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A REVIEW ON PHYTOCHEMISTRY AND PHARMACOLOGICAL ACTIVITY OF JIVAK

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ABSTRACT: *Malaxis acuminata* (Jeevaka), a terrestrial orchid belonging to the Orchidaceae family, is a vital medicinal plant extensively used in traditional Ayurvedic medicine. Found in India, Sri Lanka, and other parts of Southeast Asia, the plant is recognized for its diverse pharmacological properties. Rich in bioactive compounds such as alkaloids, flavonoids, glycosides, and phenolics, *M. acuminata* demonstrates significant therapeutic potential. It exhibits anti-inflammatory, antioxidant, antimicrobial, adaptogenic, immunomodulatory, and rejuvenating properties. Traditionally, it is used as a tonic to promote vitality, enhance immunity, and manage conditions like respiratory disorders, joint inflammation, and reproductive health issues. The plant is also valued for its aphrodisiac properties and ability to accelerate wound healing. Recent studies highlight its neuroprotective, hepatoprotective, and anti-diabetic potential, further supporting its role in managing chronic diseases. Despite its prominence in traditional medicine, comprehensive scientific validation of its pharmacological effects through clinical trials remains necessary. This review aims to consolidate existing knowledge about *Malaxis acuminata*, emphasizing its medicinal value, phytochemistry, and potential applications in modern therapeutic practices.

INTRODUCTION: One of the largest, most varied, and most advanced families of flowering plants is the Orchidaceae, which includes orchids, which make up around 10% of all flowering plant species [1, 2]. The application of phytomedicines in the management of chronic illnesses has garnered more attention in recent years. The utilisation of medicinal plants in the food, cosmetic, and pharmaceutical industries is made possible by their unique bioactivities. Oddly enough, orchids play a big part in the old Indian "Ayurvedic" healing system.

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Among the eight therapeutic plants in the "Ashtvarga," *Malaxis acuminata* or "Jeevak," a highly valued medicinal orchid, stands out [3, 4]. Jivaka is also used to promote wallichi bulbs of *Malaxis muscifera*, *Lipasis rostrata*, and Microstylis [5, 6]. A common terrestrial medicinal orchid is *Malaxis acuminata*, also referred to as jeevak. It is found in the Himalayan temperate to sub-alpine ranges, which are between 1800 and 2300 meters high. Jeevak is a small, tuberous, eract orchid plant that grows on land.

Height about 20 to 25 cm. Its stems usually have pseudo-bulbous bases. The fresh fake bulb has a conical shape and is smooth, shiny, green, and meaty. It is 1 to 9 cm long and 1 to 3 cm wide, slightly mucilaginous, and covered with three or four sheathing leaves that are placed alternately and have parallel venation.

The stem is simple, and roots emerge where the stem and bulb unite. Simple leaves with sheathing at the base and three or five in number. The tiny flowers have a light yellowish-green hue [7, 8]. Colonies of this species are found in areas with shade, damp soil, and moss [9].

Habitat: It is found in the Andaman Islands, Travancore, Anaimalai hills, Madhya Pradesh, and the temperate and subtropical Himalayas of India, with elevations ranging from 1200–2100 m in Assam, Nagaland, Manipur, Mizoram, Himachal Pradesh and Uttarakhand to Arunachal Pradesh, Tripura, and the Khasi hills at 1500–1800 m. At heights of up to 1400 meters, it can also be found in South-East Asia, China, and Cambodia [11, 12].

Substitute species: *Pueraria tuberosa, Centaurea behen, Dioscorea bulbifera, Tinospora cordifolia* and also *Malaxis cylindrostachya, Malaxis mackinnoni* [13, 14].

This specie`s seeds need a particular mycorrhizal fungus to germinate, its natural multiplication rate is extremely low (0.2–0.3%). Due to brutal collection practices and overexploitation, this species' natural populations are rapidly declining, making it scarce in its natural habitats despite its significant therapeutic value [15, 16].

Taxonomical Features: It has fibrous roots pointing downward from an underground stem.

Leaves: typically 2-4, ovate lanceolate, light green, sessile or petioled; About 10 mm in diameter, the flower is yellowish-green with a purple centre; the fruits are capsules with six chambers; and the seeds are tiny, ovoid, and powdery [17].

TABLE 1: AYURVEDA PROPERTIES

Common name	Jeevak
API mention	Jivaka
Scientific name and family	*Malaxis acuminata*; *Orchidaceae*
Taxonomic synonym (for Orchid)	*Crepidium acuminatum*
Other Orchidaceae members	Lipasis rostrata; *Microstylis wallichi*; *Malaxis muscifera*
Dosha	Vata-Pitta Pacifying
Vipaka	Madhura
Virya	Sheeta
Rasa	Madhura
Guna	Picchala, Snigdha

Organoleptic Evaluation: The quickest and easiest way to determine a drug's identification and purity is through organoleptic evaluation, which is carried out by sense organs.

Size, colour, taste, smell, and other organoleptic traits are evaluated. These characteristics of the *C. acuminatum* sample's pseudo bulb powder were noted. **Table 1** presents the results in detail [18, 19].

TABLE 2: ORGANOLEPTIC EVALUATION OF PSEUDO BULBS OF *MALAXIS ACUMINATA*

S. no.	Parameter	Observations
1	Colour	Green(fresh) and brown (dry form)
2	Shape	Conical taste
3	Taste	Slightly bitter and astringent in
4	Surface	Fleshy, smooth and shining, covered with membranous sheath
5	Size	3-9 cm long and 1-3cm in diameter
6	Odour	Odourless

TABLE 3: QUALITATIVE MORPHOLOGICAL FEATURES OF MALAXIS ACUMINATE

Parameter/plant part	Feature
Habit	Erect, perennial
Leaf	Simple, ovate-lanceolate, margins undulate, narrowed to sheathing base, petiolate, acute to acuminate
Root	Adventitious arising from base of rhizome (fibrous)
Stem	Bracteates, zygomorphic, bisexual, complete, epigynous, greenish yellow tinged with purple spot
Flower	Inflorescence racemose, peduncle ribbed
Bract	lanceolate, sub-acute, reflexed
Inflorescence	Erect, modified in to rhizome like structure
Fruit	Capsule
Corolla	Petals 3, lip slightly convex, base with auricles, petals linear, narrowly ovate-sagittate, obtuse, marginsre curved
Calyx	Dorsal sepal linear-oblong, sub-acute, Sepals3, lateral sepals oblong, obtuse
Rhizome	Elongated and tapering
Pseudobulb	Globular to conical
Seed	Microscopic, powdery

FIG. 1: PLANT OF JIVAK (*MALAXIS ACUMINATA*)

Phytochemicals: Its active principle is pseudobulbs, which include alkaloids, flavonoids, glycosides, and β- sitosterol, are the primary ingredient. includes piperitone along with limonene, p-cymene, 1, 8- cineole, citroenellal, eugenol, glucose, rhamnose, coline, limonene, and cerylalcohol.

Alkaloids, glycosides, flavonoids, β-Sitosterol, piperitone, O-Methylbatatasin, 1,8-cineole, carbohydrates like glucose and rhamnose, and different alcohols including ceryl alcohol and eugenol are all known to be present in dried pseudo bulbs of Jeevaka [20, 21].

Qualitative Phytochemical Screening: In order to identify the presence of different phyto-constituents such as glycosides, tannins, phytosterols, proteins, amino acids, carbohydrates, flavonoids, phenolic compounds, oils and fats, and saponins, a plant extract of the entire plant was put through a series of qualitative chemical tests as part of the initial phytochemical screening process.

Various Quantitative analysis of phytochemicals can be done such as, Estimation of total phenolic compounds, GC-MS Analysis of volatile components, Alkaloid determination, Estimation of total flavonoids and Estimation of Total carbohydrate [22, 23].

The molecule is a long-chain hydrocarbon, with a double bond at position C13 and a single carboxyl group joined at one end. The molecule is 2.42 nm long and has a polar "COOH" group at the end of a lipophilic hydrocarbon chain, making it a useful amphiphile for nanotechnology and nanoscience, according to the energy minimised structure [24].

TABLE 4: PHYTOCHEMICALS ISOLATED FROM *MALAXIS ACUMINATA*

Class	Phytochemical	Source
Alkaloids	Shihunidine	*Dendrobium lodigesii*
	Cremastrine	*Cremastra appendiculata*
	Dendrobine	*Dendrobium nobile*
	Cephalandole	*Cephalanceropsis gracillis*
Bibenzyl derivatives	Alkyl ferulates	*Dendrobium moniliforme*
	Pholidotol A&B	*Pholidota chinesis*
	Cumulatin, Densifloral A	*Bulbophyllum kwangtungense*
	Gigantol	*Cymbidium goeringii, Epidendrum rigidum, Scaphyglottis livida*
	Aloifol	*Nidema boothii*
Flavonoids	Homoisoflavanone	*Cremastra appendiculata*
	Chrysin	*Crpripedium macranthos*
	Quercetin	*Dendrobium tosaense*
	Derivative of Quercetin	*Anoectochilus roxburghii*
Phenanthrenes	Moscatin	*Dendrobium loddigesii*
	Coeloginanthridin	*Coelogyne cristata*
	Fimbriol A	*Maxillaria densa*
Terpenoids	Dendroside A	*Dendrobium nobile*
	Dendromoniliside A&B	*Dendrobium monilif*

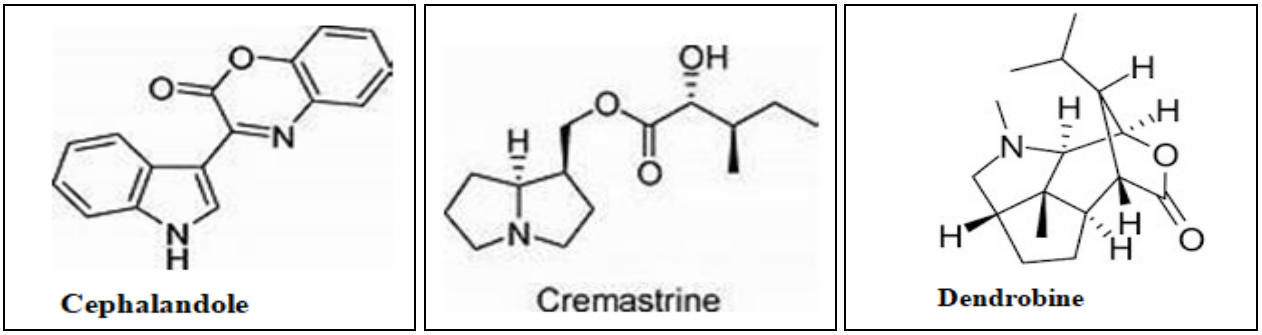

FIG. 2: ALKALOIDS ISOLATED FROM *MALAXIS ACUMINATA*

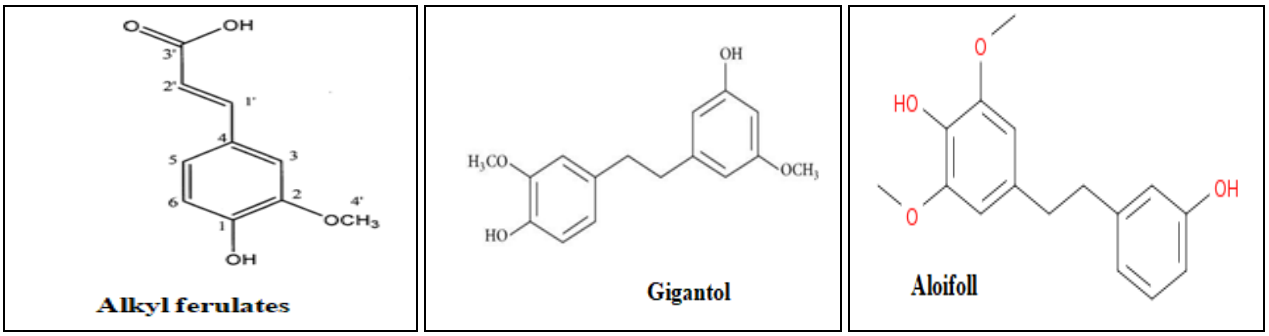

FIG. 3: BIBENZYL DERIVATIVES ISOLATED FROM *MALAXIS ACUMINATA*

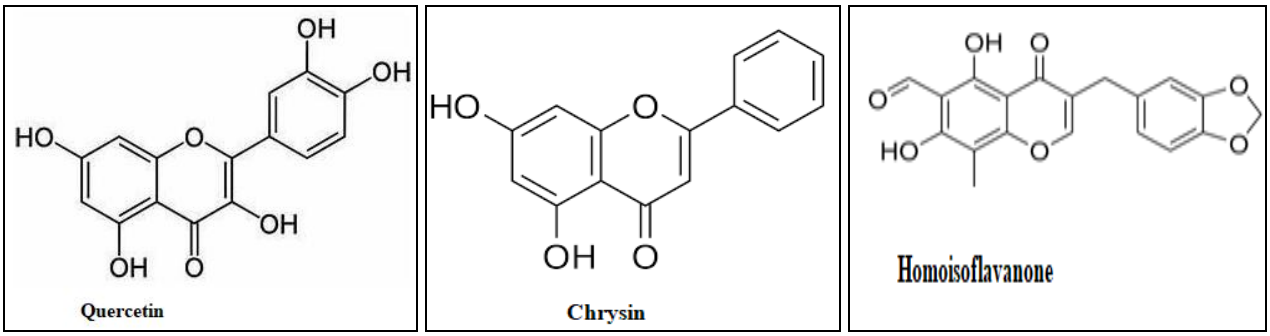

FIG. 4: FLAVONOIDS ISOLATED FROM *MALAXIS ACUMINATA*

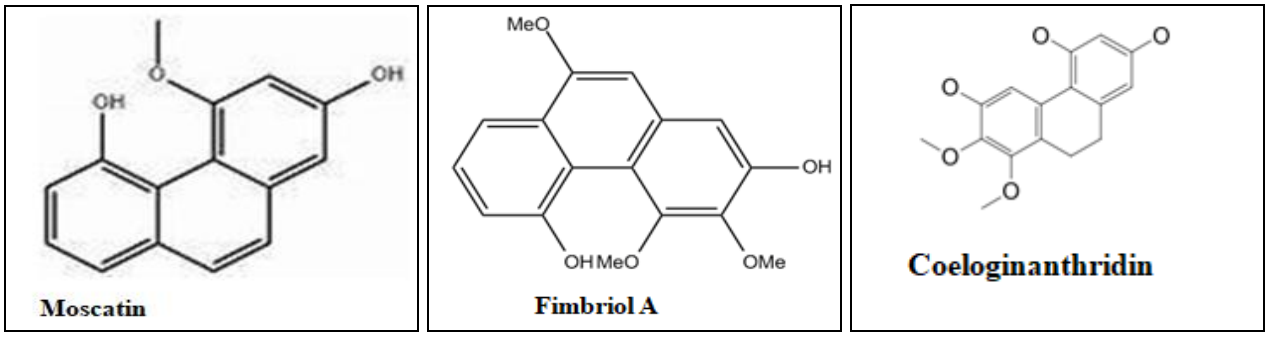

FIG. 5: PHENANTHRENES ISOLATED FROM *MALAXIS ACUMINATA*

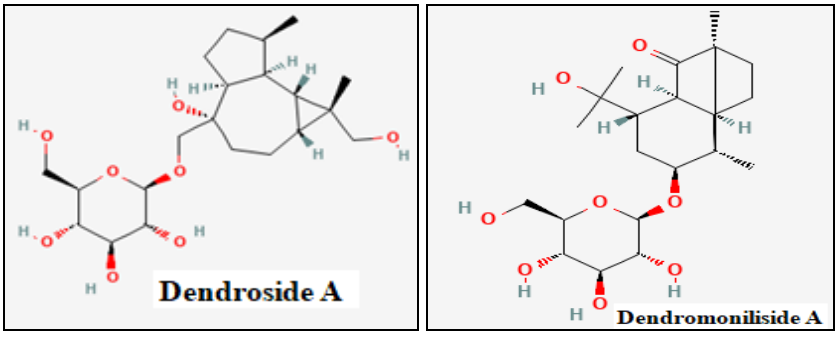

FIG. 6: TERPENOIDS ISOLATED FROM *MALAXIS ACUMINATA*

Pharmacological Activities:

Anti-oxidant Activity: Antioxidant activity measurement using DPPH in plant biochemistry, assays are frequently used to assess how well plant components scavenge free radicals. Using the method outlined in the literature, the alcohol extracts of Jeevak pseudobulb were examined for their ability to scavenge free radicals against DPPH. When DPPH interacts with antioxidants (A-H), 2,2-diphenyl-1-picryl hydrazine is produced. The plant extract's capacity for scavenging is shown by the extent of decolorization. Monitoring the drop in absorbance intensity at 517 nm in the UV-visible spectrum allows one to assess the lowering capacity of antioxidants towards DPPH radicals. Using ascorbic acid as a standard, the antioxidant capabilities of the various tissues were represented as IC_{50} values [25, 26].

Anti-microbial: The examined extracts may have antibacterial activity against *B. subtilis*, *P. aeruginosa*, *S. aureus*, and *E. coli*. When analysed using the disc diffusion method, the extracts from ethanol pseudobulbs, ethyl acetate, and chloroform showed the most encouraging outcomes. Chloroform extract has been found to have the highest ZOI, specifically. *S. aureus* (14.33 mm), *B. subtilis* (15.33 mm), *E. coli*, and aqueous extract have all been found to be most susceptible to 20 mm. The activity of *C. acuminatum's* ethyl acetate pseudo bulb extract against *E. coli* is the highest at 18.66 mm, followed by *B. subtilis* at 13.33 mm, *S. aureus* at 10.33 mm, and *P. aeruginosa* at 8 mm [27].

Anti-inflammatory: The anti-inflammatory effect of *Malaxis acuminata* has been thoroughly explored due to its therapeutic value in traditional systems of medicine like Ayurveda. Extracts of this plant, made using solvents such as water, ethanol, methanol, or chloroform, have shown promising effects in decreasing inflammation through multiple pathways. *Malaxis acuminata's* anti-inflammatory qualities are mostly due to its bioactive components, which include flavonoids, phenolics, terpenoids, and polysaccharides. These substances limit the activity of important inflammatory enzymes, including cyclooxygenase (COX-2) and lipoxygenase (LOX), which generate inflammatory mediators including prostaglandins and leukotrienes, as well as pro-inflammatory cytokines like TNF-α, IL-6, and IL-1β. Furthermore, the plant's strong antioxidant activity lowers oxidative stress, a major contributor to chronic inflammation, and neutralises free radicals [28, 29].

Anti-aging: *Malaxis acuminata* is a vital component of rejuvenation treatments in traditional medicine, especially Ayurveda, which has acknowledged its anti-aging properties. The plant has bioactive substances that improve skin health, prevent oxidative stress on cells, and postpone the onset of ageing. *Malaxis acuminata* extracts made with solvents including water, ethanol, and methanol have potent antioxidant qualities that mitigate the impacts of free radicals, a primary contributor to tissue damage and cellular ageing. Because flavonoids, phenolics, and polysaccharides neutralise reactive oxygen species (ROS) and stop oxidative damage to skin cells and other tissues, they are largely responsible for the anti-aging effects. These substances increase the synthesis of collagen, which increases skin suppleness and minimises wrinkles. Furthermore, the plant's terpenoids contribute to the reduction of chronic low-grade inflammation, a condition that is strongly associated with ageing, by modifying inflammatory pathways. By preventing the action of enzymes such as collagenase and elastase, *Malaxis acuminata* helps maintain the skin's structural integrity and postpones the thinning or sagging that comes with ageing [30, 31].

Anti-proliferation: The ability of *Malaxis acuminata*, a medicinal orchid with therapeutic promise, to block the growth and multiplication of aberrant or malignant cells has drawn more attention in recent years. *Malaxis acuminata's* antiproliferative properties are mostly due to its bioactive components, which include flavonoids, phenolic acids, terpenoids, and polysaccharides. The SRB assay was used to test the ethanol extract and its fractions for antiproliferative activity against four human cancer cell lines, including A549, DU145, DLD1, and MCF-7While acid-soluble fractions were found to be ineffective, the ethanol extract and n-BuOH (MABUOH) fraction shown a considerable antiproliferative efficacy. When compared to normal doxorubicin, the EtOAc fraction (MAETOAC) demonstrated strong antiproliferative activity against cancer cell lines, including A549 (70.29 ± 7.22), DLD1 (73.12 ±

8.58), MCF-7 (79.10 ± 9.62), and DU145 (68.65 ± 8.10) [32, 33].

Anti-bacterial: Because of its bioactive phytochemicals, *Malaxis acuminata*, a medicinal plant belonging to the Orchidaceae family, has been shown to have antibacterial properties. These substances, which include polysaccharides, alkaloids, terpenoids, flavonoids, and phenolic acids, are essential for preventing the growth of bacterial infections. In scientific investigations, extracts of *Malaxis acuminata* made with solvents such as ethanol, methanol, and aqueous solutions have shown strong antibacterial qualities. Bacterial growth is efficiently stopped by terpenoids and alkaloids, which are known to hinder bacterial DNA replication and protein synthesis. By scavenging free radicals and oxidative stress, which encourage bacterial survival, the plant's antioxidant qualities bolster its antibacterial activity [30, 34].

Anti-fungal: *Malaxis acuminata* is a valuable medicinal plant whose anti-fungal activity has drawn attention because of its bioactive components, which effectively limit the growth of pathogenic fungus. *Malaxis acuminata* extracts have shown strong antifungal effects when made with solvents such as methanol, ethanol, chloroform, and aqueous solutions. The phytochemicals found in the plant, such as flavonoids, phenolics, terpenoids, alkaloids, and polysaccharides, are responsible for these actions. There are several ways in which *Malaxis acuminata* exerts its antifungal properties. By specifically targeting ergosterol, a crucial component of fungal cell membranes, the bioactive chemicals damage fungal cell walls and membranes. The integrity of the membrane is compromised by this disruption, which allows intracellular contents to leak out and eventually results in fungal cell death. Inhibiting fungal enzyme activity and interfering with spore germination, phenolic substances and flavonoids also stop fungal growth and reproduction. Furthermore, the antioxidant qualities of the plant counteract oxidative stress, which is important for fungal life [33, 35].

Nutraceutical Properties: The medicinal potential of this plant is enhanced by the abundance of bioactive substances such flavonoids, phenolics, polysaccharides, terpenoids, and alkaloids. *Malaxis acuminata* has long been utilised in Ayurvedic formulations to enhance energy, respiratory health, and digestion, especially in rejuvenation treatments for ageing and convalescence. It is also prized for its adaptogenic properties, which improve mental clarity and assist the body in managing stress.

Recent research indicates that it may have anticancer properties, as evidenced by its capacity to stop tumour growth and cause cancer cells to undergo apoptosis. The plant is an essential component of Ayurvedic tonics that support lifespan and general health, such as Chyawanprash. *Malaxis acuminata* is considered endangered because of overharvesting, despite its enormous potential. To fully realise its nutraceutical benefits and guarantee its long-term use in contemporary healthcare products, sustainable cultivation, standardisation of extraction techniques, and additional pharmacological research are necessary [28, 34, 36].

Traditional Medicinal uses:

- When taken as directed, Jivaniya Ghrita, which is prepared with Jivaka and other herbs, can help treat gout and other long-term conditions linked to Vata.
- When taken in the right dosage, ghrita processed with Devadaru, Kakoli, Jivaka, and other therapeutic herbs can help children who are malnourished.
- A powder made from its pseudo bulb can be taken for seminal weakness, and a decoction made from it can be taken for general debility.
- Consuming its powdered pseudobulb encourages lactation [24].

CONCLUSION: Certain chemicals that have a specific physiological effect on the human body are what give plants their therapeutic value. Numerous phytochemicals have been shown to have a variety of properties that could aid in preventing chronic illnesses. Plants of *Malaxis acuminata* were erect, small, and herbaceous with modified stem consisting of rhizome and pseudobulbs bearing 4-5 leaves/plant. The various traits found in *C. acuminatum* pseudobulbs are the foundation for

determining which plant sample is suitable for use as a medication and for further research. According to the current study, the chosen plant, *Malaxis acuminata*, has a number of bioactive components that make it extremely therapeutic. The various traits found in *C. acuminatum* pseudobulbs are the foundation for determining which plant sample is suitable for use as a medication and for further research. *Malaxis acuminata's* significance in the Ayurvedic medical system is widely known. However, there isn't a lot of information available on this species' phytoconstituents. This review supported the conventional medical system's purported usage of pseudobulbs to treat a range of microbially caused infectious diseases.

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