Poisonous Plants of Forensic Sgnificance

INTRODUCTION : The history of poisons and poisoning dates back several thousand years. Early poisons were almost exclusively plant and animal toxins, and some minerals. They were used mainly for hunting. Some were used as —ordeal poisons‖ which means _Ingestion of these substances were believed to be lethal to the guilty and harmless to the innocent‘, for e.g. physostigmine from Physostigma venenosum (Calabar bean), and amygdalin from peach pits. One of the earliest classifications of poisons was done by the Greek physician Dioscorides (AD 40–80) who categorised poisons into 3 groups—Animal, Vegetable, and Mineral An early treatise on plant poisons is De Historia Plantarum, by Theophrastus (370–286 BC). The ancient Indian text Rig Veda (12th century BC) also describes several plant poisons. The Greeks used some plant toxins as poisons of execution. Socrates (470–399 BC) was executed by the administration of hemlock.

FORENSIC ISSUES :Since India is a tropical country, it is host to rich and varied flora of thousands of plants, some of which are extremely poisonous. Most people in rural areas depend for their food upon farms and gardens. Cases of accidental poisoning occur not infrequently due to mistaken ingestion of toxic plant products or contamination of foodstuffs. Some cases are related to intake of harmful herbal remedies and traditional medicines. A substantial number of cases involve children for whom plants are accessible and attractive. In some Western countries, 5 to 10% of all human exposures reported to poison control centres involve plants. In India, the over-all percentage ranges from 6 to 15%, while if rural populations are taken in isolation, the percentage may be as high as 63%.

CLASSIFICATION OF PLANT POISONS Plant poisons are categorized in following classes based upon their action: 4.1 Neurotic: They chiefly act on the Central Nervous System (CNS), Spinal cord, Symptoms usually consist of headache, drowsiness, giddiness, delirium, stupor, coma, and convulsion. E.g., Papaver somniferum, Strychnos nux vomica, Cannabis sativa, Erythroxylon coca, Atropa belladonna, Dhatura fastuosa, etc. 4.2 Cardiac: These affect functioning of heart. E.g., Nicotiana tabacum, Aconitum napellus, Digitalis purpurea. 4.3 Irritant: These produce symptoms of pain in the abdomen, vomiting and purging. E.g., Abrus precatorius, Calotropis gigantea, Calotropis procera, Cytisus laburnum, Taxus baccata, Croton tiglium, Argemone mexicana, Gloriosa superba. 4.4 Miscellaneous: Cyanogenetic glycosides, Ergot (Claviceps purpurea), Oleander (Glycoside)

SOME NOTABLE PLANT POISONS

STRYCHNINE: Strychnine is the primary alkaloid in the strychnos plant (seeds), and is a powerful spinal stimulant. Its botanical name is Strychnos nux vomica. It is also known as Dog button, Poison nut. This is a tree belonging to family Logianaceae which grows well in South India, as well as in certain other parts of the country. The main alkaloid strychnine has been in use as a rodenticide since the 16th century. It is sometimes used for killing stray dogs (hence the name —dog buttons‖).

The toxic parts of this tree are Leaves, fruits, and seeds. Strychnine and Brucine are the principal alkaloids, of which the former is much more powerful. It is a basic alkaloid and can be extracted from the seeds as an odourless, bitter-tasting, white crystalline material. The Fatal Dose is about 30 to 50 mg for strychnine and about 1 to 3 grams for strychnos seeds.

The poisonous properties reside in piperidine alkaloids, coniine and gamma- coniceine. They are structurally similar to nicotine and possess similar clinical features in toxicity

POISON HEMLOCK: Greeks chiefly employed Hemlock, for suicidal purposes and as State poison as a form of capital punishment. Socrates was found guilty of corrupting the youth of Athens with his philosophical teachings and in 402BC was made to drink the State poison that is Hemlock. Its botanical name is Conium maculatum. Hemlock belongs to the family Umbelliferae of genus Cicuta, and is a biennial herb that grows erect to an average height of 1 to 3 metres. Several cases of poisoning have occurred, hemlock having been mistaken for parsley, fennel, asparagus, and parsnip. The leaves of the plant have a peculiar mousy odour, which is intensified when they are rubbed in a mortar with some caustic potash. The poisonous properties reside in piperidine alkaloids, coniine and gamma- coniceine. They are structurally similar to nicotine and possess similar clinical features in toxicity.

DATURA This is a small coarse shrub of Datura species with a strong and rather unpleasant smell, belonging to family Solanaceae which grows wild all over the Indian countryside. Other Common Names are Jamestown weed; Jimson weed; Thorn apple; Stinkweed; Devil‘s weed; Angel‘s trumpet. The Toxic Principles of Datura are Hyoscine (scopolamine), hyoscyamine, and traces of atropine, together referred to commonly as belladonna alkaloids.

Belladonna alkaloids competitively inhibit the muscarinic effects of acetylcholine. Sites of action are at the autonomic effectors innervated by postganglionic cholinergic nerves or on smooth muscles that do not

contain cholinergic innervation. Central Nervous System effects result from their central antimuscarinic actions, i.e. vagal stimulation and decrease in heart rate. Usual Fatal Dose is about 50 to 100 Datura seeds and about 10 to 100 mg of atropine (usually 60 to 75 mg).

ARGEMONE MEXICANA Other common names are Prickly Poppy, Yellow poppy, Mexican poppy. This is a robust, prickly, annual or perennial herb belonging to family Papaveraceae, which grows up to 4 feet in height, bearing thistle-like leaves and yellowish flowers. There is no legitimate use for argemone seeds or the oil extracted from them. In India, mustard oil and other vegetable oils are often adulterated deliberately with argemone oil. Sometimes the dark variety of mustard seeds is adulterated with argemone seeds. Toxic Part Seed and expressed oil are quite toxic. Leaves are also toxic (to a lesser degree). The Toxic Principles of Argemone are: 1) Sanguinarine 2) Dihydrosanguinarine.

Both of them are physiologically active benzophenanthridine alkaloids. In addition, other alkaloids of lesser importance are present, such as protopine, berberine, chelerythrine, isoquinoline, and coptisine. Berberine and protopine are found throughout the entire plant, while sanguinarine and dihydrosanguinarine are found in the seeds. Liver, heart, kidneys, and lungs are the target organs of argemone alkaloids, and it is postulated that membrane destruction is the probable mode of action. The exact mechanism is not well understood.

CROTON Croton tiglium, belonging to family Euphorbiaceae, grows well in Assam, Bengal, and the Western Ghats. It is a small evergreen tree with ovate or elliptical leaves which are narrowpointed, toothed, and 2 to 4 inches long, varying in colour from metallic green to bronze,

orange, or yellowish. The seeds, oil, and root extract are used as a drastic purgative in traditional medicine. The Toxic Principles of croton are: 1) Crotin (toxalbumen). 2) Crotonoside (glycoside)

ERGOT Ergot is produced by a fungus, Claviceps purpurea, which infests certain types of grain, especially rye. The spores of the fungus are carried by insects or wind to young rye where they germinate into hyphae (filaments). The hyphae penetrate deep into the grain and harden into a purplish structure called sclerotium, which particularizes a number of ergot alkaloids. During wet seasons, Claviceps purpurea can infest wheat, barley, rye (most common), Oats, Wheatgrass, Quackgrass, Smooth Bromegrass, Wild Rye and Bluegrasses. Examples of ergot alkaloids include Dihydroergocornine, Dihydroergocristine, Dihydroergosine, Dihydroergotamine, Dihydroergotaxime, Ergobasine, Ergocornine, Ergocristine, Ergocryptine, Ergosine, Ergometrine or Ergonovine, Ergotamine, Ergotaxime, Methylergonovine, Bromocriptine, Lergotrile, Lisuride, Lysergol, Metergoline, Methylergonovine, and Methysergide. All these are derivatives of 6-methylergoline, a tetracyclic compound.

There have been more than 350 chemicals identified, but less than 10 are used therapeutically. Natural ergot is also the source of the potent hallucinogen lysergic acid diethylamide or LSD.

ACONITE This plant belongs to family Ranunculaceae and grows well in the hilly regions of Northern and Eastern parts of India, extending from Assam to Kashmir. The tuberous part of this plant is very popular in Chinese medicine for the treatment of various ailments. The root is usually processed by drying, soaking, or boiling, which significantly reduces its toxicity. Raw aconite roots are highly toxic. Herbal

decoctions of aconite are generally prepared by soaking the roots in water or saturated lime water and then boiling. This causes hydrolysis of aconite alkaloids to less toxic benzylaconine and aconine derivatives. Aconite is also used in Indian folk remedies. It is also used as an antipyretic in Ayurvedic medicine, after —detoxification‖. Aconite is sometimes used as an abortifacient. Fatal Dose of Aconite is about 9 to 18 grams of root and about 3 to 5 mg of aconitine, while about 10 to 15 ml of tincture. However, deaths have been reported with as little as 1 grams of root, 0.2 mg of aconitine, and 5 ml of aconite tincture. It has been estimated that an adult lethal dose is generally about 1 grams of plant part (root), 5 ml of a prepared tincture, or 2 mg of pure aconite