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Detection and Quantitative Estimation Prussic Acid in the Members of Family Euphorbiaceae from Nanded District of Marathwada Region of Maharashtra State (India).

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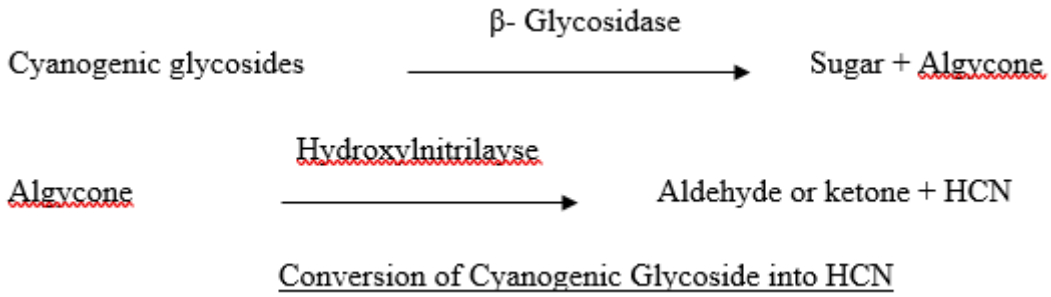
ABSTRACT

Cyanide exists various forms in nature as a salts of Sodium, Potassium and Calcium beside these, hydrogen cyanide or hydrocyanic acid or prussic acid is produced by number of plants of the World flora. In plants Cyanogenesis is a bio-chemical defense mechanism to protect themselves from microbies as well as from herbivore. Amygdalin, Dhurrin, Prunasin, Linamarin , Lotaustaralin Cardoispermin etc. are the cyanogenic glycosides present in plants. On hydrolysis these glycosides release hydrogen cyanide. In the present study the quantative estimation of total cyanide in some of the members of Euphorbiaceae family from Nanded district of Marathwada region of Maharashtra state has been done. The family – Euphorbiaceae is also called as Spurge family, is a very large family of Angiosperms. The members of this family are cosmopolitan in their distribution. Medicinally and economically the members of this family are very important. They have a potential source of starchy food, oil, medicines, rubber, biofule etc. The study is important to understand toxicity of plants.

Keywords: Cyanogenesis, Cyanogenic glycosides, Prussic acid, family Euphorbiaceae etc.

INTRODUCTION:

Hydrocyanic acid or Hydrogen Cyanide **(HCN)** or better known as prussic acid is produced by number of plants of the World flora. At least 2700 species of higher plants have been shown to contain one or more nearly thirty-two compounds capable of producing hydrogen cyanide (HCN) or prussic acid from amino acids **(Seigler 1976, Moller and Seigler 1999, Jones 1998)**. Cyanogenesis is a bio-chemical defence mechanism in plants to protect themselves from microbes as well as from herbivore. Amygdalin, Dhurrin,Prunasin Linamarin , Lotaustaralin Cardoispermin etc. are the cyanogenic glycosides present in cyanogenic plants. After hydrolysis these glycosides release hydrogen cyanide . In the first step, with the help β-glycosidase enzyme the cyanogenic glycoside present in some of the plants can be converted into sugar and an algycone . In the next step with the help of another enzyme this algycone is changed to aldehyde or ketone along with release of hydrocyanic acid.



Conversion of Cyanogenic Glycoside into HCN

Poisoning of prussic acid can be dangerous to the animals that eat cyanogenic plants but also to the plants themselves, to prevent this self poisoning the plants store cyanogenic glycosides in a vacuole of the cell and the enzyme that act to produce hydrogen cyanide in a separate compartment, when a cell is damaged the compartments walls are broken and the reaction takes place and HCN is released.

Many Agriculturally and Horticulturally important plants known to contain quite a good amount of hydrocyanic acid in them. The Grazing animals when they consume the cyanogenic plants, they suffer from the cyanide poisoning. The cyanide-poisoned animals shows an increased rate of respiration, increased pulse rate, gasping, muscular twitching or nervousness, trembling, foam from the mouth, blue colorations of the lining of the mouth and spasms or convulsions, death occurs from respiratory paralysis. Often blood passes from the nostrils and from the mouth near the time of death.

The specific survey of cyanogenic plants in angiospermic families and genera was thought to be significant from the taxonomic point of view **(Satish Patel et.al. 2013)** as the chemical variation exhibited by the plants, like any other facts of diversity, is theoretically a source of character useful in taxonomy **(Smith 1978)**. In fact, in earlier days HCN production by plants was considered as an important chemotaxonomic character **(Gibbs 1974, Hegauner 1958, 1959 a, 1961a)**.

Materials and Methods:

For experiment some of the members of family Euphorbiaceae are collected from different season and identified by using the Flora of Maharashtra (Almeida M.R. 2001) and Flora of Marathwada (V.N. Naik 1998) and tested for presence of HCN by simple sodium picrate paper test.

The leaf \ fruit \ seed extract suspected for the presence of cyanogenic compounds were taken in 0.2M. phosphate buffer pH 7 and centrifuged at 2000 RPM. The supernatant liquid was placed in a test tube.The strip of whatman filter paper No. 1, 5cm x 2cm was soaked in sodium picrate solution and dried, and it was hanged in the test tube containing the extract. The color of the picrate paper was observed, if the color changed from yellow to reddish brown, it confirmed the presence of prussic acid and the test was positive. If the test is negative, the tube should be left at room temperature for further 24 – 48 hours and then re-examined for any non- enzymatic release of hydrocyanic acid.

For quantitative estimation the simple semi-quantitative method described by Bradbury **(Bradbury et al.1999)** is used. The simple semi-quantitative method described by Bradbury using picrate paper kit involves the immobilization of linamarase enzyme in a small filter paper disc. The disc is placed in a small vial, plant material. A strip of yellow picrate paper is inserted and vial is capped. The vial is left for 16-24 hours at 25^{o}C to 35^{o}C. The color is matched against a color chart sheds and the result is summarized in the Photo Plant & Table No.- 1.

Table No. 1 Detection and Quantitative Estimation Prussic Acid in the Some of the Members of Family- Euphorbiaceae

S. No.	Name of Plant	Plant Part Tested	Test	Amount of HCN in ppm
1	Acalypha indica L.	Leaf	+ve	10
2	Acalypha wilkesiana Muell-Arg.	Leaf	+ve	20
3	Acalypha malabarica Muell-Arg.	Leaf	-ve	00
4	Croton bonplandianum Baill.	Leaf Root	+ve +ve	10 10
5	Chrozophora prostrata Dalz.	Leaf Fruit	-ve -ve	00 00
6	Chrozophora rottleri (Geis.) Juss. ex Spreng.	Leaf Root Flower Fruit	+ve +ve +Ve +ve	10 10 10 10
7	Euphorbia tirucalli L.	Leaf Root	+ve +ve	10 10
8	Jatropha gossypifolia auct.	Leaf Fruit	+ve +ve	20 20
9	Jatropha curcas L.	Leaf Fruit	+ve +ve	20 20
10	Manihot esculenta Crantz.	Leaf Stem Tuber Root	+ve +ve +ve +ve	100 200 800 800
11	Phyllanthus urinaria L.	Leaf Fruit Root	+ve +ve +Ve	10 10 10
12	Phyllanthus virgatus Forst.f.	Leaf Root Flower Fruit	+ve +ve +Ve +ve	10 10 10 10
13	Phyllanthus maderaspatensis L.	Leaf	+ve	10
14	Ricinus communis L.	Leaf Fruit	+ve +ve	10 10
15	Sebastiania chamaelea (L.) Muell Arg.	Leaf	+ve	20
16	Tragia plukenetii A.R.Sm .	Leaf Fruit	+ve +ve	10 10

Results and Discussion:

In this particular study of the family- Euphorbiaceae 16 plants were tested, out of these 16 plants 14 plants i.e. Acalypha indica L.; Acalypha wilkesiana Muell-Arg.; Croton bonplandianum Baill. ;

Chrozophora rottleri (Geis.) Juss. ex Spreng. ; Euphorbia tirucalli L.; Jatropha gossypifolia auct.; Jatropha curcas L., Manihot esculenta Crantz.; Phyllanthus urinaria L.; Phyllanthus virgatus Forst. F., Phyllanthus maderaspatensis L.; Ricinus communis L.; Sebastiania chamaelea (L.) Muell Arg.; Tragia plukenetii A.R.Sm were found to be positive for HCN with 10 to 800 ppm cyanide was released, whereas 02 plants i.e.- Acalypha malabarica Muell-Arg. ; Chrozophora prostrata Dalz. are negative for HCN test.

The study is important to understand toxicity of plants in a particular geographical region and their mechanism to cure the different types of plants and animal diseases and the tolerance of plant in the particular environmental condition.

References:

1. Almeida M.R. (2001) Flora of Maharashtra.
2. Bradbury M.G. Egan S.V. and Bradbury J.H. (1999) “Picrate kit for determination total cynogens in cassava roots and all forms of cyanogens in cassava products.” J. Sci. Food Agri 79:593-601.
3. Gibbs R.D. (1974) “Chemotaxonomy of Flowering Plants.” 4 vols McGill Queens University
4. Press, Montreal.
5. Jones D. A. (1998) “Why are so many plants cyanogenic?” Phytochemistry 47:155-162.
6. Hegnauer R. (1958) Pharm. Acta. Helv. 33:287-305.
7. Hegnauer R. (1959 a) Pharm. Weekbl. 94:241-8.
8. Hegnauer R. (1961 a) “Recent Advances in Botany.” Vol I:pp 82.
9. Satish Patel, Mukesh K. Nag, S.J. Daharwal, Manju R. Singh, Deependra Singh (2013) ' Plant Toxins: An Overview' Research J. Pharmacology and Pharmacodynamics 5 (5): 2013: 283-288.
10. Seigler D.S. (1976) “Plants of the North eastern United States that produce cyanogenic compounds.” Eco. Bot. 30:395-407.
11. Smith P.M. (1978) “Chemical evidence in plant taxonomy in essays in plant taxanomy.” Ed. H. E. street. Acad
12. Naik V. N. (1998) “Flora of Marathwada” Amrut Prakashan Aurangabad.