.[3]

Summer Flowers: Summer is the time of hot and warm weather. Floral growth is best in the summer season. The Northern region experiences summersfrom June, July, and August, while in the Southern region, from December to February. Summer is the season of the Midnight sun in the North pole and Ice land. The Flowers Blooming in Summer are: Alchemilla, Allium, Alstromeria, Amaranthus, Baby's Breath , Bird of Paradise, Calla lily, Campanula, Carnation, Chrysanthemum, Cockscomb, Cosmos, Dahlia, Delphinium, Dianthus, Didiscus, Euphorbia, Foxglove, Freesia, Gardenia, Genista, Ginger, Gladiolus, Hallaconia, Heather, Hydrangea, Hypericum, Iris, Kangaroo paw, Liatrus, Lilac, Casa Blanca Lily, Gloriosa Lily, Star Gazer, Lisianthus.[3]

Autumn Flowers: Autumn is the season of the primary harvest. Autumn falls from September to November in the Northern region, and from September to November in the Southern region. Crops get harvested during Autumn. Beautiful flowers that change colours are seen, at their best. Flowers Blooming in Autumn are: Amaranthus, Anemone, Baby's Breath, Bittersweet, China berry, Chrysanthemum, Cockscomb, Lily, Asiatic Lily, Gloriosa, Misty Blue, Orchid.[3]

Winter Flowers: Winter is the season of cold climate. The season occurs from December to February in the Northern region. In the Southern region winter occurs from June to August. The Flowers Blooming in Winter are: Helleborus, Holly berry, Lily, Asiatic Lily.[3]

Opium Poppy: Native to Southeastern Europe and Western Asia, breadseed poppy, Papaversomniferum plant contains narcotic alkaloids which are the active compounds of opium and many refined opiates, such as morphine and codeine. Somniferum – meaning "sleep bringing" in Latin – refers to the narcotic properties of the plant.[4] Most of the medicinal opium in the world is produced in India and Turkey. Opium is extracted primarily from the seed capsules. Blooming from mid-summer, this common annual can have flowers in many shades of yellow, pink, and purple, as well as white.[5]

Arsenic Floods during Rice Harvest in Eastern India

Some crops, such as rice, absorb arsenic easily, leading to contamination in the food chain. An estimated arsenic are pumped up by the tubewells and added yearly to the fertile soils here. From the last few years, many have been trying to explain how the toxic arsenic leaches into groundwater in the Ganga river-Brahmaputra floodplain. The latest research says floodwaters can remove arsenic.[6]

Latest research by LeMonte et al (2017) have highlighted that floods contaminated with arsenic, which may occur in sea levels rise due to climatic changes, could result into the mobilisation of this toxic arsenic in the soil. Research showed that element is more stable in environmental soil flooded with salty water, compared to fresh water, as saline stabilises mineral oxides, so it could inhibit microbial growth. However, micro organisms that transform toxic arsenic into water-soluble forms may adapt to salty conditions, and the risk of toxic element entering drinking waters due to rising sea levels should receive further attention.[7]

Flooding will cause arsenic to be released into water due to the transformation of mineral oxide compounds within the soil that contain arsenic. However, this study shows that this effect is more pronounced with river water flooding.[8]

Toxic Runoff during Floods

The inundation of an area with water can cause chemical release in other ways. In rural areas, runoff from flooded areas can carry with it eroded soil containing fertilizers, herbicides and insecticides. Runoff in motorways, roadsideor bridges may contain toxic arsenic and hydrocarbons. Toxic Runoff through the inundated waste sites may reveal a variety of toxic materials, depending on what was present on the location.[9]

Carbon monoxide poisoning during floods and winters

Carbon monoxide poisoning resulting from the incorrect use of fuel burning generators for electricity, barbeques, braziers or buckets of coal or charcoal for heating and cooking, or petrol-driven pumps and dehumidifiers to dry out flooded rooms.[10]

CO poisoning must form part of syndromic (Toxidrome) and event based surveillance systems for flooding and should be included in measures of the health impact of flooding.

During extreme winters in Northern part of Indian suburbs, wood burning, Kangri – amini Sigdi – Burnwood Coal inside their blankets or infrequently used places, inside closed cabinets (to prevent entry of freezing breeze of wind) sleep inside the smoke filled huts, which generate combustion gases in starting, but due to lack of air ventilation, vital oxygen is depleted, and toxic Carbon monoxide is produced, killing most of the innocent residents sleeping permanently.

Similarly in cold winters, Gas geysers get prominently utilised as low-cost alternative to electrical water heaters in economy class washrooms with poor air circulation and cheap hotels with congested rooms, without any ventilating windows, and the box shaped bathrooms. Gas water heater utilise the surrounding oxygen for burning the combustible gas as fuel, and release intoxicating CO in their bathrooms, thus if there is no ventilatory exhaust fan, the residing victim gets into deep sleep and sedated with odourless, colourless Carbon monoxide- as Asphyxiant gas, and the residing occupant suffers painless silent fatality, if not rescued urgently. CO monitors in our domestic setup should be installed not only in proximity to known CO generators and emitters but also in sleeping locations where portable or short term CO emitting appliances may be placed, including woodburners and infrequently used heating fireplaces at cold places in old buildings.

Season of Suicides- Valentine Day and Boards

Suicides are more common in February - March,

We may Predictthe possible Suicidal attempts: More common in February to March. February-Valentine Day.

March- during Final Exams for education Boards -secondary, senior secondary, professional courses like Medical, Engineering.

So Keep our Emergency department Ready and well equipped for the calamity.

Research on seasonal effects on suicide rates suggests that the prevalence of suicide is greatest during the late spring and early summer months, despite the common belief that suicide rates peak during the cold and dark months of the winter season. Suicides actually peak in the Spring and are not more common during the winter holiday period. Despite the fact that the majority of persons who commit suicide are already suffering undiagnosed from a mental disorder such as depression.[11]

M-Marijuana for M-Merry Making in M-March (MM) – Festival in Hostels

Cannabis smoking and Bhang drinking is promoted socially during festival of colours- Holi and Shivratri, in groups of college students living in Hostels, under peer- pressure are motivated to try once as no elder family member regulation is possible in Hostellers.[12] So Keep our Emergency Team Ready for the calamity. Associated Alcohol abuse and violence is common, and be ready for mass casualty.

Prevent – Serpent- Repent- Went

Some fatal calamities by Venomous bites and stings may be predictable, like the venomous serpentine bites and scorpions stings occur frequentlyin July to September, during rainy season, as their residential places underground like the -rat holes in the earth get flooded with rain water. So we must Keep our Emergency Team well equipped with sufficient stock of Anti-snake Venom (ASV) and Prazosin in pharmacy, for managing this predictable calamity, in better manner.

Alcohol

Similarly toxic methyl alcohol related toxicity is more common on the Weekends, but the pathognomic symptoms of methyl alcohol – Blind Drunks, may be delayed upto 24 to 48 hours, and may present on the Mondays – the first day of the week as Monday Blues, unlike ethyl alcohol.

So we must keep our Emergency department ready for receiving HOOCH mass casualty with their pharmacological Antidote-Fomepizole, Ethanol, Thiamine and Hemo Dialysis.

Pesticides

Pesticides used may be for different purposes in separate months around the year may be used for predicting the possible occupational and intentional poisoning (suicides more common in rural areas by villagers- farmers, due to debts and failure of crops).

Prior to harvest: many Insecticides (Organophosphates) and Herbicides (Paraquat) getutilized by farmers for protecting the harvest.

During Harvest: Mainly Fungicides and fumigants for preventing fungus infestation to the crop fruits, vegetables and consumption of grains by rats and birds.

Post-Harvest: Rat killers, Rodenticides, to protect the stored grains in storehouses from rodents like rats and mice.

Household Poisoning

More common in school and college students attempting suicide for failure in love affair during valentine days, or in exams, in March by consuming pills – Paracetamol kept in wardrobes, and corrosive – Toilet cleaner (Carbolic acid, Hydrochloric acid).

Diwali

Diwali is celebrated as the festival of lights, and phosphorescence producing colourful fire by crackers are popular among our children toddlers and teens, who may try to lick, smell and taste anything they found attractive. Thus they may suffer phosphorus poisoning or burns while manhandling the fire-cracker remainsduring mass celebrations in the households.

Christmas

Christmas is the festival of making rum cakes, and celebration goes on till new year with dance parties and alcohol abuse in Metro cities.

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Discussion

Calendars are used to help people manage their personal schedules, time and activities, particularly when individuals have numerous work, school, and family commitments. The term calendar is taken from calendae, the term for the first day of the month in the Roman calender, related to the verb calare "to call out", referring to the "calling" of the new moon when it was first seen.[13] Latin calendarium meant "account book, register" (as accounts were settled and debts were collected on the calends of each month). The Latin word was adopted in French vocabulary as calendier and inoxford English as calender by the 13th century (the spelling calendar is early modern).[14]

So, this Toxic calendar is prepared by the indian Society of Toxicology to call out the emergency medical services to prepare for managing the toxic disasters, based on the common toxins in that season, easily available to the vulnerable population (children exploring the attractive ornamental toxic plants or the pesticide liquids of bright color stored in water bottles). Or the depressed victims, look around in their environment for harming themselves, and consume the toxin found easily.

Prediction of possible toxic tragedies is very important for the safety of public health. Among its many uses, its prediction is necessary to reduce the expenditure and work labor of a medication's preclinical and clinical trials, because a lot of research evaluations (cellular trials, animal trials, and clinical trials) can be spared due to the possible toxicity. In our era of huge Data sharing and artificial intelligence by internet, prediction of toxicity can benefit from machine learning, which has been widely used in many fields such as natural language processing, speech recognition, image recognition, computational chemistry, and bioinformatics, performing with excellence.[15]

The goal of the initiative is to prioritize toxic xenobiotic substances for further in-depth toxicological evaluation as well as identify their pattern of availability in the environment, in their season of production (toxic flowers), migration (venomous snakes and scorpions) or utility (different pesticides indicated differently in preservation of crop during pre-harvest, harvest and post-harvest months every year) for further prevention of such as toxin-associated morbidity and mortality.

Conclusion

Toxicity prediction is vital to safety of public health. So, the Toxic calendar is prepared by the Indian Society of Toxicology to predict the common poisonings and call out the emergency medical services to prepare for managing the toxic disasters, based on the common toxins in that season, easily available to the vulnerable population. Among its many applications, prediction oftoxicity by Toxic Calendarcan reduce the expenditure and efforts of Medical Services in the long run, by preventing the morbidity and mortality of innocent victims.

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