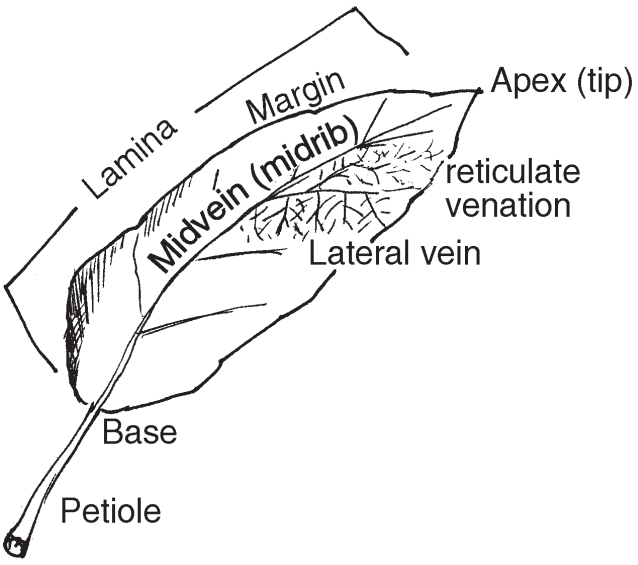
9. Leaves

Every plant species has its own combination of leaf characters that make it recognisable—shape, size, texture, form and arrangement.



Parts of a leaf

There are three principal parts to a leaf:

1. The **leaf blade** or **lamina.**
2. The **leaf stalk** or **petiole** (if absent, leaf is said to be **sessile**). Most monocot leaves are sessile. (Leaflet stalk = **petiolule**).
3. The **leaf base.** The **leaf tip** is the **apex.**

Leaf types

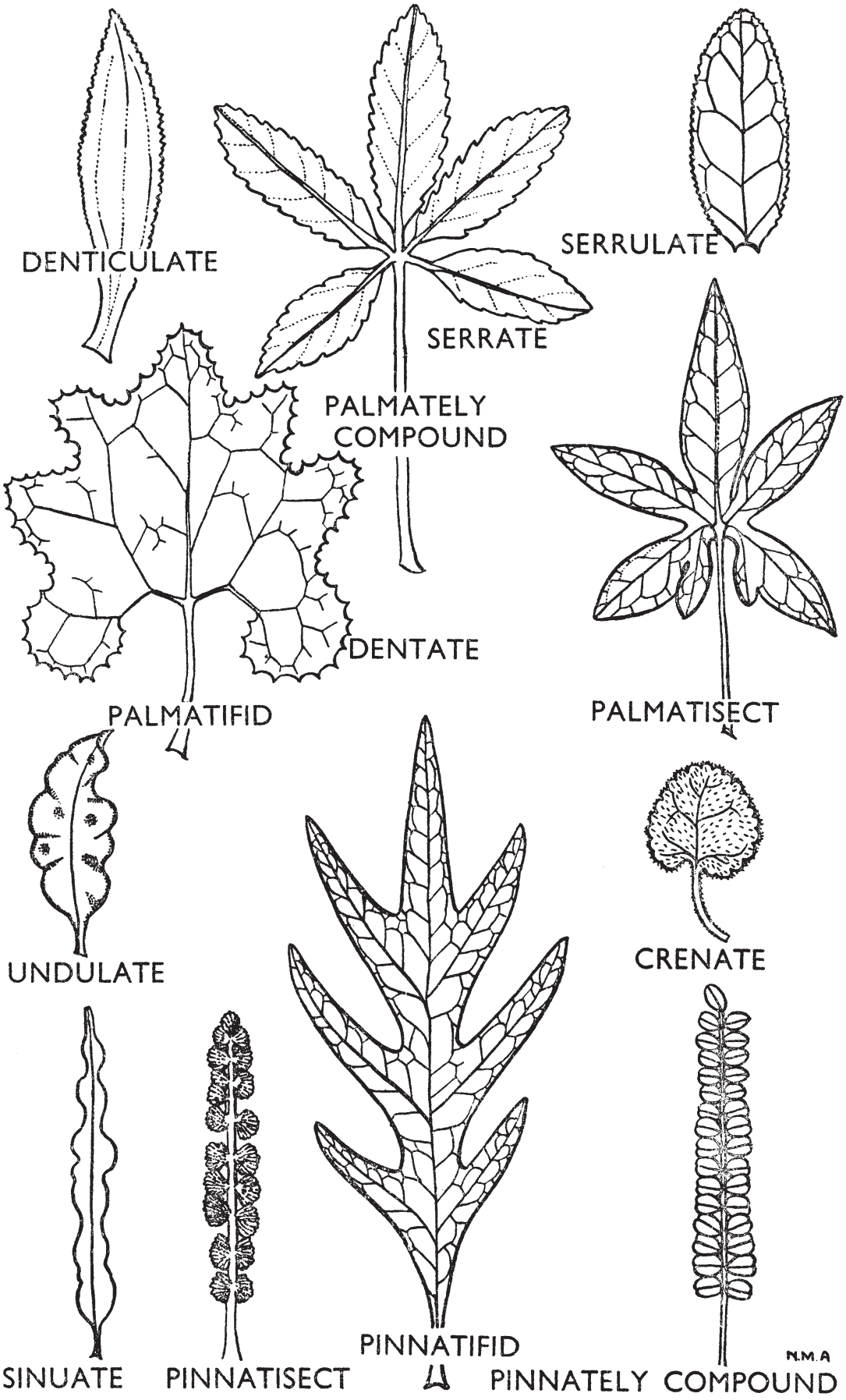
There are a number of different leaf types including the simple or compound leaf or different types of compound leaf and plants with flattened stem leaves.

1. Simple = single leaf

e.g., karamu *Coprosma lucida*

2. Compound = more than one leaf blade compose the leaf and may be either

Palmately compound: shaped like a hand.	**Digitately compound**: finger-like variation of palmately compound.	**Pinnately compound**: feather pattern.
		
e.g., fivefinger (*Pseudopanax arboreus*).	e.g., patē (*Schefflera digitata*).	e.g., kōwhai (*Sophora* species).



Leaves, simple and compound, margins and lobing. From *Flora of New Zealand* Vol. 1, by H.H. Allan (illustration by Nancy M. Adams). © Landcare Research NZ Ltd..

Each separate leaf division of a compound leaf is called a leaflet but how do you know if it is a leaflet or a leaf? In a simple leaf the **leaf stem**, or **petiole**, swells where it attaches to the twig, and the new **bud** is usually found there. The base of a leaflet on a compound leaf will neither swell nor have a bud present.

A leaf that is divided into leaflets is termed foliolate: two leaflets = bifoliolate, three leaflets = trifoliolate, etc.

3. Cladodes /phylloclades or "flattened stem leaves"

Some plants have flattened stem leaves instead of what are typically thought of as leaves.

e.g., tānekaha (*Phyllocladus trichomanoides*).

e.g., NZ broom (*Carmichaelia williamsii*).

Photo: Andrea Brandon.

4. Blade or tiller

Grasses.

e.g., red tussock (*Chionochloa rubra*).

5. Frond

Leaf of a palm or fern.

e.g., nikau (*Rhopalostylis sapida*).

e.g., *Blechnum filiforme*.

Leaf arrangement (Phyllotaxis)

Examining the leaf arrangement can be useful for distinguishing plants with similar leaves. Leaves can be alternate, opposite, whorled, imbricate or a rosette.

Alternate: singly along the stem.

e.g., *Streblus heterophyllus.*

Opposite: in pairs along the stem.

e.g., hangehange (*Geniostoma ligustrifolium*).

Whorled: Arranged in a ring around the stem.

e.g., cleavers (*Galium aparine*).

Imbricate: overlapping.

e.g., rimu (*Dacridium cupressinum*).

Rosulate/rosette: a dense radiating cluster of leaves

e.g., *Celmisia semicordata.*
Photo: John Sawyer.

Leaf shape

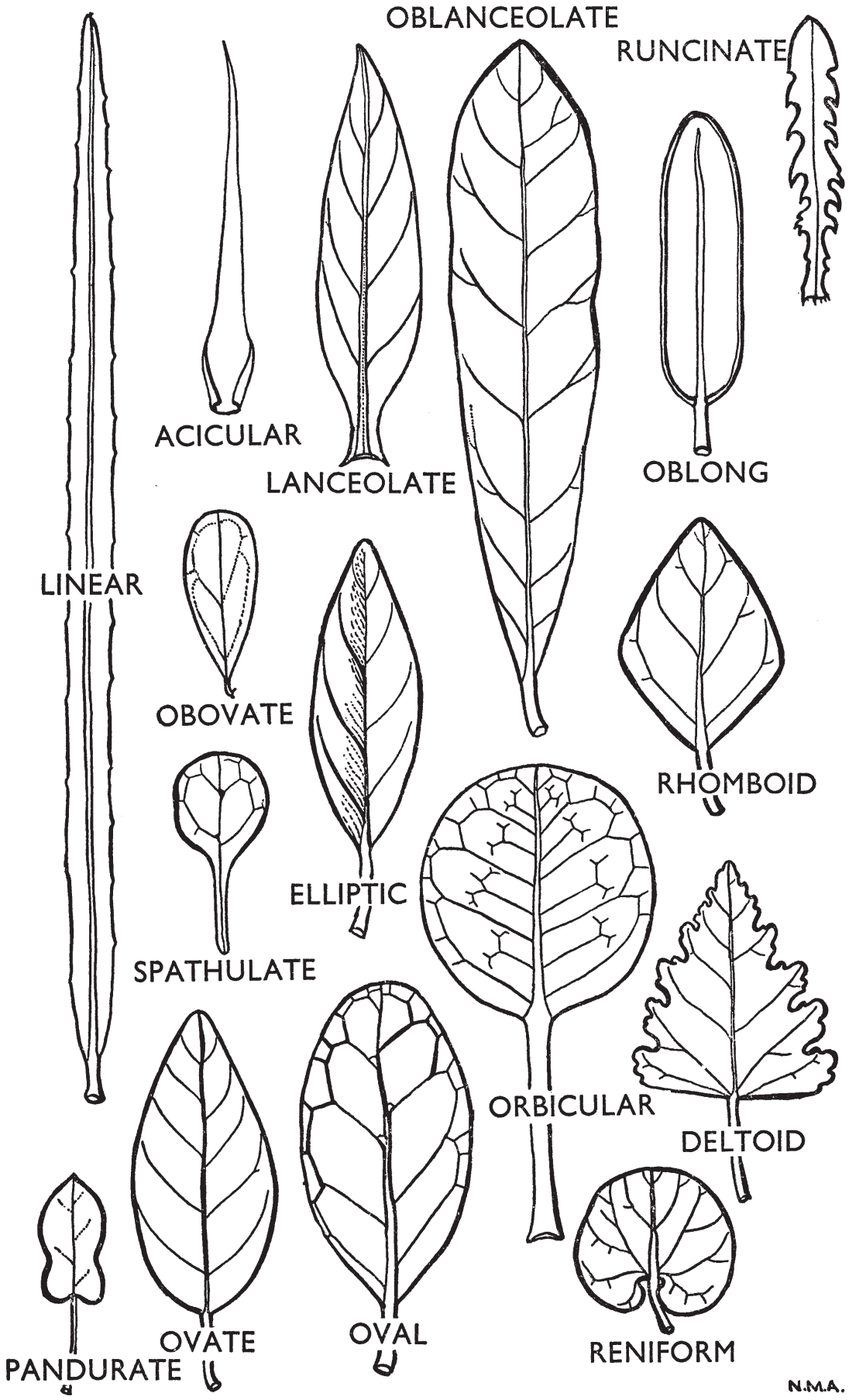
Leaves maybe described in basic **plane shapes**. Some of the terms used to describe leaf shapes are listed below with examples of plants which have these leaf shapes.

Linear: very narrow, margins ± parallel.  e.g., (*Lilium formosanum*).	**Oblong:** rectangular.  e.g., firethorn (*Pyracantha angustifolia*).	**Orbicular:** almost round.  e.g., red pondweed (*Potamogeton cheesemanii*).
Elliptic: tapering, widest at middle.  e.g., northern rātā (*Metrosideros robusta*).	**Lanceolate:** tapering, widest toward base.  e.g., tawa (*Beilschmiedia tawa*).	**Oblanceolate:** tapering, widest toward apex.  e.g., maire taike (*Mida salicifolia*).
Ovate: egg shaped, widest near base.  e.g., red beech (*Nothofagus fusca*).	**Obovate:** reverse egg shaped, widest near apex.  e.g., *Coprosma rigida.*	**Cordate:** heart shaped, notch at base.  e.g., kawakawa (*Piper excelsum*).
Obcordate: heart shaped, notch at apex.  e.g., *Myrsine umbricola.*	**Reniform:** kidney shaped.  e.g., kidney fern (*Cardiomanes reniforme*).	**Spathulate/spatulate:** spatula shaped.  e.g., *Selliera rdicans.*

Ensiform: sword shaped.  e.g., montbretia (*Crocosmia* × *crocosmiiflora*).	**Hastate:** spear like.  e.g., climbing dock (*Rumex sagittatus*).	**Flabellate:** fan shaped.  e.g., *Asplenium flabellifolium.*
Deltoid: broadly triangular.  e.g., Canadian poplar (*Populus* ×*canadensis*).	**Rhomboid:** ± diamond shaped.  e.g., *Peperomia tetraphylla.*	**Filiform:** thread like.  e.g., hook sedge (*Uncinia filiformis*).
Acicular: needle like.  e.g., *Pinus contorta.*	**Acerose:** narrow, with a sharp, stiff point.  e.g., *Leptecophylla juniperina.*	**Lyrate:** pinnatifid or pinnatisect, terminal lobe much larger than lower lobes.  e.g., tūrepo (*Streblus heterophyllus*).

Because leaves vary in shape, even on individual plants, these terms may be qualified with words such as 'narrowly' or 'broadly', or combined with other terms to fully describe the range of leaf shapes present on a plant. For example, pōhuehue (*Muehlenbeckia complexa*) is described in the book *Trees and Shrubs of New Zealand* as having leaves "oblong, obovate or orbicular".

Pōhuehue leaves vary from oblong through obovate to orbicular.

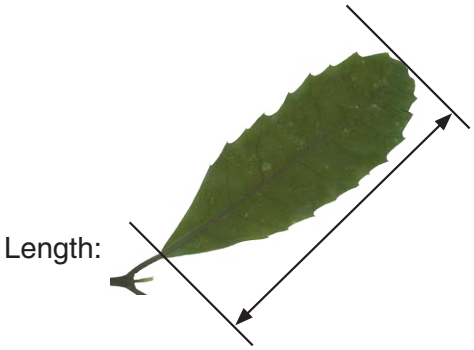


Leaf shapes From *Flora of New Zealand* Vol. 1, by H.H. Allan (illustration by Nancy M. Adams). © Landcare Research NZ Ltd..

Muehlenbeckia astonii—obcordate leaves.

Well that's about the size of it

Big/large and small/little are relative terms, so measurements are much more useful when describing a plant, for example, 5 cm long by 2.5 cm at the widest. It is important not to include the leaf stalk when taking a measurement of a leaf. A leaf is regarded as broad if its width is more than half the length:



Narrow e.g., tawa (*Beilschmiedia tawa*, left) and broad leaves, e.g., kawakawa (*Piper excelsum*).

Hebe ligustrifolia (top, orange mid-rib) and *Hebe stricta* var. *stricta*. Illustrations from *Eagle's Trees and Shrubs of New Zealand* (two volumes), © Audrey Eagle.

Leaf vein pattern (venation/veination)

Leaves usually have some pattern on them in the form of a venation. This may be parallel or like a net (see below). **Venation** can also affect the surface **appearance** or **texture**—whether veins are raised or sunk for instance. The main central vein or **midrib** maybe distinct as in the koromiko *Hebe ligustrifolia* where it is orange compared to *Hebe stricta*. *Hebe acutiflora* has orange-yellow mid-ribs.

Most monocots have parallel venation, although there are exceptions such as supplejack (*Ripogonum scandens*).

Parallel venation: most monocots.

e.g., turutu (*Dianella nigra*).

Net venation (reticulate)—pinnate: feather-like.

e.g., karamū (*Coprosma lucida*).

Net venation (reticulate)—palmate: hand-like.

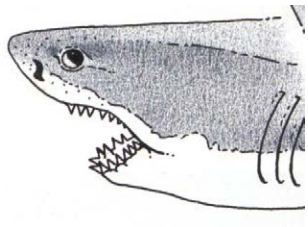
e.g., *Hibiscus diversifolius.*

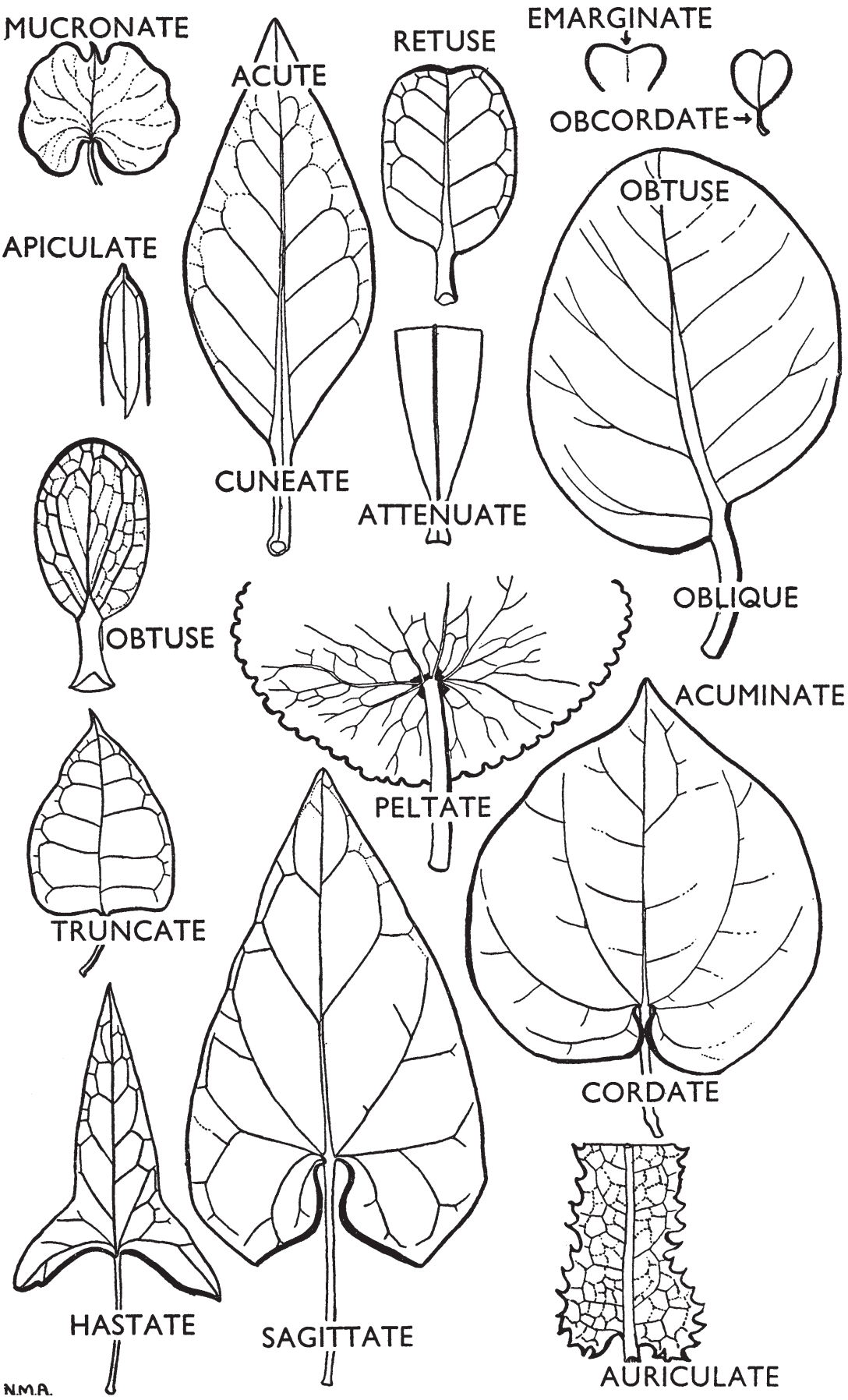
Leaf margins (edges)

Leaf margins exhibit a wide range of forms. Some of the common types of leaf margin are shown here:

Entire: smooth.  e.g., hangehange (*Geniostoma ligustrifolium*).	**Crisped:** margin tightly wavy, crinkled.  e.g., filmy fern (*Hymenophyllum flexuosum*).	**Serrate:** teeth directed toward apex.  e.g., pukatea (*Laurelia novae-zelandiae*).	**Biserrate:** doubly serrate.  e.g., blackberry (*Rubus fruticosus* agg.).
Dentate: teeth directed outward.  e.g., lacebark (*Hoheria sexstylosa*).	**Erose:** irregularly toothed.  e.g., makomako (*Aristotelia serrata*).	**Crenate**: bluntly toothed.  e.g., tūrepo (*Streblus banksii*).	**Undulate:** wavy.  e.g., māpou (*Myrsine australis*).
Pinnatifid: cleft more than halfway to midrib.  e.g., *Microsorum novae-zealandiae.*	**Pinnatisect:** deeply cleft to midrib.  e.g., poniu (*Rorippa palustris*).	**Lobed:** cut less than half way to midrib.  e.g., *Hydrocotyle elongata.*	**Cleft:** irregularly, coarsely lobed.  e.g., *Alseuosmia quercifolia.*

The irregular leaf serrations of *Aristotelia serrata* are reminiscent of shark teeth, giving rise to the Maori name 'makomako'.





Leaf tips and bases. From *Flora of New Zealand* Vol. 1, by H.H. Allan (illustration by Nancy M. Adams). © Landcare Research NZ Ltd..

Leaf tips and bases

Leaf tips and bases can be characteristic and may help to identify plants.

Terms used to describe the tips of leaves include:

Acuminate: tapering to a long fine point.  e.g., grass-leaved orchid (*Pterostylis graminea* agg.).	**Acute:** sharply pointed.  e.g., *Pittosporum cornifolium.*	**Apiculate:** a short slender ± flexible point.  e.g., spider orchid (*Corybas rivularis* agg.).	**Emarginate**: shallow notch at the apex.  e.g., rōhutu (*Lophomyrtus obcordata*).
Mucronate: with a short sharp tip.  e.g., *Tmesipteris tannensis.*	**Obtuse:** blunt.  e.g., pygmy orchid (*Bulbophyllum pygmaeum*).	**Retuse:** apex rounded with a small notch.  e.g., northern rātā (*Metrosideros robusta*).	**Rounded**  e.g., *Coprosma pedicellata.*

Terms used to describe the bases of leaves include:

Cordate: Heart shaped with a notch at base.  e.g., kawakawa (*Piper excelsum*).	**Cuneate:** wedge shaped, tapering to base.  e.g., hard beech (*Nothofagus truncata*).	**Hastate:** arrowhead shape, basal lobes pointed or narrow.  e.g., climbing dock (*Rumex saggitatus*).	**Oblique:** with unequal sides.  e.g., akapuka (*Griselinia lucida*).
Peltate: shield-like, with stalk attached well inside margin.  e.g., nasturtium (*Tropaeolum majus*).	**Saggitate:** arrowhead shape, basal lobes at narrow angle to stalk.  e.g., pink bindweed (*Calystegia sepium* subsp. *roseata*).	**Truncate:** cut squarely across the base.  e.g., round-leaved coprosma (*Coprosma rotundifolia*).	**Attenuate:** Tapering gradually to base.  e.g., *Plantago raoulii.*

Leaf surfaces

The upper (adaxial) and lower (abaxial) leaf surfaces also have distinctive features which help identify leaves. They also provide texture and colour. Some of the main terms used are shown below.

Glabrous: smooth, lacking hairs.  e.g., koromiko (*Hebe stricta*).	**Hispid:** rough with short, stiff hairs.  e.g., fireweed (*Senecio hispidulus*).	**Stellate**: star-shaped hairs with branches radiating from the base.  e.g., filmy fern (*Hymenophyllum frankliniae*).
Pubescent: covered in short, soft hairs.  e.g., *Hebe amplexicaulis* f. *hirta.*	**Hirsute:** bearing coarse hairs.  e.g., *Hydrocotyle moschata* var. *moschata.*	**Strigose:** hairs appressed against the surface.  e.g., *Hydrocotyle moschata* var. *parviflora.*
Pilose: bearing long, soft, straight hairs.  e.g., adaxial margins of toetoe (*Austroderia fulvida*).	**Villous:** bearing long, soft, shaggy hairs.  e.g., *Nertera villosa.*	**Tomentose:** "woolly".  e.g., *Pseudognaphalium luteo-album.*

Glandular: with **glands**—hairs with secretory function.

e.g., sundew (*Drosera auriculata*).

Stinging

e.g., ongaonga (*Urtica ferox*).

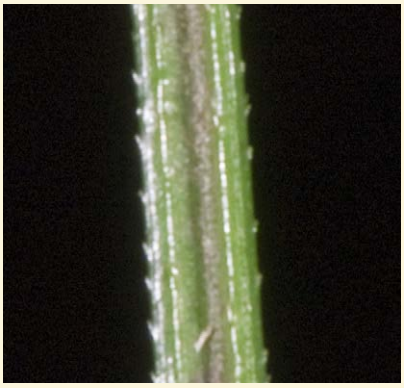
Domatia: small pits in the leaf surface.

e.g., karamū (*Coprosma lucida*).

Coriaceous: rough leathery texture.

e.g., akiraho (*Olearia paniculata*).

Scabrid (scabrous): rough.



e.g., margin of hook sedge (*Uncinia silvestris*).

Glaucous – distinctly bluish grey due to waxy surface (bloom).

e.g., shore spurge (*Euphorbia glauca*). Photo: John Sawyer.

Specific leaf patterns

In addition to hairs and glands, plants may have specific patterns. This may include blotching or wrinkly appearance.

Blotching/marbleing

e.g., marbleleaf / putaputāwētā (C*arpodetus serratus*).

Bullate: blistered appearance.

e.g., ramarama (*Lophomyrtus bullata*).

Gland dots	**Rugose:** wrinkly.
	
e.g., ngaio (*Myoporum laetum*).	e.g., *Pomaderris apetala.*

Stipule

One of a pair of scale-like or leaf-like appendages at the base of the petiole. This is present in some plants, such as *Coprosma* species:

Stipules from (left) *Coprosma macrocarpa*, *C. microcarpa, C. rhamnoides*, *C. robusta*, *C. tenuifolia.*

The difference with ferns

Fern fronds have four basic shapes. They are:

Simple/single	**Simple/lobed**
	
e.g., *Notogrammitis billardierei.*	e.g., kōwaowao (*Microsorum pustulatum*).

Pinnate (once divided)	Multipinnate (divided 2, 3 or 4 times)
	
e.g., button fern (*Pellaea rotundifolia*).	e.g., pig fern (*Paesia scaberula*).

The shape of the **pinnae** of fern fronds is described in three ways:

Untoothed (Entire)	Toothed	Lobed
		
e.g., jointed fern (*Arthropteris tenella*).	e.g., shining spleenwort (*Asplenium oblongifolium*).	e.g., *Lindsaea trichomanoides.*

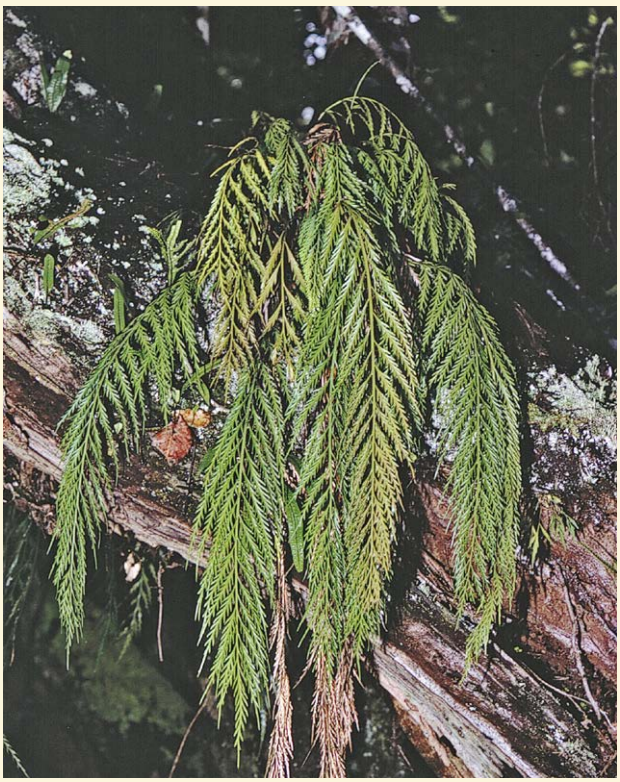
The way in which ferns grow is another way of distinguishing them:

Tufted	Creeping
	
e.g., kiwakiwa (*Blechnum fluviatile*).	e.g., kidney fern (*Cardiomanes reniforme*).

Climbing

e.g., thread fern (*Blechnum filiforme*).

Perching



e.g., hanging spleenwort (*Asplenium flaccidum*).

Tree

e.g., kātote (*Cyathea smithii*).

Floating

e.g., *Azolla filiculoides.*