

Supplementary Data

Review

Phytochemistry, medicinal properties, bioactive compounds and therapeutic potential of the genus *Eremophila* (Scrophulariaceae)

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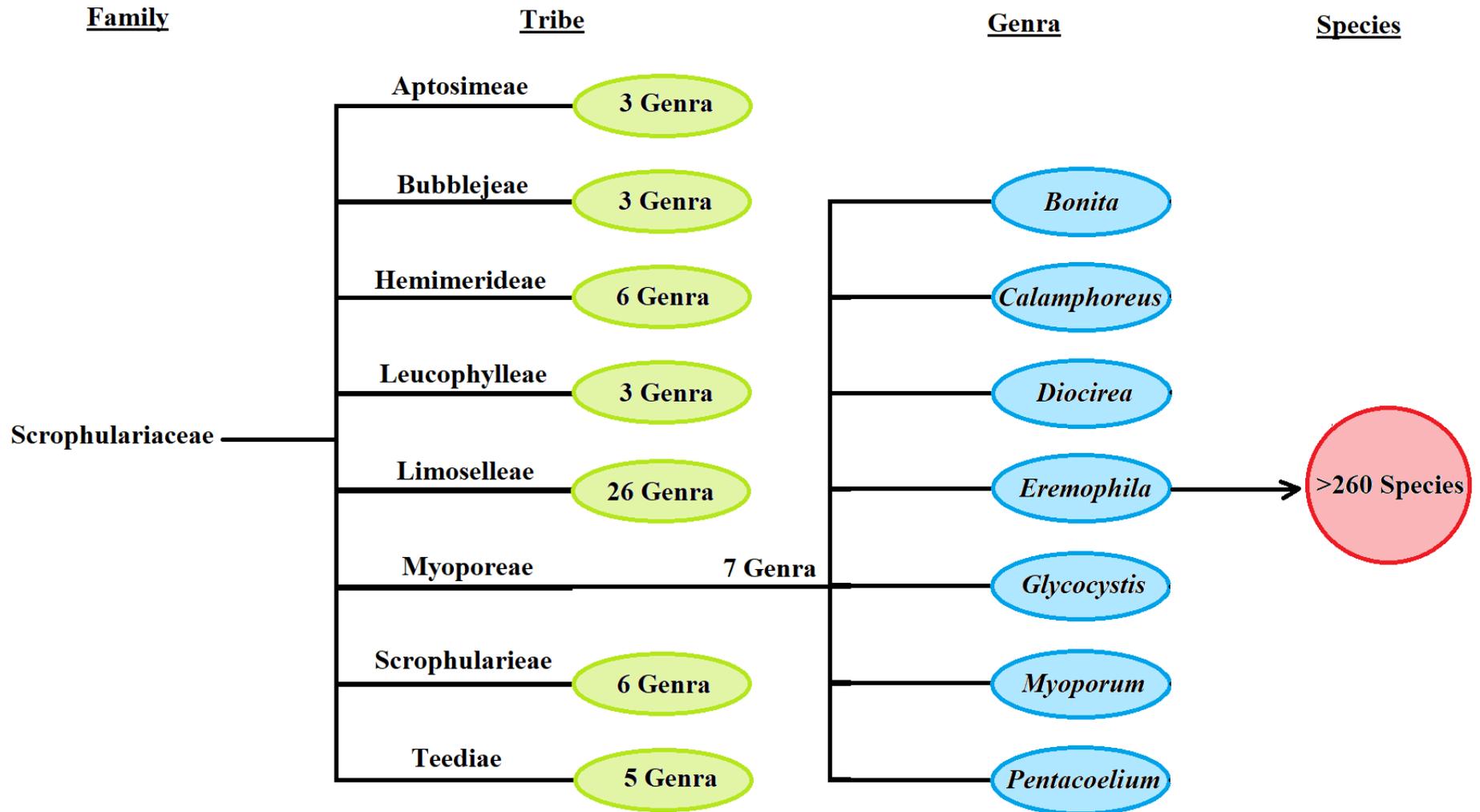


Figure S1. Classification of the genus *Eremophila* within the family Scrophulariaceae.

Table S1. The use of *Eremophila* spp. in traditional healing systems, including the indication, plant part used and how the medicine was traditionally prepared.

| Species | Common/traditional name | Indication | Part used | Preparation method | References |
|---|---|--|------------------|---|------------|
| <i>Eremophila alternifolia</i> R.Br. | Narrow-leaf fuchsia bush, emu bush, scented emu bush, round-leaf poverty bush, magenta emu bush, native honey suckles (English), Irmangka (Pitijantjatjara) | Sleeping aid and general well-being (tonic) | Leaves | Infusion, ingested | 1,2 |
| | | Colds, influenza, coughs, headaches | | Decoction, ingested | 3 |
| | | Internal pain, analgesic, expectorant and decongestant | | A paste is prepared by kneading of dry leaves with water. External application. | 4,5,6,7 |
| | | Septic wounds | | | 8 |
| | | Septic wounds | | Body wash | 3 |
| <i>Eremophila bignoniiflora</i> F.Muell. | River angee, creek wilga, emu bush (English), Gooramurra, Kurubimi (Mudburra and Djingulu) | Laxative | Leaves | Decoction, ingested | 6,8 |
| | | Purgative to treat extreme illness | Fruit | Decoction, ingested | 8 |
| | | Cold and flu | Young leaves | Aqueous decoction is applied to the body. | 4,5 |
| | | Headaches, colds, sinusitis, nasal congestion | Leaves and twigs | Preparation not specified. Applied by wrapping around the head. | 4,5 |
| <i>Eremophila dalyana</i> F.Muell. | Unknown | Relief of chest pains and colds. | Leaves | Combined with animal fat to produce a body rub, which is applied directly. | 9 |
| | | Body wash for scabies. | | Decoction is prepared and used as a body wash. | 10 |

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|-------------------------------|-------------------|--|---|--------|--|-----------------|
| <i>Eremophila</i> F.Muell. | <i>duttonii</i> | Kangaroo bush, red poverty bush (English), Arreh Indenjlie or Agherre intenthe (Aranda), Muntjunpa (Pitijantjatjara), Munyunpa (Yankunytjatjara) | Sores, cuts, colds, influenza, eye and ear complaints, minor dermal wounds, and infected lesions. Has insect repellent properties (especially for scabies mites). | Leaves | Antiseptic wash | 1,3 |
| | | | Sore throats and other respiratory tract infections. | Leaves | Decoction is ingested. | 4,5 |
| <i>Eremophila</i> F.Muell. | <i>elderi</i> | Unknown | Colds and respiratory illnesses. | Leaves | A decoction is prepared and applied externally. | 10 |
| <i>Eremophila</i> F.Muell. | <i>fraseri</i> | Turpentine bush, turpentine plant, wax bush (English), | Alleviate cold symptoms. | Leaves | Decoction. Application unspecified. | 11 |
| | | | Relief of toothache and rheumatism. | | Unspecified. | 4,5 |
| <i>Eremophila</i> F.Muell. | <i>freelingii</i> | Limestone fuchsia, rock fuchsia bush (English), Ruatta, Arrethe (Aranda), Aratja (Pitjantjatjara and Yankunytjatjara), Miyinyapa (Warlpiri) | Headaches, fever, and chest pain. | Leaves | Inhalation of steam from a hot bath containing leaves. | 4,5,12 |
| | | | Antiseptic wash for open sores, scabies, and infected cuts. | | Bath made from decoction. | 4,5,3 |
| | | | Colds and cough. | | Infusion is ingested. | 13 |
| | | | To treat diarrhea | | Decoction, ingested. | 4,5,14 |
| | | | Used as a pillow to promote rest and for sick head. | | Used externally. | 4,5,15 |
| | | | General well-being. | | Infusion is consumed. | 9 |
| | | | Perforation of nasal septum. | | Twig | External usage. |
| <i>Eremophila</i> F.Muell. | <i>gilesii</i> | Unknown | Headaches and chest pain. | Leaves | Decoction, application unspecified. | 12 |
| | | | Antibacterial agent to treat sores. | | Body wash | 5,17 |
| | | | Colds | | Infusion is consumed | 9 |
| | | | Calmativ, promotes rest. | | Pillow | 9 |
| | | | Calmativ, promotes rest. | | Infusion is consumed. | 9 |

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|--|---|---|--------|--|----------|
| <i>Eremophila goodwinii</i> F.Muell. | Unknown | Purgative | Leaves | Decoction is ingested. | 9 |
| <i>Eremophila latrobei</i> F.Muell. | Crimson turkey bush, native fuchsia, Latrobe's emu bush, grey fuchsia, warty fuchsia, Georgina poison bush (English), Mintjingka and Ngarankuta (Yankunyjatjara and Pitjantjatjara), Miyinyapa (Warlpiri) | Body wash for scabies. | Leaves | Decoction, applied topically. | 12 |
| | | Smoke is inhaled to treat general illness | | Burned and inhaled. | 15,18,19 |
| | | Colds and antibacterial agent for sore throat | | Decoction is ingested. | 3 |
| | | Malaise, colds and influenza | | Decoction, applied topically. | 3 |
| <i>Eremophila longifolia</i> (R.Br.) F.Muell. | Berrigan, emu bush, dogwood, weeping emu bush (English), Otenerrenge (Aranda), Tulypurpa (Pitjantjatjara, Yankunyjatjara), Julpur (Pitjantjatjara) | Antiseptic for minor wounds, dermatological lesions, skin/body wash | Leaves | Decoction, applied topically. | 1,20 |
| | | To enhance wellness of mothers and newborn babies. | | Infusion. Application was not specified. | 6,21,22 |
| | | Eye wash and antiseptic for ophtalmic complaints . | | Decoction is used as an eyewash. | 1,10 |
| | | Colds | | Infusion is ingested. | 23 |
| | | To relieve dermal irritation. | | Decoction is applied topically. | 23 |
| <i>Eremophila lucida</i> Chinnock | Unknown | General wellness | Leaves | Not specified. | 24 |
| <i>Eremophila maculata</i> (Ker Gawl.) F.Muell. | Fuchsia bush, spotted emu bush, native fuchsia, wild fuchsia, spotted fuchsia, (English), Wedgerra (local dialect in the Hungerford district beyond the Darling River), Tchuldani (local dialect in the Cooper's Creek region near Lake Eyre) | To treat colds | Leaves | Poultice, preparation was not specified. | 4,5,25 |

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|---|---|--|------------------|---|--------|
| <i>Eremophila mitchellii</i> Benth. | Unknown | Used to treat respiratory conditions. | Twigs | Burned and the smoked is inhaled. | 16 |
| | | | Wood | Burned and the smoked is inhaled. | 26 |
| <i>Eremophila neglecta</i> J.M.Black | Unknown | General well-being. | Leaves | Infusion is ingested. | 9 |
| <i>Eremophila paisley</i> F.Muell. | Unknown | Used as a body wash to treat scabies. | Leaves and twigs | Infusion is used as body wash. | 9,1,27 |
| | | | Branches | Preparation not specified. Applied topically. | 20 |
| | | | Whole shrub | Burnt ashes are rubbed onto the affected area. | 8 |
| | | | | Preparation and application were not specified. | 3 |
| | | | | Decoction is used topically. | 3 |
| | | | | Hot bath containing leaves (infusion). | 4,5,14 |
| | | | | Preparation and application were not specified. | 4,5,1 |
| <i>Eremophila sturtii</i> R.Br. | Turpentine bush, narrow-leaved emu bush, small sandalwood, scented sandalwood, turpentine emu bush, budda bush/ buddha bush (English), Lpurta lpurta (Aranda), Watara (Yankunytjatjara) | Backaches Fly repellent. Wash for sores and cuts. Colds, flu, and sore eyes. Cough and respiratory infections. Used to treat diarrhoea. | Leaves | Decoction is ingested. | 14 |
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Table S2. *Eremophila* spp. that have been screened for therapeutic properties.

| Species | Indication | Part used | Test method and/or results | References |
|-------------------------|----------------------------------|--------------------|--|------------|
| <i>E. alternifolia</i> | Inhibition of bacterial growth | Leaf extract | Inhibited <i>B. cereus</i> , <i>S. aureus</i> and <i>S. pyogenes</i> growth. MIC values were not reported. | 28 |
| | Antimicrobial activity | Leaf extract | <i>Staphylococcus aureus</i> (antibiotic sensitive and MRSA strains). MIC values were not reported. | 29 |
| | Inhibition of bacterial growth | Leaf extract | Inhibits <i>Listeria monocytogenes</i> growth in full cream milk, skim milk, salami, pâté and cheese. | 30 |
| | Antifungal activity | Leaf extract | <i>Cryptococcus gattii</i> and <i>Cryptococcus neoformans</i> : compound 8,19-dihydroxyserrulat-14-ene inhibited <i>C. albicans</i> , <i>C. krusei</i> and <i>C. glabrata</i> growth, with MIC values between 8 and 512 µg/mL. | 31 |
| | Antibacterial activity | Leaf extract | Inhibit macromolecular biosynthetic pathways and compromise cell membrane integrity of Gram-positive bacteria. | 31 |
| <i>E. bignoniiflora</i> | Antibacterial activity | Leaf essential oil | The essential oil displayed noteworthy antibacterial activity against a panel of bacteria including <i>Staphylococcus epidermidis</i> , <i>K. aerogenes</i> , <i>P. aeruginosa</i> in agar diffusion assays. MIC values were not determined. | 32 |
| | Antifungal activity and ringworm | Leaf essential oil | Weak inhibitory activity against ringworm-causing <i>Trichophyton</i> spp. MIC values were not determined. | 32 |
| | Anti-candidiasis activity | Leaf essential oil | Inhibitory activity against <i>C. albicans</i> , although MIC values were not determined. | 32 |
| | Anti-diabetic activity | Leaf extract | Protein tyrosine phosphatase 1B (PTP1B) inhibitory activity (IC ₅₀ = 23.9 µg/mL). (5H)-Furanone sesquiterpenoids exhibited moderate PTP1B inhibitory activity (IC ₅₀ values between 41.4 and 154.5 µM). | 33 |
| <i>E. duttonii</i> | Inhibition of bacterial growth | Leaf extract | Inhibits <i>Listeria monocytogenes</i> growth in full cream milk, skim milk, salami, pâté and cheese. | 30 |

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|----------------------|--------------------------------|--|--|----|
| | Inhibition of bacterial growth | Leaf extract | Weak to moderate inhibition of <i>B. cereus</i> , <i>E. faecalis</i> , <i>S. aureus</i> and <i>S. pyogenes</i> in agar diffusion assays. MIC values were not determined. | 28 |
| | Antibacterial activity | Leaf extract | Noteworthy inhibition of <i>Clostridium perfringens</i> , <i>Clostridium sporogenes</i> and <i>Listeria monocytogenes</i> in a agar diffusion assay, with zones of inhibition 12-15 mm. MIC values were not determined. | 34 |
| <i>E. freelingii</i> | Inhibition of bacterial growth | Leaf extract | Weak to moderate inhibition of <i>B. cereus</i> in agar diffusion assays. MIC values were not determined. | 28 |
| <i>E. latrobei</i> | Inhibition of bacterial growth | Leaf extract | Weak to moderate inhibition of <i>B. cereus</i> in agar diffusion assays. MIC values were not determined. | 28 |
| | Antiviral activity | Leaf extract | Interferes with a step in the replication cycle of Ross River virus, but was ineffective against poliovirus and human cytomegalovirus. | 35 |
| <i>E. longifolia</i> | Antibacterial activity | Leaf essential oil | Inhibitory activity against <i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , <i>Salmonella typhimium</i> , <i>Klebsiella aerogenes</i> , <i>Eschirechia coli</i> , <i>Streptococcus pneumonia</i> and <i>Bacillus cereus</i> , with MIC values of generally below 2% of the oil. | 36 |
| | Cardiac activities | Leaf extract | Verbascoside and geniposidic acid isolated from the extract inhibited negative chronotropism, negative inotropism, and coronary perfusion rates. IC ₅₀ values were not reported. | 37 |
| <i>E. lucida</i> | Anti-candiadiasis activity | Leaf essential oil | Inhibitory activity against <i>C. albicans</i> , with MIC values of approximately 0.1-2% of the oil. | 36 |
| <i>E. maculata</i> | Antibacterial activity | Leaves and resin | The sesquiterpenoid farnesal was identified and tested for antibacterial activity, with noteworthy inhibition of several <i>Staphylococcus</i> and <i>Streptococcus</i> species (MICs = 65 µg/mL). | 29 |
| | Antibacterial activity | Essential oil produced from aerial parts | Tested using a broth dilution method. Low to moderate inhibitory activity against multiple <i>Staphylococcus</i> (including several MRSA strains) and <i>Streptococcus species</i> (MICs between 500-4000 µg/mL; MBCs 1000-4000 µg/mL). | 38 |

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|--|--------------------------------|--|--|----|
| <i>E. neglecta</i> | Anti-inflammatory effects | Serrulatane diterpenoids | Significant inhibitory effect on tumor necrosis factor TNF- α and IL-6 from BMDM cells. | 39 |
| | Biofilm removal | isolated from leaf extracts | Significantly inhibited <i>Staphylococcus aureus</i> and <i>Staphylococcus epidermidis</i> biofilm formation. | 39 |
| | Antibacterial activity | Serrulatane diterpenoids isolated from leaf extracts | Significantly inhibited <i>Staphylococcus aureus</i> and <i>Staphylococcus epidermidis</i> biofilm formation (MICs = 3-25 $\mu\text{g/mL}$; MBCs = 6-316 $\mu\text{g/mL}$). | 40 |
| <i>E. sturtii</i> | Anti-inflammatory activity | Serrulatane diterpenoids isolated from fresh leaves | Serrulatic acid inhibited COX-1 and COX-2 by 99% and 97% respectively at 1 mg/mL, but was completely ineffective against 5-LOX. | 41 |
| | Inhibition of bacterial growth | Leaf extract | Weak to moderate inhibition of <i>B. cereus</i> in agar diffusion assays. MIC values were not determined. | 28 |
| | Antimicrobial activity | Fresh leaves | <i>Staphylococcus aureus</i> MIC = 1.0 mg/ml (ethanolic extract), MIC = 0.25 mg/mL (ethyl acetate fraction), MBC = 200 mg/mL; (3,8-dihydroxyserrulatic acid) MBC = 15 mg/mL (serrulatic acid). | 41 |
| <i>Eremophila serrulata</i> (A.Cunn. ex A.DC.) Druce | Antibacterial activity | Leaves | <i>Staphylococcus aureus</i> MICs = 16 to 250 mg/mL (9-methyl-3-(4-methyl-3-pentenyl)-2,3-dihydronaphtho[1,8-bc] pyran-7,8-dione and 8,20-diacetoxyserrulat-14-en-19-oic acid); MBC = 125 mg/mL (8,20-diacetoxyserrulat-14-en-19-oic acid). | 42 |

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