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Pharmacognostical, Phytochemical and Biological Investigations of *Procris repens*: Exploring the Therapeutic Potential of a Traditional Medicinal Plant

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ABSTRACT

Procris repens, a medicinal plant of significant interest, has been subjected to comprehensive investigations to explore its pharmacognostical, phytochemical, and biological properties. This review synthesizes the findings of various studies on *Procris repens*, highlighting its morphological characteristics, phytochemical composition, and pharmacological activities. The combined analysis elucidates the potential therapeutic applications of *Procris repens* in modern medicine. The findings of this study contribute to the understanding of the medicinal value and pharmacological potential of *Procris repens*, thereby offering insights for further research and development in pharmacognosy and natural product-based drug discovery.

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INTRODUCTION

Procris repens (synonym: *Pellionia repens*) plant is known as the "Trailing Watermelon Begonia" because of its unique trailing growth habit and its leaves resemble the rinds of watermelon[1]. Usually, the leaves have a pattern of light and dark green markings that resemble the distinctive stripes on watermelons. The trailing nature of the plant makes it an excellent choice for ground cover or hanging baskets.

It is a tropical plant that belongs to the family Urticaceae[2]. It is native to Southeast Asia. This plant produces small, inconspicuous flowers. Procris repens (Lour.) B.J. Conn and Hadiah (Urticaceae) is traditionally used in folk medicine for the treatment of skin injuries, nerve-related disorders, and gastrointestinal complaints and respiratory conditions. The whole plant of Procris repens was used to treat icterus, acute and chronic hepatitis, and allergic dermatitis in Chinese medicine[3]. *Procris repens* contains a variety of bioactive compounds including alkaloids, flavonoids, phenolic acids, and terpenoids, which contribute to its medicinal properties. This botanical gem, native to various regions across Europe and Asia, captivates with its delicate appearance and holds both historical significance and contemporary relevance. *Procris repens*, a modest herb gracing diverse ecosystems, embodies the broader significance of studying plant species in our quest for ecological balance. The examination of this botanical marvel extends beyond its individual characteristics, unraveling the interconnected threads that bind plant life to the health and sustainability of entire ecosystems[4].The pictorial representation of *Procris repens* are shown in figure 1.

Figure 1: *Procris repens*

1.1 IMPORTANCE OF FOLKLORE MEDICINAL PLANTS

There are about 1000s of plants which are used in traditional medicinal system to cure many diseases[5].The knowledge of medicinal plants has been accumulated in the course of many centuries based on different medicinal system such as Ayurveda, Unani and Siddha. WHO notes that 74% of plant derived medicines are used in modern medicine in a way that their modern application directly correlates with their traditional use as herbal medicines native cultures[6]. Herbs and spices have been used since antiquity for their flavoring qualities and also for their preservatives and medicinal properties[7].Their extracts have been used to cure various gastric intestinal complaints, cough, bronchitis, laryngitis, tonsilitis and act as carminative and diuretic agents[8].Therefore the demands for these plants are increasing in industrialized and non-industrialized countries which led to increase in their prices[9].

1.2 TAXONOMICAL CLASSIFICATION[10]

Kingdom	:	Plantae
Phylum	:	Tracheophyta
Class	:	Equisetopsida
Subclass	:	Magnoliidae
Order	:	Rosales
Family	:	Urticaceae
Genus	:	Procris
Species	:	Procris repens[11]

1.3 SYNONYMS

- Elatostema repens var. viride
- Pellionia pulchra[12]
- Elatostema daveauanum
- Pellionia daveauana
- Elatostema repens var. pulchrum
- Elatostema gibbosum
- Boehmeria repens
- Pellionia daveauana var. viridis
- Procris gibbosa
- Pellionia repens

1.4 VERNACULAR NAMES[13]

English : Creeping Crosswort
Hindi : Ajmoda
Tamil : Thedi Vellai
Malayalam : Adipulliyaandi
Kannada : Hebbaari
Manipuri : Yenak Dumba
Bengali : Lakuseli[14]

1.5 CLASSIFICATIONS AND CHARACTERISTICS

Plant Division ; Angiosperms (Flowering Seed Plants) (Dicotyledon)
Plant Growth Form : Herbaceous Plant, Creeper[15]
Lifespan (in Singapore) : Perennial
Mode of Nutrition : Autotrophic
Plant Shape : Irregular
Maximum Height : 0.2 m
Maximum Plant Spread / Crown Width: 0.6 m

1.6 BIOGEOGRAPHY

Native Distribution : Bhutan[16], India, Southern China, Indochina, Philippines, Malaysia, Singapore, Indonesia
Native Habitat : Terrestrial (Primary Rainforest)[17]
Preferred Climate Zone : Tropical, Sub-Tropical / Monsoonal[18]

1.7 HABITAT

Procris repens is a versatile plant species that can thrive in various habitats[19]. Its natural habitat includes:

- Meadows: *Procris repens* are often found in open grassy areas, meadows, and pastures[20].
- Woodlands: It can also occur in woodland edges, clearings, and along forest paths[21].
- Hedgerows: *Procris repens* may be found growing along hedgerows, fences and roadside verges[22].

- Rocky slopes: It can colonize rocky slopes, gravelly areas and disturbed habitats[23].

- Wetlands: In some regions, *Procris repens* may occur in wetland habitats such as marshes, bogs, and stream banks[24].

- Coastal areas: It can tolerate coastal conditions and may be found in dunes, salt marshes, and sandy beaches[25].

- It prefers well-drained, sandy or gravelly soils and can tolerate a wide range of environmental conditions. It is often considered a weed in agricultural settings but can also be cultivated as a ground cover in gardens[26].

1.8 DISTRIBUTION

It is native to Europe and has been introduced to Asia, North America, Africa, Australia and New Zealand[27].

1.9 BOTANICAL DESCRIPTIONS

It is a small herbaceous creeper, with prostrate ground-hugging habit, up to 15 cm tall, spreading or trailing up to 60 cm[28].*Procris repens* exhibits a low-growing and trailing growth habit. Its stems sprawl along the ground, creating a prostrate and spreading form. This growth pattern allows the plant to form dense mats of vegetation, contributing to its ecological role in stabilizing soil and providing ground cover[29].The stems are slender, wiry, and prostrate, rooting at the nodes[30].They can reach lengths up to 30 cm. It has alternate, fleshy leaves have toothed or wavy leaf blades that are elliptic to oblong, and sometimes broadly egg-shaped, asymmetrically cordate based, and 2.5-10 by 2-5 cm. *Procris repens* produces white or pink tiny flowers with a tinge of silver, and arranged in branched clusters and is unisexual,monoecious[31].It has staminate inflorescences 6-30 mm across and pistillate inflorescences 3mm across[32].It has polycarpic flowering habit. The seeds are small and smooth, with a brownish colouration[33].It possesses fibrous root system that aids in nutrient and water absorption[34].

2.TRADITIONAL USES

It is used by Malays for poulticing boils, swollen areas, and the abdomen when it is painful[35].A decoction from the plant is used for rheumatism. *Procris repens* (Lour.) B. J. Conn and Hadiah(Urticaceae)is traditionally used in folk medicine for the treatment of skin

injuries and respiratory conditions. Whole plant of *Procris repens* was used to treat icterus, acute and chronic hepatitis, and allergic dermatitis in Chinese medicine[36].

3. PHARMACOGNOSTICAL STUDY OF *Procris repens*

3.1 (a) Organoleptic Characteristic

The organoleptic characters such as colour, odor and taste of the leaf was recorded. The pictorial representation of mature leaves *Procris repens* are shown in figure 2.

Table 1: Organoleptic characters of leaf of *Procris repens* leaf

Sl No	Organoleptic character	Dried powder of mature leaf
1.	Colour	Gray-green to dark green
2.	Odour	Aromatic
3.	Taste	Bitter and Astringent
4.	Fracture	Brittle

Figure 2: Leaves of *Procris repens*

3.2 (b) Macroscopic Characteristics

Table No.2: Macroscopic characters of the leaf of Procris repens

Sl No.	**Macroscopic character**	**Dried powder of mature leaf**
1.	Part	Leaf
2.	Taste	Bitter and Astringent
3.	Size	2-8 cm × 1-4 cm in size
4.	Shape	Elliptic to oblong apex acute
5.	Surface	Surface is smooth,glabrous,glossy or slightly waxy texture,base asymmetrically-cordate, venation pinnate.

3.3 (c) Microscopic Characteristics

Free hand section of leaf was taken and stained by the reagent safranin to confirm its lignification[37]. Powder microscopy was also carried out and their specific diagnostic characters were recorded. Microscopic examination of *Procris repens* further elucidated its anatomical characteristics[38].

- **STEM ANATOMY:**

Cross-sections of the stem revealed a typical herbaceous structure, with epidermal layers, cortex, collenchyma, and vascular bundles arranged in a circular pattern. The epidermal cells are thin-walled, with stomata present on the lower surface of the leaves. Trichomes are sparse and primarily consist of unicellular, glandular hairs[39].

- **LEAF MORPHOLOGY:**

Leaf anatomy of *Procris repens* shows elliptical to oblong shapes, with crenate margins and prominent veins[40].The epidermal cells of the leaf are arranged in regular pattern, and glandular trichomes present on the leaf surface[41].

- **POWDER MICROSCOPY**:

Examination of the powdered plant material exhibited fragments of epidermal cells, parenchyma cells, glandular trichomes, and vascular elements[42].

➢ Epidermal cells: These cells have thin walls[43].

➢ Parenchyma cells: These cells often appear as irregularly shaped fragments with thin walls.

➢ Glandular trichomes: Elongated structures with a bulbous glandular head.

➢ Vascular elements: Fragments of vascular tissue, including xylem and phloem present in the powder.

➢ Calcium oxalate crystals: In the form of raphides or druses are observed under microscopy, further aiding in the identification process[44].

These microscopic features collectively contribute to the accurate identification and authentication of *Procris repens* and serve as valuable tools for pharmacognostical analysis.
The pictorial representation of the powder of *Procris repens* shown in figure 3.

Table No. 3: Powder Microscopic Characters of *Procris repens*

Sl No	Organoleptic Character	Powder of *Procris repens*
1.	Part	Leaf
2.	Colour	Brown
3.	Odour	Aromatic
4.	Taste	Bitter and Astringent
5.	Touch	Fine

4. PHYTOCHEMICAL ANALYSIS

Procris repens has been subjected to extensive phytochemical analysis to identify its chemical constituents. Soxhlet extraction is employed to isolate phytochemicals from different parts of the plant, including leaves, stems, and roots[45]. Alkaloids, flavonoids, terpenoids, phenolic compounds, glycosides, saponins, tannins, lignans, coumarins and steroids are present in procris repens[46]. From the aqueous ethanolic extract of whole plants of *Pellionia repens (Procris repens)*, pellioniareside (1), along with lupeol (2), uracil (3), (22E,20S,24R)-5α,8α-epidioxyergosta-6,22-dien-3-ß-ol (4), and daucosterol (5) were identified as novel glucoceramides. The relative configurations and structure of pellioniareside were determined to be (2S,3S,4R,6E,8E)-1-O-ß-D-glucopyranosyl-2-[(2R)-2-hydroxytetracosanoylamino]-1,3,4-octadecanetriol-6,8-diene by analysis of spectral data and by chemical evidence[47]. Pellioniareside, a new sphingolipid, may be the active constituent of *Pellionia repens* to treat icterus, acute and chronic hepatitis and allergic dermatitis.

5. PHARMACOLOGICAL ACTIVITIES

1.Wound healing activity:

Carla Marrassini et al;(2018) says that in Chinese medicine *Pellionia repens (Lour.) Merr.(Urticaceae)* is used for the treatment of skin injuries although there is no scientific research carried out regarding it.

2.Inhibition of osteoclastogenesis:

Duong Thu Trang et al; (2021) study carried on the extract of stem of *Pellionia repens* (*Procris repens*) with methanol 1:1 (w/v) for 20 minutes, followed by 15 minutes in an ultra-sonicator and then assay for in vitro differentiation of osteoclasts are carried out and found that Lupeol-one of the chief components of *Pellionia repens* exhibits strong inhibitory effects on osteoclastogenesis.

3. Whole plant of *Procris repens* was used to treat **icterus, acute and chronic hepatitis,and allergic dermatitis** in Chinese medicine.

6. ENVIRONMENTAL TRIGGERS INFLUENCING LIFE CYCLE EVENTS:

The life cycle events of *Procris repens*, like those of many plant species, are influenced by various environmental triggers. These triggers respond to changes in factors such as temperature, light, and moisture, orchestrating the plant's phenological events. Here are the key environmental triggers influencing the life cycle events of *Procris repens*:

1. Temperature:

• Germination: The germination of *Procris repens* seeds is influenced by temperature. Favorable temperatures, typically occurring in early spring, stimulate seed germination.

• Vegetative Growth: Warmer temperatures in late spring and summer promote vigorous vegetative growth. The plant's spreading stems and runners thrive in these conditions.

• Flowering: The onset of flowering is often triggered by specific temperature thresholds. As temperatures rise during the summer months, *Procris repens* produces bright yellow flowers.

• Seed Development: Temperature conditions during the summer play a role in the development of fruit capsules and seeds.

• Dormancy: In regions with cold winters, decreasing temperatures in late autumn and winter can trigger dormancy, allowing the plant to conserve energy during unfavorable conditions[48].

2. Day Length (Photoperiod):

• Flowering: Photoperiod, or the duration of daylight, can influence the timing of flowering in *Procris repens*. Longer days during the summer months may contribute to the initiation of flowering.

3. Moisture:

• Germination: Adequate soil moisture is crucial for the germination of *Procris repens* seeds. Increased moisture availability in early spring supports successful seed germination.

• Vegetative Growth: *Procris repens* thrives in habitats with moderate moisture levels, and moisture availability contributes to the plant's vegetative growth during the growing season.

• Seed Dispersal: Moisture, especially in late summer or early autumn, can trigger the release of seeds from fruit capsules. Rainfall or humidity may facilitate seed dispersal mechanisms.

4. Disturbance:

• Colonization of Disturbed Areas: *Procris repens* often colonizes disturbed areas, such as roadsides or abandoned fields. Human-induced disturbances, such as land clearing or construction, can trigger the establishment of *Procris repens* in these habitats.

5. Seasonal Changes:

• Senescence: Seasonal changes, including decreasing temperatures and shorter day lengths in autumn, may trigger senescence, leading to the aging and deterioration of above-ground plant parts.

Understanding these environmental triggers provides insights into the ecological adaptability of *Procris repens* and its ability to respond to specific cues for various life cycle events. These triggers contribute to the plant's success in colonizing diverse habitats and persisting in fluctuating environmental conditions.

7. THE SIGNIFICANCE OF *PROCRIS REPENS* IN BIODIVERSITY: NURTURING ECOSYSTEM DIVERSITY

Procris repens, a modest herb with an unassuming presence, contributes significantly to the intricate tapestry of biodiversity[49]. Understanding the significance of this botanical species in the realm of biodiversity unveils its role as a vital thread, weaving through ecosystems and enriching the overall fabric of life.

1. Species Diversity: *Procris repens*, like all plant species, adds to the mosaic of species diversity within its native habitats. Its unique morphological features, growth habits, and ecological adaptations contribute to the rich array of life forms coexisting in its environment. This species diversity is fundamental to the health and resilience of ecosystems, enhancing their capacity to respond to environmental changes.

2. Habitat Complexity: The growth patterns of *Procris repens*, with its trailing stems and ground-hugging habit, introduce a layer of complexity to its habitat. This complexity creates diverse microhabitats, offering shelter and foraging opportunities for various organisms. In doing so, *Procris repens* fosters habitat heterogeneity, a key driver of biodiversity as it accommodates species with different ecological requirements[50].

3. Food Source for Herbivores: The leaves and stems of *Procris repens* serve as a valuable food source for herbivores within its ecosystem. In contributing to the dietary options for herbivores, the plant becomes an integral part of local food webs. This herbivore-plant interaction further amplifies biodiversity by supporting populations of insects, small mammals, and other herbivorous organisms.

4. Pollinator Attraction: *Procris repens*, adorned with its bright yellow, star-shaped flowers, acts as a beacon for pollinators. Bees, butterflies, and other insects are drawn to these blooms, engaging in pollination activities. This pollinator-plant interaction is a crucial component of biodiversity, facilitating the reproduction of not only *Procris repens* but also various other flowering plants within the ecosystem.

5. Soil Stabilization and Erosion Prevention: The low-growing and spreading nature of *Procris repens* contributes to soil stabilization. Its root system helps bind the soil, preventing erosion in areas where it thrives. This soil-stabilizing function creates conditions conducive to the establishment of other plant species and provides a foundation for a diverse plant community.

6. Ecological Resilience: Biodiversity, as shaped by the presence of species like *Procris repens*, enhances the resilience of ecosystems. The variety of interactions, dependencies, and roles that this species fulfills contributes to the adaptability of the ecosystem to environmental changes. In the face of disturbances, biodiverse ecosystems, supported by plants like *Procris repens*, are better equipped to recover and maintain ecological balance[51].

7. Conservation and Genetic Diversity: The presence of *Procris repens* in its native habitat contributes to the conservation of genetic diversity within the plant kingdom. Different populations of *Procris repens* may exhibit variations in their genetic makeup, and conserving these populations helps safeguard the overall genetic diversity of the species. This genetic reservoir is crucial for the adaptability and long-term survival of the species in the face of changing environmental conditions.

The significance of *Procris repens* in biodiversity lies in its multifaceted contributions to the ecological dynamics of its native habitats[52]. As a component of diverse ecosystems, this unassuming herb plays a pivotal role in shaping the richness, complexity, and resilience of the natural world[53]. Recognizing and appreciating its role underscores the interconnectedness of all living organisms and emphasizes the importance of preserving biodiversity for the well-being of the planet.

CONCLUSION

Procris repens (Lour.) B.J.Conn and Hadiah belonging to the family *Urticaceae*, commonly called as ‘Trailing watermelon begonia’ and or ‘Wavy watermelon begonia’. This review gives information about the taxonomy, habit and habitat, morphological characters, chemical constituents, traditional uses, and phytochemical and pharmacological properties of *Procris repens.*The plant has immense medicinal values.It is used by Malays for poulticing boils, swollen areas,and the abdomen when it is painful.A decoction from the plant is used for rheumatism.It is traditionally used in folk medicine for the treatment of skin injuries and respiratory conditions. Whole plant of *Procris repens* was used to treat icterus, acute and chronic hepatitis,and allergic dermatitis in Chinese medicine. This review will act as an eye opener of potential of the *Procris repens* and encourage on further research on the phytoconstituents and other unexplored medicinal values.

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