

Treating Livestock with Medicinal Plants: Beneficial or Toxic?

Carica papaya

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Introduction

Carica papaya (Family Caricaceae) originated in Central America. It is an interesting tree in that the male and female parts exist in different trees. The fruits, leaves, and latex are used medicinally. Papain, a major compound in the fruit and latex has been used in brewing and wine making and the textile and tanning industries. Common names for papaya trees include:

- Betik petik
- Chich Put
- Fan Kua
- Gandul
- Katela gantung
- Kates
- Kavunagaci
- Kepaya
- Kuntaia
- Lechoso
- Lohong Si Phle
- Mapaza
- Mu Kua
- Papailler
- Papaw and pawpaw tree
- Papaya
- Papaye
- Papayer
- Pepol
- Tinti
- Wan Shou Kuo

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Chemical Compounds

Carica papaya contains many biologically active compounds. Two important compounds are chymopapain and papain, which are supposed to aid in digestion. Papain also is used to treat arthritis. The level of the compounds vary in the fruit, latex, leaves, and roots. In addition, plant parts from male and female trees differ in the quantity of the compounds. For example, phenolic compounds tend to be higher male trees than female trees. The quantity of fresh papaya latex and dry latex (crude papain) also vary with the sex of the tree and the age of the tree. Female and hermaphrodite trees yield more crude papain than male trees and older fruit yields more than younger fruit. However, the activity of the papain is higher in the extracts from the younger fruit than the older fruit. Cultivars also vary in the quantity of the compounds. For example, the primary and secondary volatile compounds in the fruit of one cultivar studied were linalool and trans-linalool oxide, respectively. In another cultivar, the primary and secondary volatile compounds were cis-linalool oxide and linalool, respectively.

The following list of compounds found in parts of *Carica papaya* is not comprehensive. The quantity of the compounds are estimates based on several sources (listed in the references). For more information please refer to the references and the [USDA Phytochemical and Ethnobotanical Databases](#).

- alkaloids -- 1,300-4,000 ppm in leaves
- butanoic acid -- as much as 1.2mg/kg in fruit pulp
- methyl butanoate -- as much as 18% of the volatile components in the fruit
- carpaine -- leaves (1,000-1,500 ppm), bark, roots, and seeds
- dehydrocarpaines -- 1,000 ppm in leaves
- pseudocarpaine -- 100 ppm in leaves
- chymopapain-a and b -- latex and exudate
- flavonols -- 0-2,000 ppm in leaves
- benzylglucosinolate -- found in all parts of the plant, but highest in young leaves
- linalool -- as much as 94% of the volatile components in the fruit
- cis- and trans-linalool oxide -- fruit
- alpha-linolenic acid -- 250-2,238 ppm in fruit
- nicotine
- papain -- fruit and 53,000 ppm in latex and exudate
- alpha-phellandrene -- fruit
- tannins -- 5,000-6,000 ppm in leaves
- alpha-terpinene -- fruit
- gamma-terpinene -- fruit
- 4-terpineol -- fruit
- terpinolene -- fruit
- methyl-thiocyanate and benzyl-isothiocyanate

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Toxicity

With the exception of infertility, the literature reviewed did not indicate any adverse reactions from the consumption of *Carica papaya* fruit, latex, or extracts. However, the leaves and roots of *Carica papaya* contain cyanogenic glucosides which form cyanide. The leaves also contain tannins. Both of these compounds, at high concentrations, can cause adverse reactions. Also, inhaling papaya powder (high in the enzymes papain and chymopapain, can induce allergies.

In trials with rats, daily oral doses of benzene and alcohol extracts (20mg/kg body weight (BW) for 30 days) did not effect body or reproductive organ weights or adversely effect liver or kidney function. However, aqueous extracts (1mg/kg BW for 7 or 15 days) and benzene extracts given orally to female rats caused infertility and irregular oestrous cycles. Male rats given ethanol seed extracts orally (10 or 50 mg/day for 30, 60, or 90 days) or intramuscularly (0.1 or 1.0 mg/day for 15 or 30 days) had decreased sperm motility. The oral doses also decreased testis mass and sperm count. Studies with aqueous seed extracts also decreased fertility in male rats. The fertility of the male and female rats returned to normal within 60 days after the treatments were discontinued.

In addition to decreasing infertility, papain might cause abortions shortly after conception. The papain apparently dissolves a protein(s) responsible for adhering the newly fertilized egg to the wall of the uterus.

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Uses and Efficacy

The efficacy of treatments with *Carica papaya* is dependent on the quantity of the different compounds in the preparation. The quantity of the compounds, as previously indicated, differ in the fruit, latex, leaves, and roots and vary with the extraction method, age of the plant part, and the cultivar and sex of the tree.

The application of papaya latex that is probably of most interest to livestock producers is as an anthelmintic (dewormer). Satrija et al. (1994) tested the efficacy of papaya latex (at doses of 2, 4, and 8 g/kg BW) against *Ascaris suum* in 16 pigs. The eggs per gram (epg) on days 0, 1, 5, and 7 were determined using a modified McMaster technique and the adult worms were collected and sexed at necropsy on day 7. The 4- and 8-g/kg BW treatments significantly decreased the epg produced (by 99%) and the number of adult worms by 80 and 100%, respectively. The study conducted by Satrija et al. supports the results of other studies which indicate that papaya latex is effective against *Ascaridia galli* in chickens. One adverse effect of the treatment was transient diarrhea in the 8-g/kg BW group on day 1 of the study. In another study, water extracts of papaya seeds decreased *Ascaridia galli* infections in chicks by 41.7% (compared to piperazine hexahydrate which decreased infections by 99%).

In traditional veterinary medicine, papaya seeds also are used as dewormers. In Indonesia and the Philippines, air-dried seeds are ground and mixed with water - 3 g of seeds/kg bodyweight. The animals are given the seed/water mixture once a day for 6 days. In Indonesia, papaya leaves are used as affed for animals after parturition - 2 leaves boiled in water fed every 2 days for 1 week. It also has been reported that papaya leaf extract is used as a profilaxis against malaria, though no studies on this use could be found in the literature.

Results from studies on biological activities of *Carica papaya* parts, extracts, and isolated compounds are briefly summarized below:

- Antimicrobial
 - Latex (with a minimum protein concentration of 138 microliters/ml) and root extracts inhibited *Candida albicans*. However, aqueous extracts were not active.
 - Extracts of pulp and seeds showed bacteriostatic properties when tested against *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi*, *Bacillus subtilis*, and other bacteria *in vitro*. However, in another study, aqueous extracts (type of extract and plant part not indicated) were not active against *Staphylococcus aureus* and *Escherichia coli* *in vitro*.
 - Alpha-D-mannosidase and N-acetyl-beta-D-glucosaminidase (isolated from latex) acted synergistically to inhibit yeast growth.
- Parasitic
 - Powdered air-dried seeds given orally to 4 dogs (60mg/kg BW for 30 days) decreased *Dirofilaria immitis* infections.
 - Papaya latex fed (at a rate of 2, 4, 6, or 8g/kg BW) to mice with experimental infections of *Heligmosomoides polygyrus* decreased infections rates by 55.5-84.5% compared to non-treated control mice.
 - Seeds at concentrations of less than 100 micrograms/ml exhibited activity against *Entamoeba histolytica* *in vitro*.
 - Benzylisothiocyanate (isolated from papaya) at concentrations of 100-300 micromoles inhibits the energy metabolism and affected the motor activity of *Ascaridia galli* *in vitro*
- Sedative and muscle relaxer -- studies with rats indicate that alcohol extracts (at a dose of 5 mg/kg BW intraperitoneally or greater) relaxed central muscles. The extracts (at a dose of 10 mg/kg BW intraperitoneally or greater) also had sedative properties.
- Purgative -- in one study with rats, aqueous extracts increased the number of wet feces and the movement of intestinal contents.

Papaya has been used to treat the following ailments in humans:

- Abortifacient -- Java, Panama, Sri Lanka, and Turkey
- Amebicide -- Japan
- Arthritis and rheumatism -- Haiti and Java
- Asthma and respiration -- Mauritius, Mexico, and Philippines
- Bactericide -- India
- Cancer -- Australia and Mexico
- Cardiotonic -- Turkey
- Colic -- Malaya
- Constipation and laxative -- Honduras, Panama, and Trinidad
- Corns and boils -- India, Malagasy, Malaya, and Philippines
- Decoagulant -- Trinidad
- Diarrhea and dysentery -- Honduras, Japan, Panama, and West Africa
- Digestive -- China, Dominican Republic, Panama, and Turkey
- Diuretic -- Trinidad

- Dyspepsia -- Mexico
- Dysuria -- Java
- Emmenagogue -- Mexico and Turkey
- Epithelioma -- St. Vincent
- Fever -- Java and Mexico
- Flu -- Trinidad
- Fumitory -- New Caledonia
- Hypertension -- Honduras and Trinidad
- Infection -- Panama
- Intestinal disorders -- Philippines
- Kidney -- Cameroon and Honduras
- Liver -- Honduras and Turkey
- Madness -- Ivory Coast
- Milk production (increase/stimulate) -- Indonesia and Malaysia
- Ophthalmology treatments -- Soviet Union
- Pectoral -- Mexico
- Scorpion bites -- Trinidad
- Smooth upper respiratory tract -- Nigeria
- Toothache -- Cote d'Ivoire and Samoa
- Tuberculosis -- Mexico
- Tumor (Uterus) -- Ghana Indochina Nigeria
- Ulcer -- Panama
- Urology treatments -- Soviet Union
- Venereal -- Trinidad
- Vermifuge -- Haiti, Malaya, Panama, Samoa, and Turkey
- Warts -- Indonesia, Jamaica, Peru, South Africa, and Sri Lanka

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Not all of the references in the list below were used in writing this web page. Some references could not be easily located and others were in non-romance languages. They are included here so that a more complete resource list is available for those interested in the subject area.

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