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RESEARCH ARTICLE

A REVIEW ON THE NEED OF TRACING TOXIC SUBSTANCES IN HERBAL MEDICINES USED BY TRADITIONAL HEALERS IN MANIPUR

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ABSTRACT

We have come across a number of herbal medicines used by local traditional healers of Manipur. And also the treatments of local healers are effective. But most of the herbal medicines used by the local healers consist of not only a single plant but also of a number of plants so that by the action of any one or the other plant the ailment can be cured blindly. Some of the plants might have some adverse effects on other organs and organ systems of the human body. So it is time for the researchers to track all the elements and compounds in the constituents of the herbal medicines used by the local healers. Plants as we know have a number of defensive mechanisms to protect themselves from their enemies like herbivorous animals and insects. Plants do the defensive mechanisms either by developing defensive structures such as thorns, sticky substances etc. or by secreting poisonous chemicals. So in the present paper the need of investigating the organic and inorganic substances present in different parts of the plants used by the local healers is being discussed.

INTRODUCTION

Plants cannot move to escape their predators, so they must have other means of protecting themselves from herbivorous animals. Some plants have physical defenses such as thorns, spines and prickles, but by far the most common protection is chemical (Keddy, 2007). Over millennia, natural selection has produced a complicated and vast array of chemical compounds that deter herbivores. Tannin is a compound that emerged relatively early in the evolutionary history of plants, while more complex molecules such as polyacetylenes are found in younger groups of plants such as the Asterales. Many of the plant defense compounds arose to defend against consumption by insects, although when livestock or humans consume such plants, they may also experience negative effects, ranging from mild discomfort to death (Wikipedia, the free encyclopedia). We cannot avoid the local traditional medicines also. So it is the high time for the researchers to find out what are the substances available in the medicinal plants and whether they are useful or not.

DISCUSSION

Many of the poisonous compounds formed by plants as defensive mechanism also have important medicinal benefits (Lewis and Elvin-Lewis 1977). There are so many kinds of plant defenses that there are many unanswered questions about them.

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Questions include (1) which plants have which type of defenses, (2) which herbivores are the plants defended against, (3) what are the chemical structures of the compounds that provide defense, (4) and what are the potential medical uses of these compounds? This is still an active area of research with important implications for understanding plant evolution, and for medical research. Below is an extensive, if incomplete, list of plants containing poisonous parts that pose a serious risk of illness, injury, or death to humans or animals. Human fatalities caused by poisonous plants – especially resulting from accidental ingestion – are rare in the USA (Krenzelok and Mrvos, 2011).

Many food plants possess toxic parts, are toxic unless processed, or are toxic at certain stages of their life. Notable examples include: Apple (Malus domestica). Seeds are mildly poisonous, containing a small amount of amygdalin, a cyanogenic glycoside. The quantity contained is usually not enough to be dangerous to humans, but it is possible to ingest enough seeds to provide a fatal dose.

Images of Cassava plant

Cassava (Manihot esculenta) Roots and leaves contain two cyanogenic glucosides, linamarin and lotaustralin. These are decomposed by linamarase, a naturally occurringenzyme in cassava, liberating hydrogen cyanide (Cereda and Mattos, 1996).

Cassava varieties are often categorized as either sweet or bitter, respectively signifying the absence or presence of toxic levels of cyanogenic glucosides. The 'sweet' cultivars can produce as little as 20 milligrams of cyanide per kilogram of fresh roots, whereas bitter ones may produce more than 50 times as much (1 g/kg). Cassavas grown during drought are especially high in these toxins (Aregheore and Agunbiade, 1991; White *et al.*, 1998). A dose of 40 mg of pure cassava cyanogenic glucoside is sufficient to kill a cow. It can also cause severe calcific pancreatitis in humans, leading to chronic pancreatitis. Processing (soaking, cooking, fermentation, etc.) of cassava root is necessary to remove the toxins and avoid getting sick. "Chronic, low-level cyanide exposure is associated with the development of goiter and with tropical ataxic neuropathy, a nerve-damaging disorder that renders a person unsteady and uncoordinated. Severe cyanide poisoning, particularly during famines, is associated with outbreaks of a debilitating, irreversible paralytic disorder called konzo and, in some cases, death. The incidence of konzo and tropical ataxic neuropathy can be as high as 3 percent in some areas (Wagner and Holly, 2010).

For some smaller-rooted sweet varieties, cooking is sufficient to eliminate all toxicity. The cyanide is carried away in the processing water and the amounts produced in domestic consumption are too small to have environmental impact (Cereda *et al.*, 1996). The larger-rooted, bitter varieties used for production of flour or starch must be processed to remove the cyanogenic glucosides (Padmaja *et al.*, 1995). Industrial production of cassava flour, even at the cottage level, may generate enough cyanide and cyanogenic glycosides in the effluents to have a severe environmental impact Cereda, M. P.; Mattos, (1996). Cherry (Prunus cerasus), as well as other Prunus species such as peach (Prunus persica), plum (Prunus domestica), almond (Prunus dulcis), and apricot (Prunus armeniaca). Leaves and seeds contain cyanogenic glycosides.Grape (Vitis spp.), is potentially toxic to dogs, although the precise mechanism is not fully understood. See grape and raisin toxicity in dogs.

Images of Indian pea (Lathyrus sativus)

Indian pea (Lathyrus sativus). A legume grown in Asia and East Africa as an insurance crop for use during famines. Like other grain legumes, L. sativus produces a high-protein seed. The seeds contain variable amounts of β-N-Oxalyl-L-α,β-diaminopropionic acid or ODAP, a neurotoxic amino acid (Rao *et al.*, 1964). ODAP causes wasting and paralysis if eaten over a long period, and is considered as the cause of the disease neurolathyrism, a neurodegenerative disease that causes paralysis of the lower body and emaciation of gluteal muscle (buttocks). The disease has been seen to occur after famines in Europe (France, Spain, Germany), North Africa and South Asia, and is still prevalent in Eritrea, Ethiopia and parts of Afghanistan when Lathyrus seed is the exclusive or main source of nutrients for extended periods.

Image of Kidney bean Phaseolus vulgaris L.

Kidney bean or common bean (Phaseolus vulgaris). The toxic compound phytohaemagglutinin, a lectin, is present in many varieties of common bean but is especially concentrated in red kidney beans. The lectin has a number of effects on cell metabolism; it induces mitosis, and affects the cell membrane in regard to transport and permeability to proteins. It agglutinates most mammalian red blood cell types. The primary symptoms of phytohaemagglutinin poisoning are nausea, vomiting, and diarrhea. Onset is from 1 to 3 hours after consumption of improperly prepared beans, and symptoms typically resolve within a few hours "Foodborne Pathogenic Microorganisms and Natural Toxins Handbook: Phytohaemagglutinin" . Consumption of as few as four or five raw kidney beans may be sufficient to trigger symptoms. Phytohaemagglutinin can be deactivated by cooking beans at 100 °C (212 °F) for ten minutes. However, for dry beans the U.S. Food and Drug Administration (FDA) also recommends an initial soak of at least 5 hours in water; the soaking water should be discarded "Foodborne Pathogenic Microorganisms and Natural Toxins Handbook: Phytohaemagglutinin". The ten minutes at 100 °C (212 °F) is required to degrade the toxin, and is much shorter than the hours required to fully cook the beans themselves. However, lower cooking temperatures may have the paradoxical effect of potentiating the toxic effect of haemagglutinin. Beans cooked at 80 °C (176 °F) are reported to be up five times as toxic as raw beans "Foodborne Pathogenic Microorganisms and Natural Toxins Handbook: Phytohaemagglutinin". Bad Bug Book. United States Food and Drug Administration (Retrieved, 2009). Outbreaks of poisoning have been associated with the use of slow cookers, the low cooking temperatures of which may be unable to degrade the toxin.

Red kidney beans are commonly used in chili con carne and are an integral part of the cuisine in northern regions of India and Pakistan, where the beans are known as rajma and are used in a dish of the same name. Red kidney beans are used in New Orleans and much of southern Louisiana for the classic Monday Creole dish of red beans and rice. The smaller, darker red beans are also used, particularly in Louisiana families with a recent Caribbean heritage. Small kidney beans used in La Rioja, Spain, are called *caparrones*.

Kidney beans are more toxic than most other bean varieties if not pre-soaked and subsequently heated to the boiling point for at least 10 minutes. The U.S Food and Drug Administration recommends boiling for 30 minutes to ensure they reach a sufficient temperature long enough to completely destroy the toxin (Lewis and Elvin-Lewis 1977). However, cooking at the lower temperature of 80 °C (176 °F), such as in a slow cooker, can increase this danger and raise the toxin level up to five fold Food borne Pathogenic Microorganisms and Natural Toxins Handbook, US Food and Drug Administration (2009).

Images of Nutmeg (Myristica fragrans)

Nutmeg (Myristica fragrans). Contains myristicin. Myristicin is a naturally occurring insecticide and acaricide with possible neurotoxic effects on neuroblastoma cells (Lee *et al.*, 2005). It haspsychoactive properties at doses much higher than used in cooking. Raw nutmeg produces anticholinergic-like symptoms, attributed to myristicin and elemicin (McKenna *et al*., 2004). The intoxicating effects of myristicin can lead to a physical state somewhere between waking and dreaming; euphoria is reported and nausea is often experienced. Users also report bloodshot eyes and memory disturbances. [McKenna *et al.*, 2004] Myristicin is also known to induce hallucinogenic effects, such as visual distortions. Nutmeg intoxication has an extremely long time before peak is reached, sometimes taking up to seven hours, and effects can be felt for 24 hours, with lingering effects lasting up to 72 hours.

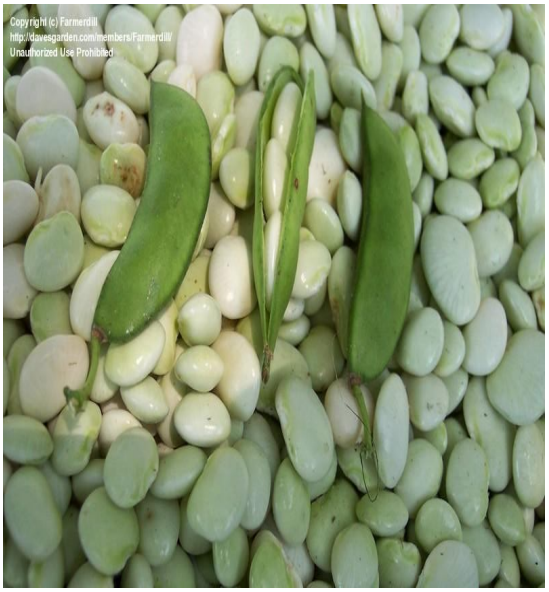

Image of Lima bean or butter bean (Phaseolus lunatus)

Lima bean or butter bean (Phaseolus lunatus). Raw beans contain dangerous amounts of linamarin, a cyanogenic glucoside.

Images of lupin

Lupin. Some varieties have edible seeds. Sweet Lupins have less, and Bitter Lupins have more of the toxic alkaloids lupinine and sparteine. Onions and garlic. Onions and garlic (genus Allium) contain thiosulphate, which in high doses is toxic to dogs, cats and some other livestock. Potato (Solanum tuberosum). Potatoes contain toxic compounds known as glycoalkaloids, of which the most prevalent are solanine and chaconine. Solanine is also found in other members of the Solanaceae plant family, which includes Atropa belladonna ("deadly nightshade") and Hyoscyamus niger ("henbane") (see entries below). The concentration of glycoalkaloid in wild potatoes suffices to produce toxic effects in humans. The toxin affects the nervous system, causing headaches, diarrhea and intense digestive disturbances, cramps, weakness and confusion, and in severe cases coma and death. Poisoning from cultivated potatoes occurs very rarely however, as the toxic compounds in the potato plant are, in general, concentrated in the green portions of the plant and in the fruit ("Tomato-like Fruit on Potato Plants". Iowa State University. Retrieved 8 January 2009). and cultivated potato varieties contain lower toxin levels (Glycoalkaloid and calystegine contents of eight potato cultivars, J-Agric-Food-Chem. 2003). Cooking at high temperatures (over 170 °C or 340 °F) also partly destroys the toxin. However, exposure to light, physical damage, and age increase glycoalkaloid content within the tuber, "Greening of potatoes". Food Science Australia. 2005. Retrieved 15 November 2008 the highest concentrations occurring just underneath the skin. Tubers that are exposed to light turn green from chlorophyll synthesis, thus giving a visual clue as to areas of the tuber that may have become more toxic; however, this does not provide a definitive guide, as greening and glycoalkaloid accumulation can occur independently of each other. Some varieties of potato contain greater glycoalkaloid concentrations than others; breeders developing new varieties test for this, and sometimes have to discard an otherwise promising cultivar. Breeders try to keep solanine levels below 200 mg/kg. However, when these commercial varieties turn green, even they can approach concentrations of solanine of 1000 mg/kg. The U.S. National Toxicology Program suggests that the average American consume at most 12.5 mg/day of solanine from potatoes (the toxic dose is actually several times this, depending on body weight).

Image of Rhubarb (Rheum rhaponticum)

Rhubarb (Rheum rhaponticum). The leaf stalks (petioles) are edible, but the leaves themselves contain notable quantities of oxalic acid, which is a nephrotoxic and corrosiveacid that is present in many plants. Symptoms of poisoning include kidney disorders, convulsions and coma. Rarely fatal. The LD50 (median lethal dose) for pure oxalic acid in rats is about 375 mg/kg body weight (Rhurbarb poisoning on rhurbabinfo. com) or about 25 grams for a 65 kg (~140 lb) human. Although the oxalic acid content of rhubarb leaves can vary, a typical value is about 0.5%, (Pucher *et al.,* 1938) so a rather unlikely 5 kg of the extremely sour leaves would have to be consumed to reach an LD50 of oxalic acid. Cooking the leaves with soda can make them more poisonous by producing soluble oxalates (Everist, Selwyn L., Poisonous Plants of Australia. Angus and Robertson, Melbourne, 1974). However, the leaves are believed to also contain an additional, unidentified toxin, (Rhubarb leaves poisoning". Medline Plus Medical Encyclopedia) which might be an anthraquinone glycoside (also known as senna glycosides (Canadian Poisonous Plants Information System". Cbif.gc.ca. 2009-09-01. Retrieved,

2010). In the edible leaf stalks (petioles), the amount of oxalic acid is much lower, only about 2–2.5% of the total acidity that is dominated by malic acid (McGee, Harold. On Food and Cooking: The Science and Lore of the Kitchen. New York, NY: Scribner, 2004). This means that even the raw stalks may not be hazardous (though they are generally thought to be in the US). However the tart taste of raw stalks is so strong as to be unpalatable to many.

Tomato (Solanum lycopersicum). Like many other nightshades, tomato leaves and stems contain solanine that is toxic if ingested, causing digestive upset and nervous excitement. Use of tomato leaves as an herbal tea (infusion) has been responsible for at least one death (Pittenger and Dennis, 2002). Leaves, stems, and green unripe fruit of the tomato plant also contain small amounts of the poisonous alkaloid tomatine, although levels are generally too small to be dangerous (Barceloux *et al.,* 2009). Ripe tomatoes do not contain any detectable tomatine (Barceloux *et al.,* 2009). Tomato plants can be toxic to dogs if they eat large amounts of the fruit, or chew plant material (Hound health handbook: the definitive guide to keeping your dog happy By Betsy Brevitz page 404). The leaves of Lima bean or butter bean (Phaseolus lunatus) known as Kalandri in our local language in Manipur was used by our forefathers to decrease the high temperature due to fever in young children by applying its crushed leaves on the soft region of the young ones. When applied like this one of my cousin was died because of convulsion in the 1970s. It is also heard from our elder persons now that the same leave is highly poisonous and when it is crushed with the leaves of marigold and given to the cattle, they eventually died.

Conclusion

Thus there are reports of unwanted or toxic substances even in our daily vegetables and fruits in our kitchen. In Manipur there are innumerable traditional healers. Most of them use multiple plants to make their herbal medicine for treatment to their patients so that any one or the other plant extract might heal the ailment. So it is very much needed for the researchers to trace toxic substances in herbal medicines used by traditional healers in Manipur so that the toxic substances can be removed by some way or the other and use only the useful substances in the medicinal plants.

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