



## Original Research Article

# Ethenomedicinal, phytochemical and pharmacological profile of *Ficus religiosa* Roxb

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## ABSTRACT

*Ficus religiosa* is known to be a native Indian tree. *F. religiosa* is a large evergreen tree found throughout India, wild as well as cultivated. It is a familiar sight in Hindu temples, Buddhist monasteries and shrines, villages and at roadsides. It is known to be a sacred plant in India and since ancient times it is widely being used to treat various ailments like skin diseases, heart diseases, diabetes, vomiting, burns, nervous disorder, constipation, dysentery, snakebite and important constituent of various traditional herbal preparations like shankha vati, chandraprabha vati and kaminivindravan rasa. In recent studies, *F. religiosa* has been investigated for presence of a wide range of phytoconstituents viz. glycosides, flavonoids, tannin, terpenoids and sterol,  $\beta$ -sitosteryl-D-glucoside, vitamin K, n-octacosanol, kaempferol, quercetin and myricetin. Extract of the plant posse's significant anti-diarrhoeal, anti-fungul, anti-plasmodial, anti-ulcerogenic, anticonvulsant activity, anthelmintic activity, proteolytic activity, anti immunomodulatory activity, wound-healing activity, antioxidant activity, anti-acetylcholinestrase activity, wound healing activities and antidiabetic activity. Therefore, the present reviews paper an attempt to compile an up-to-date and comprehensive review of *F. religiosa* that covers its ethnomedicinal, phytochemical, pharmacological data.

### Keywords

Ethenomedicinal,  
*Ficus religiosa*  
Roxb,  
Peepal,  
Phytochemical  
and  
pharmacological  
profile

## Introduction

*Ficus religiosa* is a large perennial tree, glabrous when young, found throughout the plains of India up to 170m altitude in the Himalayas, largely planted as an avenue and roadside tree especially near temples (API). It is a popular bodhi tree and has got mythological, religious, and medicinal importance in Indian culture since times immemorial (Prasad *et al.*, 2006). The plants

have been used in traditional Indian medicine for various ranges of ailments. Traditionally the bark is used as an antibacterial, antiprotozoal, antiviral, astringent, antidiarrhoeal, in the treatment of gonorrhoea, ulcers and the leaves used for skin diseases. The leaves reported antivenom activity and regulates the menstrual cycle (Kalpana and Rishi, 2009;

Chopra *et al.*, 1958). In Bangladesh, it has been used in the treatment of various diseases such as cancer, inflammation, or infectious diseases (Uddin *et al.*, 2009) In case of high fever, its tender branches are used as a toothbrush. Fruits are used as laxatives, (Shah, 1982) latex is used as a tonic, and fruit powder is used to treat asthma (Singh *et al.*, 2002; Ananda and Kunjani, 2000).

### Taxonomic position

Domain: Eukaryota  
Kingdom: Plantae  
Subkingdom: Viridiaeplantae  
Phylum: Tracheophyta  
Subphylum: Euphyllophytina  
Infraphylum: Radiatopses  
Class: Magnoliopsida  
Subclass: Dilleniidae  
Superorder: Urticales  
Order: Urticales  
Family: Moraceae  
Tribe: Ficeae  
Genus: *Ficus*  
Specific epithet: *Religiosa Linnaeus*  
Botanical name: *Ficus religiosa Roxb*

### Vedic history

The “Brahma Purana” and the “Padma Purana”, relate how once, when the demons defeated the Gods, Vishnu hide in the peepal. Therefore spontaneous worship to Vishnu can be offered to a peepal without needing his image or temple. The “Skanda Purana” also considers the peepal, a symbol of Vishnu. He is believed to have been born under this tree. Some believe that the tree houses the Trimurti, the roots being Brahma, the trunk Vishnu and the leaves Shiva. The Gods are said to hold their councils under this tree and so it is associated with spiritual understanding. The peepal is also closely linked to Krishna. In the Bhagavad Gita, he says: "Among trees, I am the

ashvattha." Krishna is believed to have died under this tree, after which the present Kali Yuga is said to have begun. Five-trees (Panchavat) are considered sacred in India. They are:

1. Fig tree,
2. A wild fig (Sycamore) tree (Gular),
3. Banyan tree,
4. Pakar (citron-leaved), Indian fig tree,
5. Mango tree.

According to the “Skanda Purana”, if one does not have a son, the peepal should be regarded as one. As long as the tree lives, the family name will continue. To cut down a peepal is considered a sin equivalent to killing a Brahmin, one of the five deadly sins or Panchapataka. According to the “Skanda Purana”, a person goes to hell for doing so. Some people are particular to touch the peepal only on a Saturday. The “Brahma Purana” explains why, saying that Ashvattha and peepala were two demons who harassed people. Ashvattha would take the form of a peepal and peepala the form of a Brahmin. The fake Brahmin would advise people to touch the tree, and as soon as they did, Ashvattha would kill them. Later they were both killed by Shani. Because of his influence, it is considered safe to touch the tree on Saturdays. Lakshmi is also believed to inhabit the tree on Saturdays. Therefore it is considered auspicious to worship it. Women ask the tree to bless them with a son tying red thread or red cloth around its trunk or on its branches (Shastri *et al.*, 1978).

### Habitat

*F. religiosa* is known to be a native Indian tree, and thought to be originating mainly in Northern and Eastern India, where it widely found in uplands and plane areas and grows up to about 1650 meters or 5000 ft in the mountainous areas. It is also found growing

elsewhere in India and throughout the subcontinent and Southern Asia, especially in Buddhist countries, wild or cultivated. It is a familiar sight in Hindu temples, Buddhist monasteries and shrines, villages and at roadsides. People also like to grow this sacred tree in their gardens. *F. religiosa* has also been widely planted in many hot countries all over the world from South Africa to Hawaii and Florida but it is not able to naturalize away from its Indian home, because of its dependence on its pollinator wasp, *Blastophaga quadraticeps*. An exception to this rule is Israel where the wasp has been successfully introduced. The vernacular names are given table 2.

### **Nomenclature**

'*Ficus*' is the Latin word for 'Fig', the fruit of the tree. '*Religiosa*' refers to 'religion' because the tree is sacred in both Hinduism and Buddhism and is very frequently planted in temples and shrines of both faiths. 'Bodhi' or its short form 'Bo' means 'supreme knowledge' or 'awakening' in the old Indian languages. 'Pipal' relates to the same ancient roots which give rise to English words like 'Pip' and 'Apple' and therefore mean something like 'fruit-bearing tree'. 'Ashwattha' and 'Ashvattha' come from an ancient Indian root word "Shwa" means 'morning' or 'tomorrow'. This refers to the fact that Ashwattha is the mythical Hindu world tree, both indestructible and yet ever-changing: the same tree will not be there tomorrow (Kala, 2004).

### **Morphology**

This big and old tree is of 30m long. They shatter bark and are of white or brown in color. The leaves are shiny, thin, and bear 5–7 veins. Fruits are small, about ½ inches in diameter, similar to that of eye pupil. It is circular in shape and compressed. When it is

raw, it is of green color and turns black when it is ripe. The tree fruits in summer and the fruits get ripened by rainy season (Sajwan *et al.*, 1977).

### **Leaves**

When the leaves first appear their colour is red-pinkish, but then they turn deep green and grow to about 12 to 18 cm long (5–7 inches). They are attached to long flexible stalks which makes them rustle, flutter and dance in the slightest whiff of wind. The foliage can often be dense. The alternate leaves are heart-shaped, shiny with an elegant tail-like tip which is often called a "drip-tip", guiding water efficiently down to the soil. This prevents sometimes heavy monsoon rain from collecting on the leaves for prolonged periods, which could make them hot in very warm weather.

The leaves have 6–8 pairs of side-veins and a further network of very fine veins. This delicate venation and the ability of the leaf to disintegrate easily in water are both clearly illustrated in the greeting cards which are sometimes made with peepal leaves. The leaves are soaked for 8 hours (in warm countries) in a bowl of water and then washed carefully under running water until only the veins remain.

### **Bark**

Bark occurs in flat or slightly curved pieces, varying from 1.0 to 2.5 cm or more in thickness; outer surface brown or ash colored; surface uneven due to exfoliation of cork; inner surface smooth and somewhat brownish; fracture - fibrous; taste – astringent.

### **Flowers**

The small red flowers appear in February.

The tree is dependent on its associated pollinator wasp, *Blastophaga quadraticeps* to set seed.

### **Fruit**

The tree fruits in May/June and bears a small flat-topped figs (12–13 mm or ½ inch in diameter), which appears in pairs in the angles of the leaves on the twigs (or above the scars in the bark left by fallen leaves). They have 3 basal bracts, are green at first and ripen to a blackish purple (may have reddish dots). The fruiting tree becomes a treat for many different birds and animals.

### **Microscopy**

An external features of bark of *F. religiosa* showed that bark differentiated into outer thick periderm and inner secondary phloem. Periderm is differentiated into phellem and phelloderm. Phellem zone is 360 mm thick and it is wavy and uneven in transection. Phellem cells are organized into thin tangential membranous layers and the older layers exfoliate in the form of thin membranes. The phelloderm zone is broad and distinct. Phelloderm cells are turned into lignified sclereids. Secondary phloem differentiated into inner narrow non-collapsed zone and outer broad collapsed zone. Non-collapsed zone consists of radial files of sieve tube members, axial parenchyma, and gelatinous fibres. Outer collapsed phloem has dilated rays, crushed obliterated sieve tube members, thick walled and lignified fibres, and abundant tannin filled parenchyma cells. Laticifers are fairly abundant in the outer secondary phloem zone. Phloem rays are both uniseriate and multiseriate. Multiseriate rays are homocellular and uniseriate rays are either homocellular or heterocellular (Babu *et al.*, 2010).

### **Physical constants**

Total ash 7.86 % w/w, acid insoluble ash 0.41 % w/w, alcohol soluble extract 7.21 % w/w and water soluble extractive 15.76 % w/w (Babu *et al.*, 2010).

### **Phytochemical profile**

Preliminary phytochemical screening of *F. religiosa* barks, showed the presence tannins, saponins, flavonoids, steroids, terpenoids and cardiac glycosides (Babu *et al.*, 2010; Jiwala *et al.*, 2008). The barks of *F. religiosa* showed the presence of bergapten, bergaptol, lanosterol,  $\beta$ -sitosterol, stigmasterol, lupen-3-one,  $\beta$ -sitosterol-d glucoside (phytosterolin), vitamin K<sub>1</sub> (Swami *et al.*, 1989; Joseph and Justin, 2010; Margareth and Miranda, 2009). The bark also contains tannin, wax, saponin,  $\beta$ -sitosterol, leucocyanidin-3-O- $\beta$ -D-glucopyranoside, leucopelargonidin-3-O- $\beta$ -D-glucopyranoside, leucopelargonidin-3-O- $\alpha$ -L-rhamnopyranoside, lupeol, ceryl behenate, lupeol acetate,  $\alpha$ -amyrin acetate, leucoanthocyanidin and leucoanthocyanin (Husain *et al.*, 1992). Leaves yield campesterol, stigmasterol, isofucosterol,  $\alpha$ -amyrin, lupeol, tannic acid, arginine, serine, aspartic acid, glycine, threonine, alanine, proline, tryptophan, tryosine, methionine, valine, isoleucine, leucine, **nnonacosane**, n-hentricontanen, hexa-cosanol and n-octacosan (Panda *et al.*, 1976; Prasad *et al.*, 2007; Suryawanshi *et al.*, 2011). The fruit of *F. religiosa* contains asgaragine, tyrosine, undecane, tridecane, tetradecane, (e)- $\beta$ -ocimene,  $\alpha$ -thujene,  $\alpha$ -pinene,  $\beta$ -pinene,  $\alpha$ -terpinene, limonene, dendrolasine, dendrolasine  $\alpha$ -ylangene,  $\alpha$ -copaene,  $\beta$ -bourbonene,  $\beta$ -caryophyllene,  $\alpha$ -trans bergamotene, aromadendrene,  $\alpha$ -humulene, alloaromadendrene, germacrene, bicyclgermacrene,  $\gamma$ -cadinene and  $\delta$ -cadinene (Grison *et al.*, 2002). Alanine,

threonine and tyrosine have been reported in seeds of *F. religiosa* (Ali and Qadry, 1987). The crude latex of *F. religiosa* shows the presence of a serine protease, named religiosin. Religiosin is an acidic protein acts optimally at pH 8.0 5 and temperature 50°C. The extinction coefficient ( $\epsilon_{1\%}^{1\text{cm}}$ ) of religiosin is 29.47 m<sup>-1</sup> cm<sup>-1</sup> with 16 tryptophan, 26 tyrosine, and 11 cysteine residues per molecule. The enzyme exhibits milk-clotting as well as detergent activity (Kumari *et al.*, 2010). Reverse phase high performance liquid chromatographic analysis of flavonoids in *F. religiosa* using kaempferol, rhamnetin, myricetin, isorhamnetin and quercetin as a standards. The findings showed that quercetin was most abundant flavonol present in *F. religiosa* (Taskeen *et al.*, 2009). The structures of active constituents reported in *F. religiosa*.

## Pharmacological profile (Table 2)

### Anti-ulcer activity

The anti-ulcer activity was investigated using ethanol extract of stem bark of *F. religiosa* against *in vivo* indomethacin- and cold restrained stress-induced gastric ulcer, and pylorus ligation assays (Khan *et al.*, 2011).

### Proteolytic activity

A comparison of the proteolytic activity of the latex of 46 species of *Ficus* was done by electrophoretic and chromatographic properties of the protein components. *F. religiosa* showed significant proteolytic activity (Williams, 1968).

### Anticonvulsant activity

The methanol extract of figs of *F. religiosa* was also reported to exhibit a dose-

dependent anticonvulsant activity against maximum electroshock- and picrotoxin-induced convulsions through serotonergic pathways modulation (Singh and Goel, 2009). The anticonvulsant activity of the extract (25, 50 and 100 mg/kg, p.o.) was investigated in strychnine-, pentylenetetrazole-, picrotoxin- and isoniazid-induced seizures in mice. Rat ileum and fundus strip preparations were used to study the effect of the extract on acetylcholine (Ach)- and serotonin (5-HT)-induced contractions, respectively. The extract also exhibited dose-dependent potentiation of Ach in rat ileum but failed to potentiate the effect of 5-HT in rat fundus strip preparation (Patil, 2011).

### Antibacterial activity

Aqueous and ethanolic extracts of *F. religiosa* leaves showed antibacterial effect against *Staphylococcus aureus*, *Salmonella paratyphi*, *Shigella dysenteriae*, *S. typhimurium*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *S. aureus*, *Escherichia coli*, *S. typhi* (Valsaraj *et al.*, 1997; Mousa *et al.*, 1994; Farrukh and Iqbal, 2003). In another study, chloroform extract of fruits showed antimicrobial effect against *Azobacter chroococcum*, *Bacillus cereus*, *B. megaterium*, *Streptococcus faecalis*, *Streptomycin lactis* and *Klebsiella pneumonia* (Mousa *et al.*, 1994). The ethanolic extract of leaves showed antifungal effect against *Candida albicans* (Farrukh and Iqbal, 2003). Aqueous, methanol and chloroform extracts from the leaves of *F. religiosa* were completely screened for antibacterial and antifungal activities. The chloroform extract of *F. religiosa* possessed a broad spectrum of antibacterial activity with a zone of inhibition of 10–21mm. The methanolic extracts possessed moderate antibacterial activity against a few bacterial strains. There was less antibacterial activity or none at all

using aqueous extracts. The extracts of *F. religiosa* were found to be active against *Aspergillus niger* and *Penicillium notatum*. The extracts from the leaves exhibited considerable and variable inhibitory effects against most of the microorganisms tested (Farrukh and Iqbal, 2003; Hemaiswarya *et al.*, 2009).

### **Anthelmintic activity**

*F. religiosa* bark methanolic extract was 100% lethal for *Haemonchus contortus* worms (Kaushik *et al.*, 1981). The stem and bark extracts of *F. religiosa* proved lethal to *Ascaridia galli in vitro*. The latex of some species of *Ficus* (Moraceae), i.e., *Ficus inspida*, *F. carica* was also reported to have anthelmintic activity against *Syphacia obvelata*, *Aspiculuris tetraptera*, and *Vampirolepis nana* (De Amarin *et al.*, 1999). The pharmacological studies on *F. glabrata* latex with live *Ascaris* demonstrated a lethal effect at concentrations reduced to 0.05% latex in physiological saline solution. It has been accepted that anthelmintic activity is due to a proteolytic fraction called ficin. It is evident from above that methanolic extracts of *F. religiosa* possibly exerted anthelmintic effect because of ficin (Hansson *et al.*, 1986).

### **Immunomodulatory activity**

The immunomodulatory effect of alcoholic extract of the bark of *F. religiosa* (moraceae) was investigated in mice. The study was carried out by various hematological and serological tests. Administration of extract remarkably ameliorated both cellular and humoral antibody response. It is concluded that the extract possessed promising immunostimulant properties (Mallurvar and Pathak, 2008).

### **Antioxidant activity**

The ethanolic extract of leaves of *F. religiosa* was evaluated for antioxidant (DPPH), wound healing (incision, excision, histopathological and dead space wound model) and anti-inflammatory (Carageenan induced paw odema) activity. The tested extract of different dilutions in range 200 µg/ml to 1000 µg/ml shows antioxidant activity in range of 6.34% to 13.35%. Significant increase in wound closure rate, skin breaking strength, granuloma breaking strength was observed. The extract shows prominent anti-inflammatory activity as compared to that of standard (Ibuprofen gel)<sup>30</sup>. Antiamnesic activity- the effect of the methanol extract of figs of *Ficus religiosa* (FRFE) on scopolamine-induced anterograde and retrograde amnesia in mice was investigated. The methanolic extracts were administered at a dose of 10, 50 and 100 mg/kg, i.p. and scopolamine at 10 mg/kg, i.p. Methanol extract of figs of *Ficus religiosa* showed a significant improvement of memory as it treatment attenuated the scopolamineinduced anterograde and retrograde amnesia dose dependently. Cyproheptadine pretreatment significantly reversed the anti-amnesic effect (Kaur *et al.*, 2010).

### **Wound-healing activity**

The effect of hydroalcoholic extract of *F. religiosa* leaves on experimentally induced wounds in rats using different wound models results in dose-dependent wound-healing activity in excision wound, incision wound, and burn wound. A formulation of leaves extract was prepared in emulsifying ointment at a concentration of 5% and 10% and applied to the wounds. In excision wound and burn wound models, the extract showed significant decrease in the period of epithelization and in wound contraction

(50%). A significant increase in the breaking strength was observed in an incision wound model when compared to the control. The result suggests that leaf extract of *F. religiosa* (both 5% and 10%) applied topically possess dose-dependent wound-healing activity (Naira *et al.*, 2009).

### **Hypolipidemic activity**

Dietary fiber content of food namely peepalbanti (*F. religiosa*), cellulose, and lignin were predominating constituents in peepalbanti, fed at 10% dietary level to rats, induced a greater resistance to hyperlipidemia than cellulose. Teent had the most pronounced hypocholesterolemic effect that appeared to operate through increased fecal excretion of cholesterol as well as bile acids. Dietary hemicellulose showed a significant negative correlation with serum and liver cholesterol and a significant positive correlation with fecal bile acids. The dietary fiber influenced total lipids, cholesterol, triglycerides, and phospholipids of the liver to varying extents (Agarwal and Chauhan, 1988).

### **Hypoglycemic activity**

B-Sitosterol-D-glycoside was isolated from the root bark of *F. glomerata* and *F. religiosa*, which has a peroral hypoglycemic activity (Ambike and Rao, 1967). Oral administration of *F. religiosa* bark extract at the doses of 25, 50, and 100mg/kg was studied in normal, glucose-loaded, and STZ (streptozotocin) diabetic rats. The three doses of bark extract produced significant reduction in blood glucose levels in all the models.

The effect was more pronounced in 50 and 10mg/kg than 25mg/kg. *F. religiosa* also showed significant increase in serum insulin, body weight, and glycogen content in liver

and skeletal muscle of STZ-induced diabetic rats, while there was significant reduction in the levels of serum triglyceride and total cholesterol. *F. religiosa* also showed significant antilipid peroxidative effect in the pancreas of STZ-induced diabetic rats. The results indicate that aqueous extract of *F. religiosa* bark possesses significant antidiabetic activity (Panit *et al.*, 2010).

### **Anti-amnesic activity:**

The anti-amnesic activity was investigated using *F. religiosa* methanol extract of figs of *F. religiosa* on scopolamine-induced anterograde and retrograde amnesia in mice. Figs were known to contain a high serotonergic content, and modulation of serotonergic neurotransmission plays a crucial role in the pathogenesis of amnesia (Kaur *et al.*, 2010).

### **Anticancer activity**

Fruit extracts of *F. religiosa* exhibited antitumor activity in the potato disc bioassay. None of the tested extracts showed any marked inhibition on the uptake of calcium into rat pituitary cells GH4C1 (Mousa *et al.*, 1994).

### **Anti-acetylcholinestrase activity**

Methanolic extract of the stem bark of *F. religiosa* found to inhibit the acetylcholinestrase enzyme, thereby prolonging the half-life of acetylcholine. It was reported that most accepted strategies in alzheimer's diseases treatment is the use of cholinestrase inhibitors. The calculated 50% inhibitory dose (ID50) value was 73.69 µg /ml respectively. The results confirm and justify the popular traditional use of this plant for the treatment of alzheimer's diseases (Vinutha at al., 2007).

**Table.1** Vernacular names of *F. religiosa*

Languages	Vernacular Names
Hindi	Pipala, Pipal
Marathi	Pipal, Pimpal, Pippal
Guajarati	Piplo, Jari, Piparo, Pipalo
Sanskrit	Pippala
English	Pipal tree
Telgu	Ravichettu
Tamil	Ashwarthan, Arasamaram, Arasan, Arasu, Arara
Malayalam	Arayal
Oriya	Aswatha
Punjabi	Pipal, Pippal
Kashmiri	Bad
Assamese	Ahant
Bengali	Asvattha, Ashud, Ashvattha
Kannada	Arlo, Ranji, Basri, Ashvatthanara, Ashwatha, Aralimara, Aralegida, Ashvathamara, Basari, Ashvattha

**Table.2** Ethnomedicinal uses of different parts of *F. religiosa*

Sr. no.	Plant Parts	Traditional uses
1	Bark	Astringent, cooling, aphrodisiac, antibacterial against <i>Staphylococcus aureus</i> and <i>Escherichia coli</i> , gonorrhoea, diarrhoea, dysentery, haemorrhoids and gastrohelcosis, anti-inflammatory, burns (Warrier, 1996).
2	Bark Decoction	Cooling, gonorrhea, skin diseases, scabies, hiccup, vomiting (Kapoor, 1990).
3	Leaves and tender shoots	Purgative, wounds, skin diseases (Warrier, 1996).
4	Leaf juice	Asthma, cough, sexual disorders, diarrhea, haematuria, toothache, migraine, eye troubles, gastric problems, scabies (Warrier, 1996; Kapoor, 1990).
5	Fruit	Asthma, laxative, digestive (Warrier, 1996).
6	Dried fruit	Tuberculosis, fever, paralysis, hemorrhoids (Khanom <i>et al.</i> , 2000).
7	Seeds	Refrigerant, laxative (Warrier, 1996).
8	Latex	Neuralgia, inflammations, haemorrhages (Warrier, 1996).

### Antidiabetic activity

The antidiabetic effect of aqueous extract of *F. religiosa* bark (FRAE) in normal glucose loaded hyperglycemic and streptozotocin (STZ) induced diabetic rats, at the dose of 25, 50 and 100 mg/kg were investigated. The effect was more pronounced in 50 and 100 mg/kg than 25

mg/kg. FRAE also showed significant increase in serum insulin, body weight and glycogen content in liver and skeletal muscle of STZ- induced diabetic rats while there was significant reduction in the levels of serum triglyceride and total cholesterol. FRAE also showed significant antilipidperoxidative effect in the pancreas of STZ induced diabetic rats (Pandit *et al.*, 2010).



## Antifungal activity

The benzene extract of both the plants i.e. *Ficus infectoria* Roxb and *Ficus religiosa* Linn afforded furanocoumarins, bergapten and bergaptol. The isolated compounds of both the plants were assayed against its microorganisms *Staphylococcus aureus*, *Escherichia coli*, *Penicillium gluacum* and *Paramecium* at concentration of 0.2% for aqueous bark extracts and  $1 \times 10^{-2}$  M for the isolated compounds. The results indicate bacterial activity of both the compounds bergapten and bergaptol against *S. aureus* and *E. coli*. An antifungal activity of the compounds against *P. gluacum* was also observed (Swami and Bisht, 1996).

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