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*Research Article*

## Patterns Of Ocular Toxicity Due To Plant Sap Exposure In Rural Karnataka, India: A Comprehensive Review Of The Mechanisms Of Ocular Toxicity.

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### Abstract

**Importance:** Plant sap exposure is an underrecognized cause of ocular morbidity in rural India.

**Objective:** To describe the clinical profile of ocular injuries due to plant sap exposure in patients presenting to a rural ophthalmic center in Karnataka, India.

**Design, Setting, and Participants:** Retrospective chart review of patients with confirmed ocular plant sap exposure between January 2019 and December 2022 at the Department of Ophthalmology, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Karnataka.

**Main Outcomes and Measures:** Demographic profile, causative plant, clinical features, visual acuity, and treatment outcomes.

**Results:** A total of fourteen patients (male-to-female ratio 4:3; age range 10–70 years) presented with ocular sap exposure. Farmers and homemakers were equally represented. *Calotropis* accounted for 11 patients (16 eyes), *Euphorbia* for 2 patients (4 eyes), and *Nerium oleander* for 1 patient. The predominant clinical feature was corneal edema with Descemet's membrane folds (100%), accompanied by lid edema (28%), epithelial defects (21%), and anterior uveitis (14%). Bilateral involvement was observed in 50% of *Calotropis* cases and in all *Euphorbia* cases. With prompt treatment using topical antibiotics, corticosteroids, cycloplegics, hypertonic saline, and lubricants, complete recovery was achieved within 6–14 days.

**Conclusions and Relevance:** Accidental exposure to the latex of *Calotropis*, *Euphorbia*, and *Nerium oleander* can lead to considerable ocular injury. Immediate irrigation followed by timely ophthalmic intervention typically ensures full recovery. Preventive health education targeting farmers, homemakers, and individuals handling flowers is crucial to reduce such incidents.

**Key words:** Calotropis; Euphorbia milii; Nerium oleander; Eye Injuries; Corneal toxicity; Toxic Uveitis; Plant sap toxicity; Occupational Exposure; Health Education.

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## Introduction

Ocular plant sap exposure during handling certain plants or flowers during pruning, picking flowers or plant removal is rare and causes dramatic visual disturbance due to ocular surface toxicity and damage. Common plants causing ocular sap exposure belong to the *Calotropis* genus and the *Euphorbiaceae* family.<sup>1–13</sup> *Calotropis* and oleander flowers are offered to the gods in most areas in rural India.<sup>7</sup>

Reported ocular manifestations span from mild conjunctivitis to severe keratouveitis, with rare cases progressing to irreversible blindness.<sup>14</sup> Our series describes ocular exposure cases involving three latex-bearing plants—*Calotropis procera*, *Calotropis gigantea*, *Euphorbia milii*, and *Nerium oleander*—among patients from rural Karnataka, India. Early management yields favorable outcomes, with complete recovery of corneal clarity and vision in most cases. Public health education stressing hand hygiene and avoidance of ocular contact during the handling of latex-producing plants offers a simple yet effective preventive strategy.

## Material and Methods

A retrospective file review was undertaken of all confirmed cases of ocular plant sap exposure presenting to the Department of Ophthalmology at Akash Institute of Medical Sciences and Research Centre, Devanahalli, Karnataka, during the period January 2019 to December 2022. The study adhered to the ethical principles outlined in the Declaration of Helsinki (2000 revision), with approval obtained from the Institutional Ethics and Research Committee. This study included 14 patients with ocular latex exposure from January 2019 to December 2022. Demographic data and detailed histories were obtained to establish injury context. All patients underwent ocular evaluation, including best corrected visual acuity at presentation, slit-lamp examination, conjunctival assessment, corneal involvement with fluorescein staining, and intraocular pressure measurement using non-contact tonometry. Therapy comprised tapering topical antibiotics, steroids, cycloplegics, 5% hypertonic saline, and tear substitutes. Follow-up was conducted at intervals based on severity, with systematic evaluation of all parameters. All patients presenting to the Ophthalmic Emergency Department of AIMSRC, Devanahalli, with accidental ocular plant sap exposure between January 2019 and December 2022 were included, while those who refused examination or treatment, failed to follow up, had a history of ocular trauma or chemical injury, provided vague exposure histories, or were mentally or physically unfit for evaluation were excluded.

## Results

Plant sap exposures were more frequent in males (M:F ratio 4:3; 57% vs. 43%). Patient ages ranged from 10–70 years, with one pediatric case. Housewives and farmers were equally affected (5 each), while construction workers (2), a flower seller (1), and a schoolboy (1) accounted for the remainder. Occupational exposures in farmers, gardeners, and construction workers typically occurred during weed clearance and pruning; the child was injured while playing, and the flower seller during garland preparation with *Nerium oleander*. Ten of 14 patients (71%) presented within 24 hours. Bilateral involvement was seen in 7 patients (50%), including half of those exposed to *Calotropis* and all patients exposed to *Euphorbia milii*.

*Calotropis* sap accounted for 11 patients (16 eyes), *Euphorbia milii* for 2 patients (4 eyes), and *Nerium oleander* for 1 patient (1 eye). Common findings were acute stinging followed by insidious visual blurring (4–12 hours), absence of pain after onset, and corneal edema with Descemet's membrane folds. Variable conjunctival staining was noted in some cases. A gardener developed corneal abrasion from a *Euphorbia* leaf fragment acting as a tarsal foreign body during pruning. Treatment included tapering topical antibiotics, steroids, cycloplegics, hypertonic saline, and tear substitutes. Steroids were delayed in large epithelial defects. Recovery was complete in 6–14 days, averaging 7 days.

Visual acuity in affected eyes ranged from 6/12 to 1/60. Severe vision loss was linked to epithelial defects, corneal edema, and anterior uveitis. *Euphorbia milii* exposure produced more extensive epithelial defects and diffuse corneal edema. All eyes demonstrated mild to severe corneal edema with Descemet's folds; two cases (14%) had mild iridocyclitis, and four (28%) showed lid edema. No secondary glaucoma was observed. One patient (7%) developed punctate epithelial keratopathy. Intraocular pressures measured by non-contact tonometry were within normal limits (9.0–14.5 mmHg) compared with fellow eyes. Complete resolution occurred in 12 eyes (87%) with a mean recovery time of 7 days (range: 3–14 days), and treatment was discontinued one week after healing. Post-treatment BCVA improved to 6/6 in 13 cases (93%), with corneal appearance returning to normal in all patients.

## Discussion

Plant latex-induced ocular injury from *Calotropis*<sup>5–8,10–13</sup>, *Euphorbia*<sup>14–26</sup>, and *Nerium oleander*<sup>27</sup> is potentially sight-threatening. *Calotropis* and *Nerium* belong to the *Apocynaceae* family, whereas *Euphorbia* is a member of the *Euphorbiaceae*. *Calotropis procera* and *C. gigantea* are flowering species native to North Africa, tropical Africa, Western Asia, South Asia, and Indochina.<sup>28</sup>

Locally, *Calotropis* is known by several names including “apple of Sodom”<sup>11</sup>, “king’s crown,” “Indian milkweed,” *aak*, *arka* (Sanskrit), and *yekkada gida* (Kannada). *Calotropis* thrives in arid wastelands and is often regarded with reverence. The flowers are traditionally offered to Lord Shiva and Goddess Kali, embodying purity and devotion.<sup>29</sup> During Mahashivaratri, devotees decorate Shiva lingams with Crown Flower garlands, valued for their durability as a symbol of unwavering faith and their five petals as a representation of cosmic balance.<sup>29</sup>

The latex of *Calotropis* contains a mixture of toxic and irritant compounds, including cardiac glycosides<sup>30</sup>, alkaloids, resins, tannins, histamine<sup>5,13</sup>, and proteolytic enzymes such as calotropin, calotoxin, uscharin, calactin, and calotropagenin.<sup>31</sup> Ocular injury results initially from direct corneal epithelial toxicity,<sup>5,11</sup> with subsequent manifestations attributable to the toxicity of these compounds.<sup>5,10</sup> Glycosides and oxalates contribute to corneal edema and Descemet’s membrane folds<sup>32</sup>, while histamine<sup>31</sup> and prostaglandin-mediated inflammatory pathways produce conjunctivitis and lid dermatitis.<sup>33</sup> Symptoms typically appear within hours and progress rapidly.<sup>5,7,8,11</sup> Specular microscopy has demonstrated endothelial cell loss<sup>11,32</sup> in some cases, and prolonged exposure without irrigation may precipitate toxic iridocyclitis. In our series, corneal involvement was universal, with one eye additionally showing features of iritis. No patient developed secondary glaucoma. All patients responded favorably to topical corticosteroids, underscoring the therapeutic value of anti-inflammatory treatment.

*Euphorbia* (spurge) is a large genus comprising over 2,000 flowering species, widely cultivated for ornamental purposes for their distinctive flowers and resilience.<sup>32</sup> The genus is native to Africa but has been introduced to tropical regions including Brazil, India, Vietnam, the Philippines, and Ghana. Both our cases were exposed to *Euphorbia milli*,<sup>16</sup> commonly known as christ thorn. Its latex is highly toxic,<sup>24</sup> containing diterpene esters (phorbol and ingenol derivatives) and calcium oxalate crystals, which are potent irritants and cytotoxic agents that can damage skin and mucous membranes.<sup>16,32,24</sup> Exposure usually occurs accidentally during gardening, farming, or pruning. Ocular exposure produces rapid ocular inflammation on contact. Clinical severity ranges from mild conjunctivitis and punctate keratopathy to corneal edema, Descemet’s folds, epithelial loss, and anterior uveitis with hypopyon in severe cases. exposure.<sup>16,18,21–26,33</sup> Following exposure, ocular symptoms emerge within minutes to hours. Recovery is generally within days to weeks if managed promptly with topical antibiotics, corticosteroids, lubricants, and cycloplegics. Delay in treatment, however, may result in persistent corneal haze, scarring, or the development of secondary glaucoma. Exposure to *Euphorbia* sap constitutes an ophthalmic emergency. It produces rapid corneal damage and intense inflammation, often more severe than that caused by *Calotropis*. Immediate irrigation and prompt ophthalmic management are essential to preserve vision.

*Nerium oleander*, (locally called *Kaner*), another Apocynaceae member is an evergreen shrub, occurs widely across all tropical and subtropical nations.<sup>34</sup> *Oleander* is widely used as a highway median and roadside plant<sup>34</sup> because it is hardy, drought-resistant, and provides a natural visual barrier against oncoming vehicular light. In spite of its toxic properties, the plant retains cultural significance and is still employed in religious rituals and worship.<sup>35</sup>

*Nerium oleander* flower sap contains cardiac glycosides (oleandrin, neriine, digitoxigenin derivatives), flavonoids, phenols, tannins, alkaloids, saponins, sterols, triterpenes, and calcium oxalate crystals.<sup>36–38</sup> These constituents explain its high toxicity and irritant effects on skin, mucous membranes, and eyes. The toxic effects of *N. oleander* are mostly related to its inhibitory effects on the Na<sup>+</sup>-K<sup>+</sup>ATPase pump in the cellular membrane.<sup>38</sup> These effects are due to the plant’s toxic glycosides and irritant compounds like saponins and calcium oxalate in its latex.<sup>36</sup>

Originally from the Mediterranean region, *Nerium*, botanically known as *Nerium oleander* L., is an evergreen shrub in the family Apocynaceae that has since spread widely across all tropical and subtropical nations. The commonly used names are oleander and rosebay. *Nerium* is a perennial shrub; plants are easily propagated by cuttings or layering. Plants can be kept attractive with regular proper pruning soon after the flowering season ends. *Nerium* is frequently utilized in median landscaping since it blooms throughout the year; however, summer is the peak season for flowering. Ocular toxicity due to *Nerium oleander* sap is rare. This sap can cause acute keratitis, corneal epithelial defects, corneal edema, conjunctivitis, and even anterior uveitis.<sup>27</sup> The ocular toxicity of *Nerium oleander* arises through a synergistic interplay of cytotoxic glycosides, oxalate-related mechanical trauma, and inflammatory mediator release. The pathogenic mechanisms closely mirror those of *Calotropis* and *Euphorbia*, involving cytotoxic glycosides, oxalate-related trauma, and inflammatory mediator release.

Exposure to the latex of *Calotropis*, *Euphorbia*, and *Nerium oleander* poses a significant risk of ocular morbidity. Early irrigation and prompt ophthalmic management typically result in complete recovery. Strengthening preventive health education among farmers, homemakers, and flower handlers is essential to reduce accidental exposures and safeguard vision.

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Table 1

| Sl. No | Age/sex | Occupation/circumstance of exposure        | Presenting Vision |      | Causative plant | Clinical findings                                                                                                                                    |
|--------|---------|--------------------------------------------|-------------------|------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |         |                                            | OD                | OS   |                 |                                                                                                                                                      |
| 1      | 35/F    | Housewife – collecting flowers for worship | 6/6               | 6/60 | Calotropis.spp  | OS , diffuse conjunctival congestion with chemosis temporally, corneal edema with Descemet's (DM) folds, mild iritis.                                |
| 2      | 55/F    | Housewife – collecting flowers for worship | 6/60              | 3/60 | Calotropis.spp  | OU corneal edema with DM folds                                                                                                                       |
| 3      | 48/M    | Farmer clearing fields                     | 1/60              | 6/60 | Calotropis.spp  | OU corneal edema with DM folds OS lid edema with congestion                                                                                          |
| 4      | 29/F    | Housewife – collecting flowers for worship | 6/36              | 6/6  | Calotropis.spp  | OD corneal edema with DM folds                                                                                                                       |
| 5      | 10/M    | Schoolboy playing in the field             | 6/60              | 6/12 | Calotropis.spp  | OU corneal edema with DM folds OS lid edema with congestion                                                                                          |
| 6      | 66/F    | Housewife – collecting flowers for worship | 3/60              | 6/60 | Calotropis.spp  | OU diffuse conjunctival congestion with chemosis corneal edema with DM folds OD lid edema with congestion                                            |
| 7      | 49/M    | Farmer cleaning around fields              | 6/24              | 6/60 | Calotropis.spp  | OU diffuse conjunctival congestion with chemosis corneal edema with diffuse conjunctival congestion with chemosis folds OU lid edema with congestion |
| 8      | 70/m    | Farmer clearing fields                     | 3/60              | 6/9  | Calotropis.spp  | OD epithelial defect with corneal edema and diffuse DM folds                                                                                         |
| 9      | 45/M    | Farmer clearing fields                     | 6/6               | 2/60 | Calotropis spp  | OS Diffuse SPKs , central corneal DM folds with edema                                                                                                |
| 10     | 36/m    | Construction labourer                      | 1/60              | 6/6  | Calotropis spp  | OD epithelial defect with corneal edema and diffuse DM folds                                                                                         |
| 11     | 34/F    | Housewife – collecting flowers for worship | 6/6               | 6/24 | Calotropis spp  | OS punctate keratopathy with edema                                                                                                                   |
| 12     | 30/M    | Gardener pruning hedge                     | 6/12              | 6/36 | Euphorbia milli | OU corneal edema with DM folds                                                                                                                       |
| 13     | 39/M    | Gardener pruning hedge                     | 6/12              | 6/60 | Euphorbia milli | OU corneal edema with DM folds                                                                                                                       |
| 14     | 55/F    | Flower seller preparing garland            | 6/6               | 1/60 | Nerium Oleander | OS Corneal epithelial defect with anterior uveitis                                                                                                   |

Pictures

Picture 1: Calotropis plant and its ocular toxicity



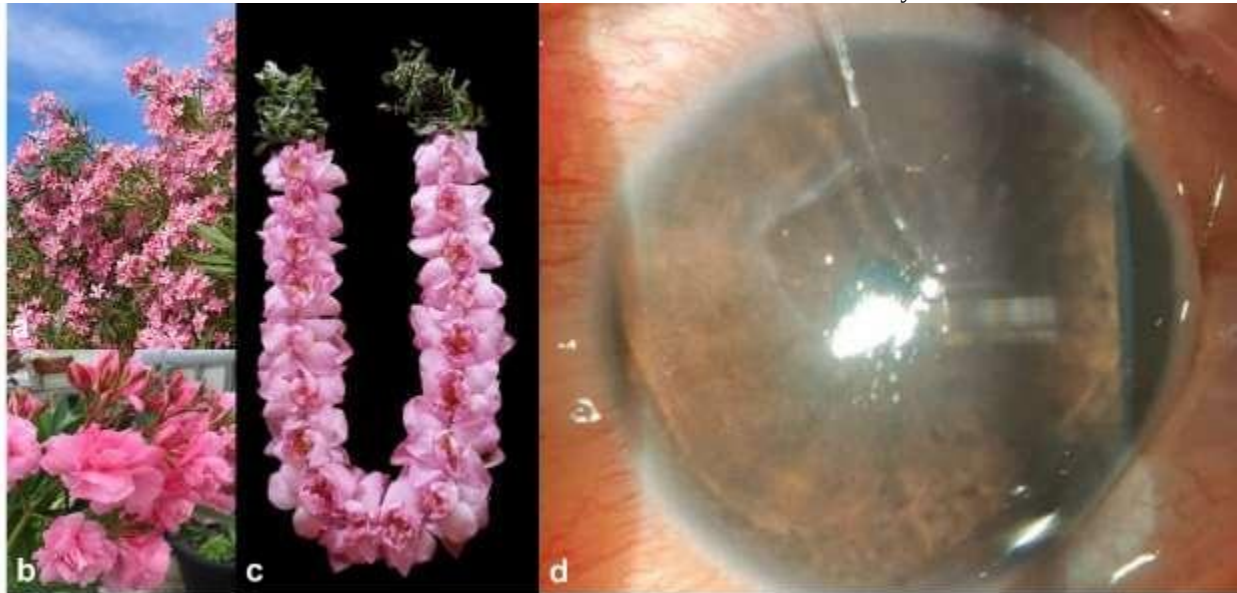
- 1a: *Calotropis procera* plant  
 1b: Garlands made from *Calotropis* flowers in the market for sale to be used for worship  
 1c: Corneal epithelial defect following acute *Calotropis* sap exposure  
 1d: Chemical conjunctivitis and punctate epitheliopathy  
 1e: Diffuse corneal edema with Descemet's Membrane folds  
 1f: Punctate epithelial keratopathy following sap exposure

**Picture 2: *Euphorbia* plant and its ocular toxicity**



- 2a: *Euphorbia milli* plant, commonly called Crown of Thorns, is a spiny ornamental shrub with fleshy green leaves and vibrant red or pink bracts surrounding tiny yellow flowers.  
 2b: Toxic sap oozing from a spiny stem of *euphorbia milli* plant highlighted in the yellow circle  
 2c: Inferior corneal edema and Descemet's membrane folds  
 2d: Acute corneal epithelial defect following *Euphorbia milli* sap exposure

Picture 3 : Nerium Oleander Plant and its ocular toxicity



3a: Nerium oleander (pink variety) is an evergreen shrub with glossy green leaves and clusters of showy, fragrant pink flowers.

3b: Nerium oleander produces clusters of showy, five-petaled, funnel-shaped flowers that are typically pink in colour.

3c: Garland made up of Nerium oleander pink flower

3d: Acute corneal epithelial erosion caused due to Nerium oleander sap exposure.