

PA plants – what to look for and what to do about it

AN INFORMATION PACK FOR BEEKEEPERS

April 2021



APICULTURE
NEW ZEALAND



Why this pack?

Pyrrolizidine Alkaloids (PAs) are a naturally occurring toxin produced by some plants, most likely as a defence against herbivores.

As honey is a food source gathered from nature, PAs make their way into honey through bees collecting nectar and pollen from plants that produce PAs. This isn't unique to New Zealand – plants containing PAs are found all over the world – but those plants are prevalent in New Zealand.

Whilst there's no evidence to date that PAs in honey harm humans, in order to provide certainty for our consumers and stability for our export markets, it's important for apiarists to reduce the levels of PA in the honey they produce.

This pack helps to identify the plants and weeds that produce PA levels and offers some practical steps to mitigate risks from PAs. We hope you'll find it useful.



Identifying plant sources of PAs

The main plant sources of PAs in honey are the families *Boraginaceae* (all genera), *Asteraceae* (tribes *Senecioneae* and *Eupatorieae*) and in New Zealand the *Apocynaceae* (genus *Parsonsia*). These families all produce characteristic PA types which can be used to 'fingerprint' the nectar source of the honey.



PA fingerprints in the honey jar

There are over 600 known PAs in nature. Using them all for fingerprinting is not practical, nor is it necessary. Three main types of PAs cover all known PA producing plants in New Zealand and we can use these PA types to tidily categorise the plants, as the table below demonstrates.

PA TYPE	FAMILY	TRIBE/GENUS
RET/SEN	<i>Asteraceae</i>	<i>Senecioneae</i>
INT/LYC	<i>Boraginaceae</i>	All, except <i>Echium</i>
	<i>Asteraceae</i>	<i>Eupatorieae</i>
	<i>Apocynaceae</i>	<i>Parsonsia</i>
ECH	<i>Boraginaceae</i>	<i>Echium</i>

There is detailed information on all these PA types and the common names for plants that are associated with them (whew!), later in this pack, so keep reading.

RET/SEN = Retrorsine/Senecionine type PAs

INT/LYC = Intermidine/Lycopsamine type PAs

ECH = Echimidine type PAs



High risk habitats – avoid these areas for hives

Our research has identified specific habitats attractive to PA plants. Keeping your hives away from these areas might well reduce PA levels in your honey.

For RET /SEN PAs

Forestry blocks felled in past 5 years
Burnt, cleared or barren land
Weed infested pasture



For INT/LYC PAs

Bush margins that contain Parsonsia vines
Wild or commercial sites, and gardens containing borage, comfrey and other *Boraginaceae* and *Eupatorieae*



For ECH PAs

Wild fields and gardens of *Echium* species

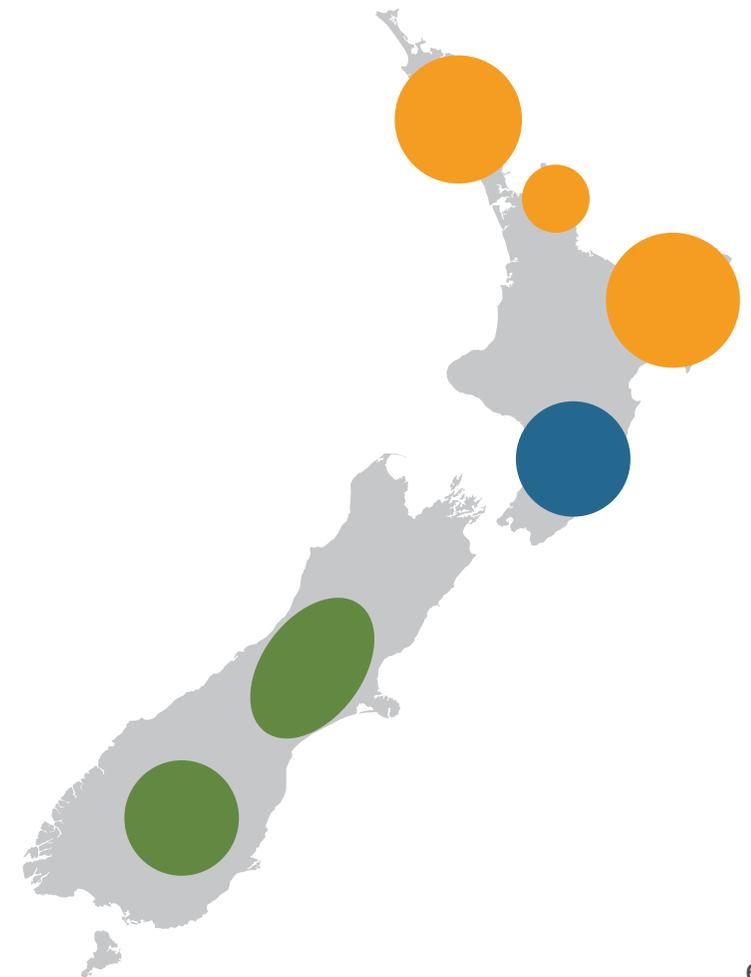


New Zealand geographical PA hotspots

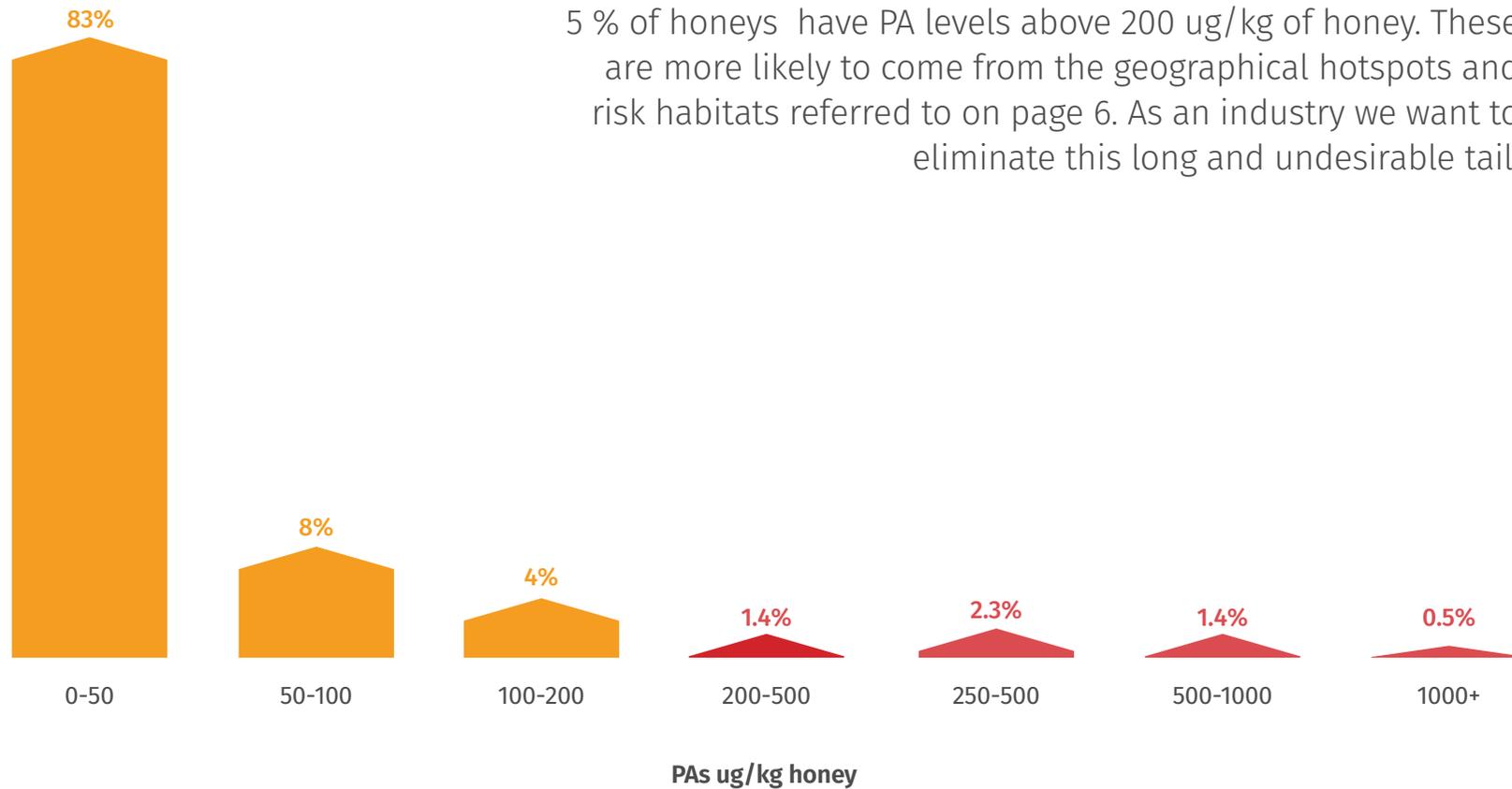
Our research shows that PAs occur in honeys produced throughout New Zealand, particularly INT/LYC PAs, but some regions to date appear to have a higher prevalence in certain PA types.

These areas are:

For RET /SEN PAs	Northland Coromandel Peninsula East Cape through to Wairoa
For INT/LYC PAs	Wairarapa Manawatu
For ECH PAs	South Island high country Central Otago

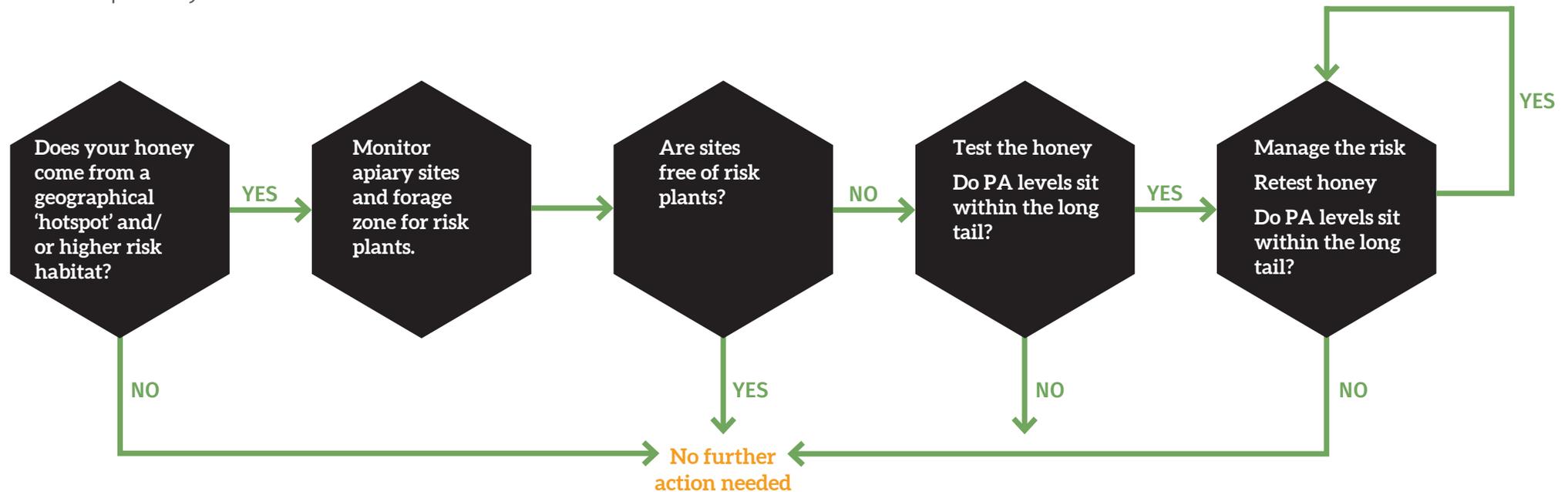


The long tail of high PA honeys



Risk management decision tree

There has to be a flow chart in an information pack – and here it is! Use this to inform your decisions around hive placements, and keep an eye on the environment around them.



It's unlikely that we can eliminate PAs entirely from our supply chain, but bringing levels down as low as possible is the best outcome for ourselves, our consumers and our export markets.

Next, let's take a closer look at the PA types associated with our common plants, how to identify them, where they like to hang out, and when they flower.

Plants relevant to New Zealand with RET/SEN PA types

Family	Genus	Species	Common name	Rural location	Urban location
Asteraceae	Senecio	<i>Senecio bipinnatisectus</i>	Australian fireweed	Yes	Minor
		<i>Senecio skirrhodon</i>	Gravel groundsel	Yes	Minor
		<i>Senecio biserratus</i>	Fireweed	Yes	No
		<i>Jacobaea vulgaris</i>	Ragwort	Yes	No
		<i>Senecio vulgaris</i>	Groundsel	Yes	Yes
		<i>Jacobaea maritima</i>	Dusty Miller	No	Yes
	Erechtites	<i>Erechtites hieracifolius</i>	American fireweed	Yes	No
	Brachyglottis	<i>Brachyglottis repanda</i>	Rangiora	Yes	No
	Roldana	<i>Roldana petasitis</i>	Velvet groundsel	Yes	Yes
	Tussilago	<i>Tussilago farfara</i>	Coltsfoot	Yes	Minor

1. *Senecio bipinnatisectus* (Australian fireweed)

Description

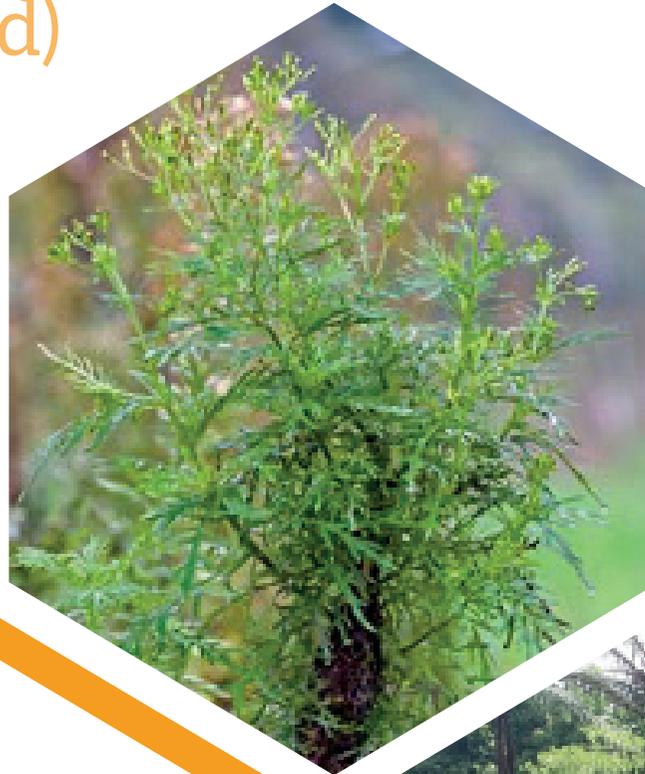
Erect, annual or short-lived perennial herb, up to 2m tall. Stems are usually hairless or with a few fine scattered hairs and bristles. Leaves are feather-like in structure, 5-20cm in length and 2-8cm in width, and usually hairless. Flower discs are greenish yellow, 2mm in diameter and 5-7mm long.

Habitat

Waste places, coastal sites, pasture, forest margins and clearings. Will inhabit any disturbed ground (hence the term fireweed as it frequents land cleared by fire).

Flowering

Dec – Jun, extending to Aug in some regions.



2. *Senecio skirrhodon* (Gravel groundsel)

Description

Annual or short-lived perennial herb, 15-50cm tall. Stems have no hair, are much-branched above and below, and are sometimes leafless and woody toward base. Leaves are 20-60mm in length, 2-10mm in width, tapered with the narrow end attached to the stems. They are fleshy and pale to mid green in colour. Some leaves may be serrated with 2-4 incisions on each side. Flowers are bright yellow with 11-16 petals 7-15mm in length.

Habitat

Coastal sites, waste places, inland mainly as a weed of railway lines, yards and ballast.

Flowering

Year round.



3. *Senecio biserratus* (Fireweed)

Description

Annual to short-lived subsucculent perennial herb up to 1m tall but usually much less. Stems erect and stem bases are sparsely or sometimes moderately coarse-hairy. Mid stem leaves are evenly spaced and sized, 50-150 mm long. Mid stem leaves are dark green to yellow green, elliptic to narrow-elliptic with segments 3-9 per side extending along much of length. Lower stem and upper stem are pale green to purple. All leaves are hairless or sparsely haired. Flowers are pale yellow, 3-6mm in length.

Habitat

Coastal and lowland sites, in early successional habitats.

Flowering

Aug - Jan.



4. *Jacobaea vulgaris* (Common ragwort)

Description

Erect biennial or perennial herb, 30 to 120cm tall. Stems, green in younger plants turning purple as the plant ages, can be covered with dense, fine, long hairs in places. Basal leaves also covered in fine hairs, especially in younger plants. In older plants hairs on the leaves are less frequent, often remaining hairy only on veins of the lower surface. Leaves are segmented/toothed. Flowers are bright yellow with 11-13 petals 5-12mm in length.

Habitat

Mostly waste places and pasture; also riverbeds, swamps and open forest.

Flowering

Nov - Apr, extending to Jul in some regions.



5. *Senecio vulgaris* (Common groundsel)

Description

Erect, annual herb, 10-50cm tall. Stems moderate to densely hairy when young, becoming hairless or sparsely hairy as the plant ages. Similar for the leaves which are toothed and elliptical, 1-10cm in length and 0.5-3cm wide. Flowers are dull yellow, 1.8-2.8mm long.

Habitat

Waste places, cultivated land, gardens, riverbeds and stony sites, from coastal areas to 700m.

Flowering

Jan - Dec.



6. *Jacobaea maritima* (Dusty miller)

Description

Jacobaea maritima is a very white-woolly, heat and drought tolerant evergreen shrub growing to 0.5–1 m tall. The stems are stiff and woody at the base, densely branched, and covered in long, matted grey-white to white hairs. The leaves are feather-like or segmented, 5–15 cm long and 3–7 cm broad, stiff, with oblong and obtuse segments, and like the stems, covered with long, thinly to thickly matted grey-white to white hairs. The flowers are yellow, daisy-like in dense bunches 12–15 mm diameter, with central disc florets surrounded by a ring of 10–13 ray florets.

Habitat

Coastal sites, locally common.

Flowering

Oct - Jan.



7. *Erechtites hieracifolium* (American fireweed)

Description

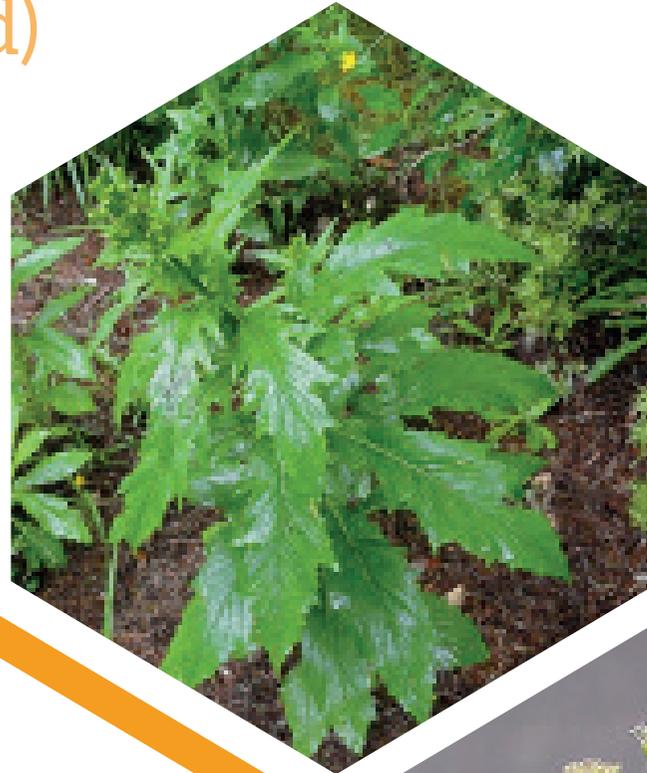
Erechtites hieracifolium is an aggressive, erect, annual weed that grows up to 2 m tall. It is a herbaceous plant with alternate, simple leaves, on thick, green stems. The stems have fine ridges, darker green vertical lines and sparse white hair or they can be hairless. The leaves are serrated and range from unlobed to deeply lobed, with the lobe pattern. There are coarse pointed teeth on the lobes. The blade is mostly ovate to lanceolate with lobes. The flower heads are yellow coloured florets which are followed by a cluster of small, wispy achenes. The plant often branches and grows in a clump with multiple stems.

Habitat

Common in moist sites in the north of the North Island Bay of Plenty, Waikato, Coromandel Peninsula and Auckland. Benefits from fire and is often one of the earliest pioneer species of areas that have recently burned. It can handle gravelly soil and some degree of dry conditions. It also grows well in urban areas and around humans.

Flowering

Jan-April.



8. *Brachyglottis repanda* (Rangiora)

Description

Common large shrub or sometimes small tree with very large (5-15cm) thin mottled leaves with jagged edges and white underneath. New growth covered in tawny or white fuzz. Flowers small, white or cream, clustered into large conspicuous sprays

Habitat

Common in coastal, lowland and lower montane shrubland and open forest. Often a pioneer species.

Flowering

Jul-Nov



9. *Roldana petasitis* (Velvet groundsel)

Description

Erect perennial shrub up to 2m tall. Large round hairy leaves (up to 20 cm). bunches of yellow daisy flowers July-November. Branches hairy.

Habitat

Disturbed, open sites such as forest margins, shrublands, roadsides, quarries and wasteland. It can also be found in private gardens.

Flowering

Jul-Nov



10. *Tussilago farfara* (Coltsfoot)

Description

Perennial mat-forming herb <20cm tall. Large leathery leaves <20cm wide, finely-toothed margins, on long creeping rhizomes. Upper side of leaf green & smooth, underside is greyish-white with woolly hairs.

Habitat

Damp areas: creek beds, stream margins, gravel. Prefers free drainage but will also tolerate heavier soil conditions.

Flowering

Yellow, daisy-like flowers in early spring before leaves start to grow.



Plants relevant to New Zealand with INT/LYC PA types

Family	Genus	Species	Common name	Rural location	Urban location	
Boraginaceae	Borago	<i>Borago officinalis</i>	Blue borage	Commercial cultivation	Yes	
		<i>Symphytum sp</i>	Comfrey	Yes	Yes	
		<i>Amsinckia calycina</i>	Yellow gromwell	Yes	Minor	
		<i>Cynoglossum amabile</i>	Chinese forget-me-not	Yes	Yes	
		<i>Myosotis arvensis</i>	Field forget-me-not	Yes	Yes	
		<i>Cerithe major</i>	Honeywort	Yes	Yes	
		<i>Lithospermum sp</i>				
		<i>Phacelia tanacetifolia</i>	Phacelia, Purple tansy	Commercial cultivation	Yes	
Asteraceae	Ageratum	<i>Ageratum houstonianum</i>	Blue billy goat weed	Minor	Yes	
	Eupatorium	<i>Eupatorium cannabinum</i>	Hemp Agrimony	Yes	Yes	
Apocynaceae	Parsonsia	<i>Parsonsia capsularis</i>	NZ Jasmine	Yes	No	
		<i>Parsonsia heterophylla</i>	Kaihua	Yes	No	

1. *Borago officinalis* (Common borage)

Description

Annual herb originating in Syria grows to a height of 60–100cm and is bristly or hairy all over. The leaves are alternate, simple, and 5–15cm long. The flowers are complete, perfect with five narrow, triangular-pointed petals.

Habitat

Indeterminate growth habit which may lead to prolific spreading. Inhabits roadsides and waste places. Commercial cultivation is mainly for the oilseed.

Flowering

Sept to May. In milder climates, borage will bloom continuously for most of the year.

Flower colours

Blue mainly but may also be white and pink.



2. *Symphytum species* (Comfrey)

Description

Clumps of erect stems (30–120cm high) bearing elliptic leaves that are >25cm in length. The leaves are alternate, margins are entire, hairy, and have prominent veins, hairy on the underside and there are narrow wings that originate from the base of the leaf blades. The stems are covered in hairs.

Habitat

In New Zealand, its wild habits are damp, often shady areas on roadsides, bush edges, near streams and rivers. Most *Symphytum* cultivars prefer full sun.

Flowering

October - March.

Flower colours

White or violet/purple.



3. *Amsinckia calycina* (Yellow Gromwell)

Description

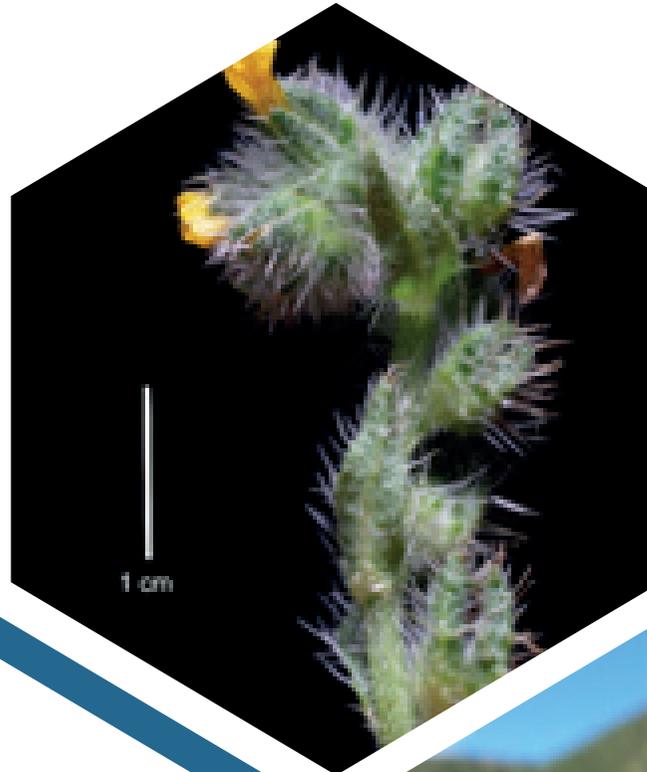
Annual herb. Stems up to 1 m high, branched, often with long straight and short curly hairs

Habitat

Locally common in drier areas, especially on arable land. North Island: not very common yet
South Island: Canterbury and Otago. It has now increased greatly, probably because of resistance to herbicides.

Flowering

Sept-Nov.



4. *Cynoglossum amabile* (Chinese forget-me-not)

Description

Bushy annual with hairy lance-shaped leaves and cymes of sky blue flowers appearing during summer. It can obtain a height of 60cm.

Habitat

It seeds easily. Wild in Wanganui district.

Flowering

Flowers maybe blue, pink or white.



5. *Myosotis arvensis* (Field forget-me-not)

Description

Annual to biennial herb. Stems numerous and erect, up to c.300mm high, angled. Lower leaves sessile, to c.80 × 20mm, oblanceolate to oblong, hairy on both surfaces; hairs not hooked; apex obtuse; upper leaves similar but smaller.

Habitat

A widespread weed of waste places, cultivated land, and other open, modified habitats also locally common in damp sites in tussock grassland. Altitudinal range sea level to c.1000m.

Flowering

October - May.

Flower colours

Blue, white.



6. *Cerithe major* (Honeywort)

Description

Cerithe major leaves are a faintly mottled blue-green, ending in nodding blue bracts (specialised leaf associated with a flower) embracing blue-purple petals.

Habitat

Found in Whanganui district, *Cerithe major* is a native of the Mediterranean. Though from this warm region they do survive in zones with cooler temperatures, where winters get down to zero degrees.

Flowering

November – April, extending to July in some regions.

Flower colours

Purple, red, pink, yellow.



7. *Lithospermum* species

Description

Stems – To +50cm tall, herbaceous, simple to branching above, multiple from taproot.

Leaves – Alternate, sessile, linear-oblong to lanceolate, densely appressed pubescent on both surfaces, with prominent midrib below.

Inflorescence – Single flowers from leaf axils, typically sessile.

Habitat

Waste ground, disturbed sites, open fields, roadsides, railroads.

Flowering

October - May.

Flower colours

Violet/purple, blue, white.



8. *Phacelia tanacetifolia* (Phacelia, Purple tansy)

Description

It grows erect to a maximum height near 100 centimetres. The stems and leaves are coated in stiff hairs. The leaves are mostly divided into smaller leaflets deeply and intricately cut into toothed lobes, giving them a lacy appearance. The very hairy inflorescence is a one-sided curving or coiling cyme of bell-shaped flowers in shades of blue and lavender. Each flower is just under a centimetre long and has protruding whiskery stamens.

Habitat

Coastal sites, locally common. Though not a problem plant it has escaped in certain areas in New Zealand.

Flowering

October - January.

Flower colours

Blue, violet, purple.



9. *Ageratum houstonianum* (Blue billy goat weed)

Description

A short-lived herbaceous plant with softly hairy stems and leaves. Up to 2 m tall. Leaves in pairs, stalked and divided into 3 segments, each with toothed edges, flowerheads a flat mass of small blue flowers on top of each stem and lack any obvious 'petals'.

Habitat

Prefers open sunny spots along forest edges. Was introduced as an ornamental plant.

Flowering

All year

Flower colours

Blue



10. *Eupatorium cannabinum* (Hemp agrimony)

Description

Tall upright herb with downy hairy branches up to 2 m tall, leaves in pairs, stalked and divided into 3 segments, each with toothed edges, flowerheads a flat mass of small pink flowers on top of each stem.

Habitat

Wetlands and riparian margins of water bodies, particularly areas that are rich in Nitrogen. Locally well established in South Taranaki and Wanganui District.

Flowering

Jan - Mar

Flower colours

Red / Pink, Violet / Purple, White



11. *Parsonsia heterophylla* (NZ Jasmine)

Description

Twining climber, through small trees or large shrubs, shade tolerant with an interesting juvenile stage.

Habitat

Commonly found in somewhat open habitats, such as bush margins and coastal forest; although it can tolerate considerable amounts of shade in lowland forests.

Flowering

January to March.



12. *Parsonsia capsularis* (Kaihua)

Description

Twining climber, through small trees or large shrubs, shade tolerant with an interesting juvenile stage.

Habitat

Commonly found in somewhat open habitats, such as bush margins and coastal forest; although it can tolerate considerable amounts of shade in lowland forests.

Flowering

January to March.



Plants relevant to New Zealand with ECH PA types

Family	Subtribe	Genus	Candidate plants in NZ	Common names	Rural location	Urban location
Boraginaceae	Echinaceae	<i>Echium</i>	<i>Echium vulgare</i>	Vipers bugloss	Yes	Minor
			<i>Echium plantagineum</i>	Echiinae/ Paterson's curse/ Bluebedder	Minor	Yes
			<i>Echium candicans</i>	Pride of Madeira	Potentially weedy	Yes
			<i>Echium pininana</i>	Giant bugloss	Potentially weedy	Yes

1. *Echium vulgare* (Vipers bugloss)

Description

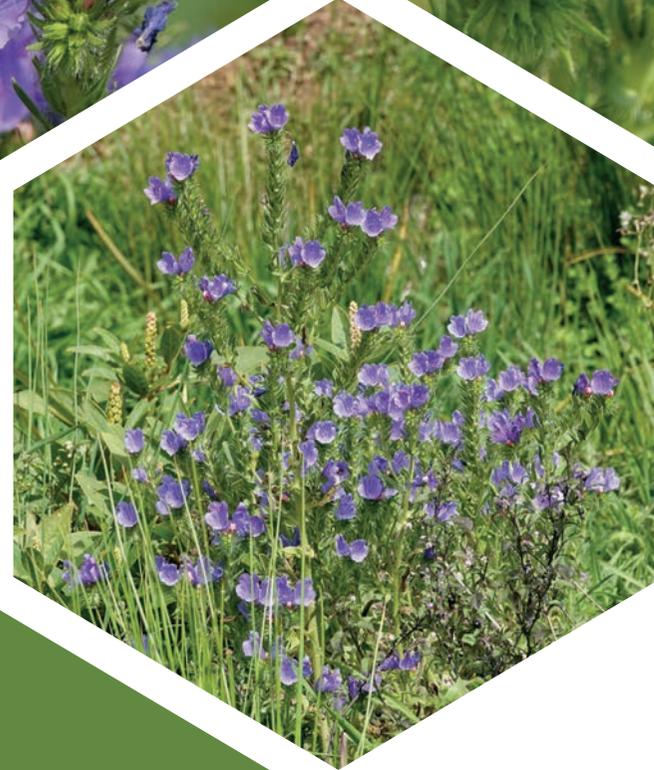
Densely bristly annual or biennial herb to 50-90 cm high. Deep taproot. Stems stiff, erect, covered in reddish bristly hairs, with many short branches. Basal rosette leaves to 15 x 5 cm, narrow, stiffly bristly, harsh to touch. Stem leaves much smaller, alternate, also rough. Flowers funnel-shaped, 5-petaled, 12-18 mm long, pink in bud, becoming vivid blue 4 long stamens protruding and 1 smaller inside flower.

Habitat

Short tussock grassland, herbfield, bare land, riverbeds, usually in dry, low fertility inland areas.

Flowering

Nov -Jan



2. *Echium plantagineum* (Pattersons' curse or Bluebedder)

Description

Less common (warmer areas only), has flowers 2-3 cm long, purplish-blue, with 2 protruding stamens, leaves less harsh.

Habitat

Short tussock grassland, herbfield, bare land, riverbeds, usually in dry, low fertility inland areas.

Flowering

Dec - Feb



3. *Echium candicans* (Pride of Madeira)

Description

It is a large herbaceous perennial shrub, growing to 1.5–2.5m. In the first year after germination the plant produces a broad rosette of leaves. In the second and subsequent years more or less woody flowering stalks are produced clothed in rough leaves.

Habitat

Cultivated as an ornamental plant for traditional and drought tolerant water conserving gardens. It is particularly suitable for coastal planting. It is a common garden escapee onto road-side verges and shingle banks throughout the drier parts of both the North and the South Islands.

Flowering

Spring through summer.



4. *Echium pininana* (Giant bugloss)

Description

Shrubby herbaceous biennial or triennial (<2-4 m) growing from a deep taproot. Narrowly lance-shaped, deeply veined rosette leaves (25-50 cm), are covered in fine, rough hairs. Stem leaves are similar to rosette leaves but are narrower and shorter (10-25 cm long). Main, unbranched, cylindrical flowering stem resembles a woody trunk (1-3 m tall). Biennial or triennial, it typically remains as a tall rosette the first year, flowers the second or third year, and then dies after shedding its seed.

Habitat

Prefers sunny habitats with moderately moist conditions. Thrives on steep and disturbed hillsides in coastal habitats. Limited by harsh winters and full shade.

Flowering

Dec to Feb





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