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Toxic effect of the fruit of Passiflora adenopoda D. C. on humans: phytochemical determination

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ABSTRACT

Human poisoning caused by ingestion of unripe fruit of *Passiflora adenopoda* is here reported, apparently for the first time.

HCN is produced in the pericarp and aril of the unripe fruit, as well as in the primary stem, petiole, bracts and stipules but not in tendrils. HCN yield has been reported previously in Passifloraceae only from vegetative parts. The pericarp and arils of completely ripe fruit of *Passiflora adenopoda* were found free of HCN. The presence of a cyanogenetic B-glycoside is suggested in *P. adenopoda.*

It is well known that most Passifloraceae yield HCN, a fact which has considerable chemotaxonomical significance (1). Nevertheless, most of the studies published are qualitative and refer only to the vegetative parts, especially leaves (2, 3, 6, 10).

In February, 1971, five children suffered poisoning in Cartago, Costa Rica. One of them died and the autopsy revealed fragments of the green pericarp and seeds of a fruit later determined as *Passiflora adenopoda* D. C. Since the literature consulted contains no information on the production of HCN by fruits of Passifloraceae, we decided to investigate the matter, using material of the same plant that caused the intoxications.

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MATERIAL AND METHODS

Leaves, stems, petioles, tendrils, bracts, and unripe and ripe fruit of *Passiflora adenopoda,* collected in Llano Grande de Cartago (2500 m) and on the main campus of the University of Costa Rica, Ciudad Universitaria Rodrigo Facio (1135 m) were used. From the fruits, the pericarp, seeds and arils were tested. The latter were separated from the seeds by squeezing through gauze.

Tests were made both at room temperature and at 45 C using always a standard amount of 3 g of plant material, whole or crushed.

The yield of HCN was determined by the freshly prepared picrate paper (5, 7, 8) and the ferricyanide (Berlin blue) tests (7), in water or acid medium and also with the addition of freshly prepared emulsine (5, 8). A paper ferricyanide test was also made according to the following technique: small pieces of the plant part were placed in the selected medium in 150 × 18 mm test tubes. A cork was placed in the tube with a fixed piece of filter paper 1-1.5 cm long, impregnated with 10 % NaOH. Test material was macerated for 30 minutes and then placed in boiling water for three minutes. Allowed to cool, the filter paper was removed and placed in a spot test plate; 1 to 2 drops of freshly prepared 3 % $FeSO_4$ were added and after 3 to 4 minutes 2 to 3 drops of 10 % HCl. A positive result was recorded when the typical blue color of ferricyanide appeared on the paper and in the depressions of the plate.

RESULTS

Table 1 shows the results of the various tests performed. These tests demonstrated that *P. adenopoda* yields HCN from the leaves, petioles, bracts, stipules, primary stems, and the pericarp and arils of the unripe fruit. Negative results were obtained from tendrils. In all vegetative parts the reaction was weaker than that obtained from parts of the fruit.

The arils form a bag-like structure, one cell thick, enveloping the seed. It is rich in carotenes. The strongest positive reaction for HCN was obtained from the arils, except when fully ripe. The fully ripe fruit can be distinguished by the bluish-purple color of the pericarp. As the fruit ripens, the yield of HCN decreases gradually to a negative point. This fact suggests the possibility that the presence of an HCN-producing substance is enzymatically hidrolysed. The fact that reactions were more evident when emulsine was added suggests the presence in *P. adenopoda* of a B-glycoside, and that the ripe fruit yields no HCN may explain why so many of the Passifloraceae are edible and palatable (4, 9).

The comparison between the ferricyanide positive reaction given by the arils and the pericarp, in relation with that obtained using a few milligrams of NaCN as standard, led us to conclude that the unripe fruit of *P. adenopoda* caused the poisoning of the children. The Coroner's report confirmed cyanide poisoning.

TABLE 1

Qualitative analysis for HCN in parts of Passiflora adenopoda *D. C.*

Method	Picrate	Picrate	Picrate	Picrate	Ferricyanide	Ferricyanide
Medium	Water	HCl 5 %	H_2SO_4 10 %	Water + emulsine	Water	H_2SO_4 10 %
VEGETATIVE PARTS						
Leaves	+	+	+			
Petiole	+	+	+			
Stem	+	+	+			
Tendrils	—	—	—			
Bracts & stipules	+	+	+			
DEVELOPING FRUITS						
Pericarp	+	+	+	+	+	+
Aril & seeds	++	++	++	++	++	+
DEVELOPED FRUITS						
Unripe pericarp	+	+	+	+	+	+
Ripe pericarp	—	—	—	—	—	—
Seeds without aril*	—	—	—	—	—	—
Seeds with aril*	++	+	+	++	++	+
Seeds with aril**	—	—	—	—	—	—
Aril*	++	++	++	++	++	++
Aril**	—	—	—	—	—	—
control (NaCN + HCl)						

* Unripe fruit
** Ripe fruit

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