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POTENTIAL ROLE OF PHYTOMEDICINAL AGENTS IN OCULAR MANIFESTATION OF MICROBIAL INFECTION

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ABSTRACT: Although the human eye has multiple physical and chemical barriers to save itself from foreign materials, there are certain times when an attack on the ocular surface may lead to trauma and/or growth of microbial flora, which can be proved lethal if left untreated. However, certain allopathic treatments and therapies are available; still, there is an increased need for herbal medicines because they have lesser side effects and effective therapeutic value. This review paper identifies different types of ocular infections, how to differentiate between them through signs and symptoms, and different types of herbs used for ocular emergencies.

INTRODUCTION: Eyes are designed in such a way that they are able to defend themselves against any infection, foreign material, or trauma; for example, the movement of eyelids and eyelashes protects the ocular surface from dust particles, lachrymal glands present in the ocular region can produce tears which keep the eye lubricated and the secretion removes any foreign particles such as dust particles and microorganisms [1]. The lachrymal secretion contains lysozymes and interferons, which act as macrophages to protect against infections; involuntary movement of eyelids keeps the cornea moist and lubricated. However, this defense mechanism cannot always protect the eye from sudden foreign matter attack, which can lead to ocular inflammation.

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Ocular inflammation may result from a bacterial, fungal, or any other microbial infection [2]. The most common ocular inflammatory diseases which come under the observation of ophthalmologists are red eye diseases or conjunctivitis and corneal ulcer or keratitis; they are amongst the common problems patients frequently suffer from. The inflammatory reaction comprises certain signs and symptoms that an ophthalmologist observes to make a prompt diagnosis and start appropriate treatment [2-3].

An ocular infection might not be threatful such as in the case of conjunctivitis and allergy. Still, an ocular infection can be serious, such as in the case of keratitis and endophthalmitis, which can lead to loss of vision and requires an immediate referral to an ophthalmologist. Proper examination of the eye in these cases plays an important role; usually, an ophthalmologist diagnoses the eye by instilling fluorescein drops in the conjunctival sac, and then, the eye is to be viewed under a cobalt blue light of the slit lamp to rule out any sign of ulceration in cornea, infection or a wound [4].

1. Conjunctivitis: When inflammation in the conjunctiva causes discharge and pain in the ocular vascular system, it results in hyperaemia and oedema of the conjunctiva, and it is characterized by redness in the cornea.

TABLE 1: SELECTED NON-CONJUNCTIVITIS CAUSES OF RED EYE

Differential Diagnosis	Symptoms	Penlight Examination Findings	PathophysiologicalFindings
Dry eye disease	Sensation of foreign body material, prolonged reading, or watching television worsens the situation because of decreased blinking time and frequent evaporation of lachrymal secretions. The condition worsens in dry, cold, and windy environments	Bilateral redness	Dysfunction of meibomian glands and eyelid margins are thickened along with telangiectasia. There is an aggregation of cloudy granular or solid secretion around the orifice of meibomian glands, which obstructs their secretion.
Blepharitis	Similar to dry eyes	Eyelids turn red	Invasion of bacteria in the eye and their colonization inside eyelids causes immune system-mediated damage due to bacterial toxins and enzymes, and waste products
Uveitis	Pain in the eyeball, photophobia, bilateral symptoms	Redness in the eye because of the presence of inflammatory cells in the anterior chamber of the eye, there is a constant eyeball pain radiating to temple and brow, pupils react poorly, vision is compromised	The blood eye barrier is similar to the blood-brain barrier, which prevents the entrance of large protein molecules into the eye; when inflammation occurs in this barrier, there is a breach in blood eye barrier, which causes WBCS to enter the eye
Angle-closure glaucoma	Symptoms are usually unilateral; eyes become sensitive towards the light, pain in ocular region, vomiting, headaches, nausea, vision is compromised, vision with halos around light	Eyeballs react firmly on palpation; redness occurs in the ocular region, cornea appears steamy or hazy, pupils are dilated moderately, and does not react to light	Dilation of papillary leads to an increase in iris and lens contact time, which increases the papillary block
Carotid cavernous fistula	History of the head injury may cause chronic Red Eye	Corkscrew vessels are dilated, bruises are observed on auscultation	Carotid arteries and veins behind the eye develop an abnormal connection between them.
Endophthalmitis	The patient may have an ocular trauma or history of eye surgery which causes photophobia and severe pain	Pus in the anterior chamber, photophobia, and redness	The Aqueous barrier is broken down, which leads to fibrin exudation and cellular infiltration by neutrophilic granulocytes.
Cellulitis	Double vision, fullness and pain	Patient may be suffering from sinusitis, restrictions of eye movement may occur, swelling of eyelids and redness	Subcutaneous tissues are deeply inflamed because of the enzymes produced by bacteria
Anterior segment tumors	Pain, compromised vision, double vision, photophobia, foreign body sensation	Presence of abnormal growth inside on the surface of eye	Changes in axenfeld loops present inside the eyeballs to transfer neoplastic cells inside them through ciliary body
Scleritis	Pain in eyeball movement, decrease in vision	Sclera appears blue and redness of cornea	Stroma is infiltered with T cells and macrophages due to inflammation in flora which leads to necrosis and scleral thinning
Subconjunctival haemorrhage	Foreign body sensation may appear or discharge of mucus from conjuctiva or the patient may remain asymptomatic	Conjunctival membrane filled with blood	Blood vessels present in the conjunctiva and sclera bleeds out and leaks into subconjunctival space

A majority of patients suffering from conjunctivitis are initially treated by a physician rather than eye care professionals [3]. Approximately 1% all primary care of the person is related to this, approximately 70% of all patients with acute conjunctivitis present themselves with primary care and urgent care [4]. Conjunctivitis can be infectious and non-infectious; this disease can be classified into acute, hyperacute, and chronic according to the severity of clinical response and rate of onset. It is important to differentiate conjunctivitis from other diseases that can threaten eyes because they may have similar clinical presentations. To take appropriate steps about further testing, treatment, and referral, an analysis of ocular history along with an examination of the eye with a pen light may be helpful in diagnosis and treatment of conjunctivitis and other ocular diseases [5].

Viral conjunctivitis is most contagious and most common type of conjunctivitis. Among the viruses which causes viral conjunctivitis, herpes simplex virus is the most common causative agent, it affects both, adults and children, in case, the infection is caused by simplex or zoster virus, a history of cold sores for shingles is sought and patient is examined for cold sores or a vascular rash. As there is no specific treatment for viral conjunctivitis patient are generally advised that viral conjunctivitis is self-limiting, they can use cold compresses, artificial tears or topical antihistamine. Antibiotics are generally not needed and may increase antibiotic resistance, ganciclovir gel or acyclovir ointment is prescribed in case there is evidence of herpes simplex or zoster virus as these are antivirals. When viral conjunctivitis is severe or the patient experiences symptoms even after its resolution, then patient must be referred to an ophthalmologist, topical steroids are given along with therapy to exclude any chance of post-viral keratitis [2].

According to Remco *et al*, signs and symptoms occurring in eyes during inflammation caused by bacteria and viruses are very similar, which makes it very difficult to differentiate between the cause of infection or causative agent of the infection solely on the basis of these signs and symptoms, which subsequently leads to non-specific prescriptions [6]. The majority of cases of viral conjunctivitis produce two of the common clinical manifestations associated with viral conjunctivitis - conjunctivitis fever and epidemic keratoconjunctivitis fever. Conjunctivitis fever is characterized by a sudden onset of fever, inflammation of the pharynx, mucous discharge from eyes, and enlargement of periauricular lymph nodes. In contrast, epidemic keratoconjunctivitis is severe and presents itself with watery discharge, hyperemia, chemosis, and ipsilateral lymphadenopathy. It is important to differentiate conjunctivitis from other sight-threatening eye diseases with similar clinical presentations and make appropriate decisions about further testing, treatment, or referral [7]. The differential diagnosis of conjunctivitis with other ocular diseases and knowledge about the typical features of each disease in this category are important **Table 1** [8].

Ocular symptoms and types of eye discharge are useful in determining the type of ocular diseases. For example, a purulent or mucopurulent discharge is often due to bacterial conjunctivitis, whereas a watery discharge is characteristic of viral conjunctivitis [9] itching is also associated with allergic conjunctivitis.

Viral conjunctivitis secondary to adenoviruses is highly contagious, and the risk of transmission has been estimated to be 10% to 50%. The virus spreads through direct contact *via* contaminated hands, surgical instruments and medical equipment, swimming pool water, and personal items. In one study, 46% of infected people had positive cultures grown from outside of their hands because of the high rate of transmission. Hand washing, strict instrument disinfection, and isolation of the infected patients from the rest of the clinic have to be frequently practiced. [10].

2. Infectious Keratitis: Infection of the cornea can progress rapidly; therefore, it is an ophthalmic emergency that requires immediate attention. It is a significant cause of corneal blindness and is one of the most common causes of visual impairment in working-age adults; risk factor is increased if a patient wears contact lenses, have suffered any corneal abrasion, physical or chemical trauma, have undergone corneal or ocular surgery, have diabetes, have a history of immunosuppressive disease or have taken steroids. According to it, practitioners look for such risk factors in a patient's history and give the treatment [11].

TABLE 2: PROPORTION OF COMMON MICROORGANISMS ISOLATES CAUSING OCULAR INFECTION IN RESPECTIVE COUNTRIES [12]

References Country	% of bacterial isolates									
	Gram-Positive				Gram-Negative					
	S. aureus	*CoNS* *	*S. pyogens*	*S. pneumoniae*	*P. aeruginosa*	*E. coli*	*K. pneumoniae*	*H. influenzae*	*M. Spp*	*N. gonorrhoeae*
Nigeria	23.7	19.2	6.2	8.6	10.1	4.4	6.2	7.7	3	3.9
India	13	37			21	3	7			
Ethiopia	28.1	10.1		13.5	10.9	5.4		8.8	4	2.7
India	26.6	6.1	1.6	22.14	8.23	0.9		3.45	5.4	0.42
Japan	21	31.4		3.2	9.7		2.4	2.3	0.8	
Iran	12.9	32.9		8.6						
Malaysia	17		3.1		16	4	5.5	8.3		
USA	22.1	6.7		2.4	13.7			2.3		
Average	20.1	19.5	4.3	6.7	12	5.9	7.7	5.3	3.2	2.3

2.1 Bacterial Keratitis: *Staphylococcus aureus* coagulase, *Staphylococcus pneumoniae* and *Pseudomonas aeruginosa* are the most common organisms causing infectious keratitis. *P. aeruginosa* is a common microorganism causing bacterial keratitis in frequent contact lenses wearing patients [13]. Acanthamoeba is suspected if a patient has been swimming or is in a spa while wearing contact lenses. Specific antifungal or anti Acanthamoeba therapy is needed, and treatment may take some months [14, 15, 16].

Signs and symptoms of bacterial keratitis include photophobia, blurred vision, corneal opacity or hypopyon (pus inside the eye) clearing, itching, discharge, dendritic ulcer, stromal haze, scarring, vascularization, for contact lens wearers with red eye or increasing pain, the patient should be referred promptly to an ophthalmologist for a slit lamp examination and corneal scraping, these scrapings are sent for gram stain and culture to identify the organism. If treatment is not started accordingly with prompt action, the condition can progress rapidly with loss of vision or even the eye.

Therapy with fluoroquinolones, the topical antibiotics for the mainstay treatment, comprising ciprofloxacin 0.3 % or ofloxacin 0.3%, 2 drops hourly for 48 hours, then every 4 hours until healed is healed prescribed. Fluoroquinolones are used to treat conjunctivitis and provide relief to patients from ocular pain. If required, corneal grafting may be done to eradicate the organism or repair the damage. The most commonly employed drug for red eyes disease or conjunctivitis is chloramphenicol. In Primary health care-chloramphenicol is not prescribed when the symptoms suggest microbial keratitis; otherwise, this might cause a delay in appropriate treatment, and the risk of loss of the patient is increased [17]. Many herbals have been explored and identified as phytomedicines, possessing antimicrobial activity. They can be further developed as products that can be used in such ocular infections; for example, it has been validated that the rosemary possesses antimicrobial activity, inhibits the biofilm formation of bacteria, prevents the planktonic cells adhesion, and consequently, blocks the microbial colonization. The results found are encouraging enough for further development into the plant extracts [18].

2.2 Herpes Simplex Keratitis: Herpes simplex virus is a major cause of infectious blindness in developed countries. A virus may affect epithelia, the stroma, and the endothelium layer of the cornea. Suspected patients are asked if they have been suffering from cold sores or a history of viral keratitis or viral infection, as this is helpful in diagnosing the disease. Epithelial herpes simplex keratitis typically manifests as dendritic ulcer, this clinical feature of herpes simplex virus can be visualized in fluorescein staining and a Cobalt blue light. It is usually treated with acyclovir ointment 5 times daily for 14 days [19].

Stromal herpes simplex keratitis causes opacity of the stroma with or without ulceration scarring or vascularization. Endothelial keratitis precipitates on the endothelium and corneal oedema management of stromal and endothelial keratitis. Treatment given is of oral antivirals, acyclovir or valacyclovir with topical steroids and follows up, until the episode has been resolved [20-23].

3. Allergic Conjunctivitis: Allergic conjunctivitis comprises multiple hypersensitivity responses due to interaction between allergens and mast cells present inside the ocular membrane. Seasonal allergic conjunctivitis and perennial allergic conjunctivitis exist as common acute disorders which are treatable, not serious, while vernal keratoconjunctivitis, atopic keratoconjunctivitis, and Giant papillary conjunctivitis exists as chronic disorders and requires ophthalmologist referral [25].

3.1 Seasonal and Perennial Allergic Conjunctivitis: Seasonal and perennial allergic conjunctivitis is usually observed in warmer climate regions such as Italy and Japan. The allergic symptoms in conjunctivitis develop typically when eyes are vulnerable to certain allergens which form cross-linking with membrane-bound IgE; this interaction stimulates mast cells degranulation followed by the release of allergic and inflammatory mediators one such mediator, histamine, is the primary contributor to the development of early phase signs and symptoms of seasonal allergic conjunctivitis (SAC) usually in distinct ways that reflect allergen exposure. The pathognomonic symptom of ocular allergy is itching; without itching a condition should not be considered as ocular allergy [26-27]. This is followed by vasodilation, which ultimately results in eyes' redness. Chemosis is the swelling of the conjunctiva, which can be present, although it is usually possible and is only visible on slit-lamp examination. The glassy appearance of the eye, however, is more readily noticeable swelling in the lids can also become apparent within 30 minutes of exposure to allergens.

It is visible on examination and dissipates slowly. The initial intensity of this swelling can induce structural changes in the delicate collagen fibers of the skin surrounding the eye. Patient history plays an important role in revealing an atopic family or personal history and the environmental triggers that might elicit this reaction, such as trees, grasses, ragweed, or pet animal dander. Signs of rhinitis, asthma, or both might also be present; it includes runny nose, wheezing, or sneezing. Approximately 90% of patients with rhinitis indicated that they had experienced at least one day of ocular symptoms within a week. Signs and symptoms reported by the patient are critical for diagnosing allergic conjunctivitis because signs and symptoms might not be present at the time of visit [28-30]. The conjunctiva represents the upper extremity of the respiratory system, which maintains a drainage system into the nose through the major lacrimal duct. The ocular surface can be considered a relatively large collection window, having an area of several hundred square millimeters for the entry of allergens into the body.

Allergens, allergic mediators released from the mast cells or antiallergy eye drops drain to the nose by this pathway, contribute to nasal symptomatology. Ocularly instilled therapy has been shown to reduce rhinitis symptoms such as running, itchy nose, sneezing, blocked nostrils. It is hypothesized that this effect is due to inhibition of the allergic reaction and mast cell degranulation at the ocular surface. Drainage of medication to the nose through the lacrimal duct. Eyewashes, cold compresses, and tear substitutions can be used as non-specific measures to avoid symptoms; however, these are often impractical or ineffective. The use of topical therapy is pharmacokinetics and clinically the most appropriate approach for the treatment of allergic conjunctivitis because it allows for direct and local application of therapy while avoiding the ocular drawing effects [20]. With the use of systematic antihistamines, seasonal and perennial allergic conjunctivitis are ideally treated with a combination of antihistamine and mast cell stabilizers; these are the newest generation of dual mechanism anti-allergic agents. The advantage of these therapeutic molecules is the Rapidity of symptomatic relief given by immediate histamine receptor antagonism coupled with the long-term disease-modifying benefit of mast cell stabilization [30].

3.2 Vernal Keratoconjunctivitis and Atopic Keratoconjunctivitis: Vernal and atopic keratoconjunctivitis are more Complex than seasonal allergic conjunctivitis; they are chronic allergies and have deeper, complex pathophysiology associated with them. The biochemistry and physiology of conjunctiva are highly inflamed. Multiple dysfunctions occur inside it due to the stimulus provoked by eosinophils, conjunctival fibroblasts, and epithelial cells such as mast cells and th2 lymphocytes. It happens because of an allergic inflammation tree endocrine immune

mediated system. It appears that the giant papillary conjunctivitis is not an allergic reaction but is a reaction that occurs due to repeated mechanical irritation caused by contact lenses. VKC is generally associated with a family history of allergic reactions. It is frequently observed in males and in warmer climates. Limbus present inside the eye is filled with a gelatinous yellow Grey infiltrate the circumference of the limbus appears thick and opaque this causes intense itching, subsequently leading to mucus secretion and it causes photo phobia, which is a characteristic of all forms of vernal keratoconjunctivitis. Recent studies have documented histaminase deficiency associated with VKC AKC occurs more frequently in men aged 30 to 50 years with a family history of allergic asthma, urticarial or hay fever.

Patients with a family history of dermatitis are typically patients of VKC and AKC; patients associated with allergies develop ocular allergies in their middle ages. In atopic keratoconjunctivitis, eyelids are highly influenced, and intense bilateral itching occurs; most of the time, burning sensation, photophobia, tears occur, the mucus discharge is often observed along with blurry vision, the eye appears scaly and swollen. Treatment of vernal and atopic keratoconjunctivitis involves similar antibacterial agents as used in another allergic conjunctivitis along with a pulse therapy with steroids. Although VKC and AKC are less prevalent, they are still a serious diseases and highly affect the patient's quality of life and must be treated with appropriate topical ocular therapy to maintain the patient's health [31].

4. Infectious Endophthalmitis: Endophthalmitis is considered as most devastating infection in the eye caused by a microbe. It is a rare condition but requires immediate referral to an ophthalmologist to prevent permanent vision loss. Endophthalmitis is caused by infection of a bacteria or fungi or any microbe which may have entered during cataract surgery, intravitreal injection, or trauma. The microbe enters into the bloodstream, presents in the ocular region, and colonizes itself to release certain bacterial toxins that affect the normal functioning of the eye. Endophthalmitis is most commonly caused during cataract surgery and is often caused by bacteria. Intravitreal injections worsen the situation, as they are used for age-related macular degeneration and diabetic retinopathy. The most common bacteria which cause endophthalmitis are coagulase-negative Staphylococcus, *Staphylococcus aureus* and gram-negative bacilli. Samples of aqueous humour and vitreous humour are taken to isolate the organism for culturing procedures to identify the organism. Treatment of endophthalmitis involves intravitreal antibiotic injections of vancomycin and ceftazidime; in some cases, vitrectomy is done to avoid vision loss. Oral doses of ciprofloxacin and intravenous gentamicin are given for treatment. Symptoms of endophthalmitis involve pain, decreased vision, redness, and hypopyon.

5. Adverse Effects of Topical Antibiotics: Topical antibiotics are the most commonly used drugs to treat the ocular infection. Although they are widely used for various diseases, they have certain adverse effects. Commercially dispensed antibiotics comprise of, capacity and doses larger than that of capacity of conjunctival sac, and therefore, this large volume of liquid drains from the eyes and reaches the gastrointestinal tract where they get absorbed, this happens through drainage of the liquid into the pharynx from aqueous humour, it affects the bioavailability of the drug.

Sulfonamide, sulphacetamide and neomycin may cause local irritation, rash, and stinging sensation. Antibacterials may cause corneal precipitation, chemosis; along with this, antibiotics have been reported to cause increased heart palpitation, alteration of taste, dry mouth, and trigeminal abnormality [33-37].

6. Potential Herbs Used in Ocular Diseases: Medicinal plants are perfect substitutes for many allopathic drugs. They have been used traditionally and are still used frequently in many rural areas of the world, as they come as the primary source of medicines. Herbal drugs are available for all types of diseases and for a specific part of body.

Eye being the most sensitive part of our body, herbal medicine has to be chosen carefully for its utilization. Following are the various ocular diseases; traditional healers use phytomedicines; further research and development in them can prove to be promising future medicines with the least side effects and high efficiencies.

Ocular diseases:

1. Glaucoma: Glaucoma can be described as a group of eye conditions that can lead to blindness. In almost all types of glaucoma, the nerve connecting the brain to the eyes is damaged because of high intraocular pressure. In most cases, glaucoma is caused due to high pressure inside the eyes, also known as visual hypertension. Glaucoma can also be characterized when intraocular weight or intraocular pressure IOP is higher than normal. Sometimes, intraocular pressure is affected by ageing, family history, high myopia, systemic hypertension; cardiovascular diseases, migraine headaches, peripheral vasospasm and nerve damage are possible causative factors for glaucoma. Glutamate-induced neurotoxicity, nitric oxide-based damage, disruption of neuro traffic factor transport, and induced neuro destruction are the possible leading factors of glaucoma. The liquid inside the eyes known as fluid amusingness, runs through the eye through a channel, if this channel is blocked, fluid does not develop. The causes of blockage are unknown but it is known that this blockage can be a genetic problem. Serious eye vein blockage can be a fiery condition. The following are types of glaucoma:

Open-Angle (Wide Angle, Chronic Simple Glaucoma): This is the most common type of glaucoma. Doctors also call it wide-angle glaucoma. The drain structure in the eye looks fine, but the intraocular fluid does not flow out as it should. It is a hereditary disease in which intraocular meshwork degenerates with age.

Angle Closure (Narrow-Angle, Acute Congestive) Glaucoma: This is more common in Asia. It is also called acute or chronic angle-closure or narrow-angle glaucoma. Here the eye does not drain like it should because the drain space between the iris and cornea becomes too narrow. Consequently, this can cause a sudden build-up of pressure in the eyes. It is also linked to farsightedness and cataracts (clouding of the eye's lens).

Secondary Glaucoma: This type of glaucoma develops due to an already prevailing disease, such as when a person has cataractor diabetes. This type of eye disease develops due to increased pressure in eyes.

Pigmentary Glaucoma: In pigmentary glaucoma, bits of iris of the eye, which is the coloured part of our eye, goes into the fluid present in the eye and clog the drainage canals. A large portion of the individuals with open-edge glaucoma does not show any side effects. When side effects does exists, they are typically late in the illness, with that, this sickness is frequently called the Sneak hoodlum of vision. For the most part angle-closure glaucoma symptoms develop rather early and are increasingly self-evident. Seeing halos around lights, vision impairment, redness in the eye, an eye that looks dim, upsets the stomach and eye distress are the common manifestations of glaucoma.

2. Cataract: The appearance of cloudiness on the lens of the eye is called a cataract. When a patient suffers from a cataract, their vision is compromised in a similar way to looking through a foggy window. A cataract is an age-related disorder that makes it difficult to drive or read; it can be environment-related, stress-related or toxins-related too. Early development of cataracts is asymptomatic and does not affect the eye much, but it becomes necessary to remove it once developed.

3. Fungal infection: *Fusarium solani, Aspergillus niger, Candida albicans, Fusrium oxysporum, Penicillium notatum,* and *Aspergillus flavus* are some fungi that can cause ocular infection. Infection through these fungi can even lead to vision loss, making it essential to identify and eradicate the organism from the affected area. The symptoms of fungal ocular infections include pain in ocular movement, redness of eyes, compromised vision, photophobia and excessive mucousy or watery discharge from tear glands. Fungal infections occur when fungal spores from any external source contact the eye, known as exogenous infectious endophthalmitis.

When fungal spores infect a certain body part, the spores are carried through blood flow and reach into the eyes, known as endogenous infectious endophthalmitis. Fungal ocular infections can last up to a week. Although endophthalmitis is not contagious, however, it must not be left untreated. Such infections usually occur through a wound caused by fungal infected matter such as plant thorn or stick, usually occurring in rural areas or

villages. Traditional healers use a certain part of plants with medicinal values to treat microbial infections, some examples of which are collected in the following table.

TABLE 3: MEDICINAL PLANTS USED IN VARIOUS TYPES OF OCULAR DISEASES

S. no.	Scientific name/ Common name	Family	Parts used	Geographical location	Use in ocular diseases	Ref.
1	*Abelmoschus esculentus*	Malvaceae	Flower	Africa, Brazil, India, Thailand, Philippines	Conjunctivitis	43-44
2	*Abrusprecatorius*	Fabaceae	Seed, root, leaf	South Africa, India	Ocular infections	45
3	*Bauhinia variegata*	Caesalpinaceae	Flower, Bud	India, Pakistan	Eye diseases	46
4	*Capparis decidua*	Capparidaceae	Plant, leaf	South Africa, Swaziland, Indian deserts	Corneal opacity	47
5	*Cassia absus*	Caesealpinaceae	Seeds and leaf	India, Sri Lanka	Eye diseases and strengthens eyesight	48
6	*Eclipta prostrata*	Asteraceae	Plant leaves	Widespread among world	Eye diseases	49
7	*Euphorbia hirta*	Euphorbiaceae	Inflorescence and leaves	Central America	Treats redness of eyes and removes any foreign body from Eyes	50
8	*Ficusthon ningii*	Moraceae	Whole plant or leaves	Africa	Conjunctivitis, blindness and related ocular affections	51
9	*Garcinia cola*	Guttiferae	Seeds	Congo, Ghana, Liberia Nigeria	Glaucoma	52
10	*Jatropha curcas*	Euphorbiaceae	Latex	Subtropical region around the world	Ocular infections	45
11	*Kigelia africana*	Bignoniaceae	Fruit	Tropical Africa	Wounds of eye	53
12	*Lantana trifolia*	Verbenaceae	Whole plant or leaves	Mexico, West indies, America	Conjunctivitis and related ocular affections blindness	50
13	*Nerium odorum*	Apocyanaceae	Leaves	Mediterranean region, Iran, India, South China	Ocular diseases	46
14	*Ocimum sanctum*	Labiatae	Whole plant	Southeast Asia	Painful Eye diseases	54
15	*Parnassia nubicola*	Parnassiaceae	Leaves	Himalayas, Afghanistan to Kumaon	Ocular inflammation	55
16	*Ricinus communis*	Euphorbiaceae	Leaves and fruits	Asia, America, Europe	Conjunctivitis, blindness, ophthalmic surgery	56
17	*Sansevieria intermedia*	Ruscaceae	Saplings of leaves	Madagascar, Asia	Ocular injuries	57
18	*Terminalia chebula*	Combretaceae	Fruits	Asia	Improve eyesight	58
19	*Vaccinum myrtillus*	Ericaceae	Leave	Europe	Vision improvement, cataracts, glaucoma, diabetic, retinopathy, eyestrain myopia	59
20	*Warbugia ugandensis*	Canellaceae	Leaves	Africa	Ocular injuries, cataract	60
21	*Ziziphusma uritiana*	Rhamnaceae	Leaves	India, China	Stye of eye	61
22	*Pantas longiflora*	Rubiaceae	Plant root	Africa	Sore Eyes	62
23	*Vitex doniana*	Verbinaceae	Bark and stem of plant	Mediterranean region	Ocular inflammation and ocular infections	63
24	*Pycanthus angolenses*	Myristicaceae	Exudate	Africa	Corneal ulcers	64
25	*Terminali abellerica*	Combretaceae	Fruits and seeds	Tropical Asia	Eye diseases	58

26	*Pyrus pashia*	Rosaceae	Fruits	Asia	Cataract ocular injuries	[65]
27	*Daucus carota*	Umbelliferon	Seeds	Europe, Asia	Glaucoma, eyesight	[66]
28	*Saccharin munja*	Poaceae	Stem	Asia	Eye diseases	[67]
29	*Datura stramonium*	Solanaceae	Seeds	Africa, Asia. America	Inflammation of iris	[68]
30	*Prunus africana*	Rosaceae	Bark of trees	Africa	Retinoblastoma	[60]
31	*Acalyfa indica*	Euphorbiaceae	leaves	South America	Ocular infections	[46]
32	*Bixa orellana*	Bixaceae	Leaf	Africa	Oculotumor, cataract	[47]
33	*Cadaba indica*	Capparaceae	Leaf	New Zealand	Eye diseases	[57]
34	*Calophyllum inophyllum*	Clusiaceae	Leaf	Ethiopia	Eye ailments	[66]
35	*Cassia auriculata*	Cesalpiniaceae	Seed	Asia	Eye infection	[55]
36	*Chenopodium album*	Chenopodiaceae	Whole plant	USA	Sore eyes	[61]
37	*Emilasonchifolia*	Asteraceae	Leaf	Asia	Ocular infection	[42]
38	*Flacourtia indica*	Flacourtiaceae	Leaf	Asia Pacific	Conjunctivitis	[61]
39	*Glycyrrhiza glabra*	Papilionaceae	Rhizome	USA	Eye diseases	[56]
40	*Heliotropium dasycarpum*	Boraginaceae	Leaf	Central America	In Corneal opacity	[59]
41	*Iris germanica*	Iridaceae	Flowers	Africa	Conjunctivitis	[52]
42	*Jatropha curcas*	Euphorbiaceae	Latex	Asia	Ocular infection	[46]
43	*Juniperus procera*	Cupressaceae	Sap	Asia	Conjunctivitis	[47]
44	*Lentanatrifolia*	Verbenaceae	Leaf or whole plant	America	Blindness, conjunctivitis, related ocular affections	[63]
45	*Luffa acutungula*	Cucurbitaceae	Leaf	Ethiopia	Granular conjunctivitis, prevent accessivemeihomian secretion	[66]
46	*Lygodium salcifolium*	Lygodiaceaea	Leaf	Africa	Pain in the eyes and night blindness	[46]
47	*Momordica charantia*	Cucurbitaceae	Leaf	South Pacific	Correct impaired vision	[65]
48	*Moringa oliefera*	Moringaceae	Flower, leaf	Asia	Eye diseases	[50]
49	*Pandanus tectorius*	Pandanaceae	Fruit	Europe	Red eyes	[54]

CONCLUSION: Eye has several natural mechanisms to prevent the entry of foreign particles inside it, such as eyelashes, to prevent dust particles and secretion of tears from lachrymal glands from clearing away foreign materials, but still there are certain times when the eye suffers from a traumatic injury which may lead to the entrance of bacteria or any microorganism inside the eye which causes disturbance in the normal functioning of the eye.

Secretions from microbes cause irritation and abnormal processes; their growth can lead to vision loss, sometimes eyes suffer from irritation, and abnormal secretions due to an environmental stimulus that affects patients' health.

These can be various types of allergies. The symptoms of allergy and infections can be similar, sometimes indistinguishable, but still, there are certain signs and symptoms which prove very helpful in identifying the causative agent of ocular diseases. Most of the time it is bacteria among the microbes which cause infections. Viruses and fungi are less prevalent but difficult to treat.

Topical antibiotics are the most common treatment for ocular infection, but since they possess many side effects and therapeutic effects, there is a need for phytomedicines. Most herbal plants are available worldwide, and their secondary metabolites can be utilized for specific treatment.

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