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absent in trees infested by the red ant *oecophylla.* In addition to the predators a braconid parasite *Hormius* sp. has also been once reared from pupating caterpillars.

Control Systematic handpicking of affected clusters with the contained insects and destroying them, forms one of the best remedies to minimise damage. The affected twigs with young or old caterpillars can be easily collected.

Spraying the foliage with calcium arsenate ($\frac{1}{2}$ oz. calcium arsenate in one gallon of water) has given satisfactory results. The caterpillars feed on the poisoned leaves and eventually die.

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SELECTED ARTICLE

Some Plants Poisonous to Livestock

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Poisoning of livestock may be caused either by some of the flowerless plants such as fungi, lichens, etc., or by flowering plants such as the gramineae and leguminosae. This article deals with plants of the second group only, inasmuch as they are more extensively concerned with the poisoning of livestock.

The history of poisoning by plants in India can be traced to the remote past. The earliest mention is to be found in the *Rig Veda*, which is one of the oldest repositories of human knowledge, while further details may be gleaned from the *Charaka Samhita* and the *Shushruta Samhita*. Although some poisonous plants are protected by an unpleasant odour, an acid or bitter taste, or by spines, the poisoning of animals by such plants is of common occurrence, in spite of the widespread belief that they are protected by some instinct against eating dangerous plants. The important contributory factors incidental to poisoning are: (1) the ingestion of wilted, frosted or defoliated plants during drought, (2) the scarcity of palatable fodder during winter and early spring, (3) fatigue in transport and draught animals, (4) lack of salt, (5) a depraved appetite, (6) the fact that poisonous plants often grow in close association with palatable fodder, (7) the importation or transport of animals to new surroundings, and (8) the ingestion of poisonous plants along with hay.

Enormous losses It appears therefore that in a country such as India where a balanced feed is rarely available to animals where pastures are over grazed and grazing grounds are infested with poisonous plants, an enormous percentage of the cattle population is exposed to the dangers of poisoning. It seems, however, difficult to obtain reliable figures with regard to livestock losses sustained by plant poisoning, as only those cases are reported in which a large number of animals are involved.

The annual loss due to plant poisoning in animals in the U. S. A. is estimated to exceed $ 200,000,000 and in some years they may be even greater. In one

extensive outbreak in Texas, it was estimated that during one spring alone animals valued at $ 300,000 died from the effect of a single species of plant. Individual losses involving five to ten thousand dollars are not uncommon, while losses involving smaller amounts occur continually throughout the length and breadth of the country. Similar reports of heavy losses have been made in England, South Africa, Australia and Germany.

The death of stock is not the only loss caused by the poisonous plants; consequent losses may be manifested in the form of: (1) a drop in milk yield, (2) the loss of milk and flesh, (3) the loss of milk and wool in sheep, (4) the loss of condition in horses, (5) losses due to the action of poisonous plants on the foetus, causing either its expulsion as a result of the contraction of the uterus or its death, (6) sterility, (7) losses due to temporary or permanent injury to different organs, such as the heart, gastro-intestinal canal, kidney, liver, salivary glands and the eyes, (8) disturbances in the processes of metabolism, and (9) deformities in hoofs.

Hydrocyanic acid producing plants It is not to be expected that the losses due to plant poisoning are less in India than in the other countries mentioned above, especially as the plants incriminated in other countries also exist in India. According to the work of Chopra and Badhwar, at least 700 poisonous plants are known to exist in India even at the present day. It appears that the reason why stock poisoning cases are not brought to the public notice is that in all probability a very large number of cases and even outbreaks of plant poisoning pass unrecognized and thus remain univestigated.

It is not possible to deal with the large number of plants that are poisonous to stock but brief mention will be made only of poisoning due to some of the important hydrocyanic (prussic) acid producing plants, which form a major portion of the food of animals and are highly relished by them. *Sorghum vulgare* Pers. (*jowar*), *Sorghum halepense* Pers. (Johnson grass, *dadam*) *Sorghum vulgare sudanese* L. glax. (Sudan grass), *Triglochin maritimum* Linn. (arrow grass), *Trifolium repens* Linn. (white clover) and *Zea mays* Linn. (maize) ordinarily form nutritious fodders, but under certain climatic and soil conditions, especially in times of drought or when the plants are wilted, stunted or young they develop dangerously large quantities of hydrocyanic acid which is highly poisonous to all stock.

It is a common practice to put stock out to graze cut-over fields in the late summer and autumn and the regrowth is much relished by the animals on account of its succulent saline character and its freedom from stems. Herein, however, danger lies, since they are very rich in hydrocyanic acid.

In practical feeding, therefore, young seedlings under one foot, plants stunted owing to drought, second growths or ratoons and secondary shoots should be avoided.

It has been observed that under conditions of drought the hydrocyanic acid content of some of the crops increases to about 2½ times the original quantity. Wherever possible, either the forage affected by the above mentioned conditions should be thoroughly cured or converted into silage with water added to ensure fermentation, since it is believed that ensiling renders the hydrocyanic acid containing plants innocuous.

Feeding animals on different species of acacia is also a common practice and it is pointed out that although, as a general rule, there is little risk of poisoning as a result of the consumption of mature pods the fresh green foliage, twigs and green pods are said to be harmful at times owing to their containing hydrocyanic acid.

Linseed cake has been found to produce prussic acid poisoning and in order to destroy the enzyme or ferment responsible for liberating the hydrocyanide

from the glucoside, the cake should be treated with boiling water. The cyanogenetic gluscosides are widely distributed in plants and hydrocyanic acid has been found in 148 species of 41 families.

The chief symptoms of hydrocyanic acid poisoning are accelerated and deepened respiration, weak and irregular pulse, increased salivation and frothing at the mouth, muscular twitching, staggering as if intoxicated, anxious expression, dilatation of the pupils, convulsion, coma and death due to respiratory paralysis.

Treatment *Preventive* When climatic conditions are most favourable for hydrocyanic acid poisoning sulphur should be fed to livestock as follows :—

Two tablespoonfuls of sulphur for cattle per head per day, and one teaspoonful to sheep and goats every fourth day.

Curative Because of the rapid course of hydrocyanic (prussic) acid poisoning, it is necessary to apply the treatment without delay. Bleeding is sometimes useful in removing large quantities of absorbed hydrocyanic acid and this should be followed by intravenous injections of 10 c. c. of 20 per cent sodium nitrite solution and 30 c c. of 20 per cent sodium thiosulphate for cattle, and a half of this dose for sheep.

Simple tests A working guide as to the poisonous nature of the fodder may be the application of the following tests:—

(1) Strips of filter paper are dipped in a saturated solution of picric acid and dried in air. The leaves of the suspected plant are macerated, preferably by adding a few drops of chloroform, to effect the release of hydrocyanic acid from the plant cells. The macerated plant material, which may have in suspected cases the odour of bitter almonds, is placed in a small bottle. When the picric acid filter paper strips are moistened with 1 per cent sodium carbonate solution and inserted with the cork in the bottle they will show the presence of hydrocyanic acid by changing colour to orange and finally to red.

(2) Cut a transverse section of the stem of suspected plant near the root, and add a small amount of tincture iodine. The changing of the cut surface to blue or black indicates the presence of hydrocyanic acid.

Enough has been said in this brief survey to indicate that the losses due to fodder poisoning in India must be enormously greater than official records would suggest. It is however, realized that in a country where animal food stuffs are extremely scarce and where the average farmer is forced by poverty to rely mainly on grazing for the feeding of his cattle, complete abstinence from the only fodder available at certain seasons is scarcely practicable. *Indian Farming, March 1943.*

Gleanings

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