A guide to
Weed Seedling Identification

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Preface

A weed is simply a plant that is growing where it is not wanted. The first step of any weed management program is to identify the weed species. With a positive identification of the plant in question, and a little knowledge about that species, you can identify weaknesses which will help you manage the weed quickly and effectively.

Most weed identification manuals feature mature weeds and use stem, leaf, flower and fruit characteristics as an aid in identification. However, the control of weeds must be taken up when they are small, before they flower, to prevent them from seriously competing with crops for nutrients and soil moisture. Identification of weed seedlings is technically important because it would be helpful to identify the seed bank of the expected competitor weeds and thus to plan the management program accordingly. Identifying the seedling stages of weeds is important because they are most susceptible to chemical or mechanical control at this stage. Also, accurate identification of these seedling weeds often is necessary to select the best herbicide or other method of weed control. Weed seedling identification is important to timely implement the appropriate weed control practice. Controlling the weeds in the early stages of growth not only increase the effectiveness of the control measures, but also reduces the crop losses.

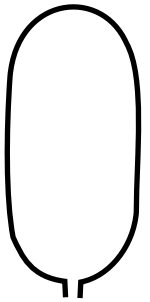
An effort has been made to brought out this publication entitled "*A Guide to Weed Seedling Identification*" to help in identifying the weeds at early stages to manage them effectively and economically. I hope this publication would be of great help to scientists, researchers, quarantine officials, academicians and students.

I thank ICAR for giving me the opportunity to serve in this position. The financial support by the Department of Agriculture and Cooperation, Ministry of Agriculture, under National Weed Surveillance project is duly acknowledged. The encouragement by the present and former Directors, scientist colleagues, and technical and other staff members of DWSR is worth to recognize. The support from PIs of the AICRP-WC centres and Area Coordinators of the NIWS is unforgettable. I express my regards to my family members who were the constant source of spirit and inspiration to me in achieving this hard target.

March, 2012

V.S.G.R. Naidu

LINEAR



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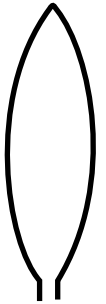
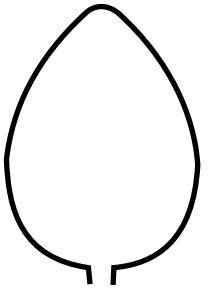


LANCEOLATE



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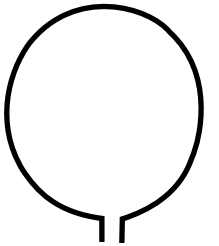
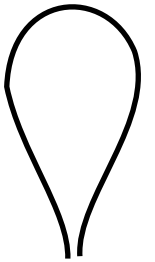


ROUND



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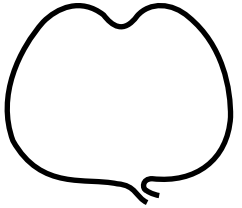
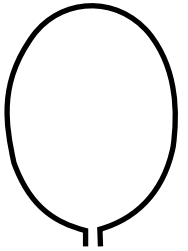


KIDNEY SHAPE



OVAL

PALMATELY LOBED

PINNATELY LOBED

Abelmoschus ficulneus (L.) Wight & Arn.

Cotyledons are dull to dark green, heart shaped, short petioled. First true leaf is petiolate with reddish petioles, cordate, with dentate margins and poited apex. Subsequent leaves are long petioled, shallowly to deeply trilobed and hairy.





Abelmoschus moschatus Medik.

Cotyledons are dull to dark green, heart shaped with a blunt apex and prominent veins; petiolate, petioles reddish. The first true leaf is petiolate, round to cordate with dentate margins. Subsequent leaves are deeply 3 to 5 lobed; petioles are covered with stiff hairs, and leaf surface and margins are covered with fine hairs.





Abutilon indicum (L.) Sweet.

Hypocotyl is covered with soft hairs. One cotyledon is heart-shaped and the other one is nearly round, and the cotyledons are also covered with short, soft hairs.
The first true leaves are alternate, heart-shaped, thin, dull green, with toothed margins, prominent veins on the underside and covered with hairs on both surfaces and are velvety to touch.





Acanthospermum hispidum DC.

The cotyledons are broadly club shaped and wavy margined.
The leaves are oval to triangular, opposite, sessile, irregularly and coarsely toothed,
light green in colour and
very broad.





Achyranthes aspera L.

Cotyledons are light green, short petiolate, linear-lancolate. First true leave are opposite, thick, ellipitic, subsequent leaves are opposite, broadly ovate-elliptic, with wavy margins and prominent viens.The leaf margins often appear purplish tinged.





Aerva lanata (L.) Juss. ex Schult.

Cotyledons are round to oval, finely hairy with reddish-purple tinged margins. First true leaves are opposite, round to reniform, often purple tinged; subsequent leaves are bright green, oval, hairy.





Aeschynomene indica L.

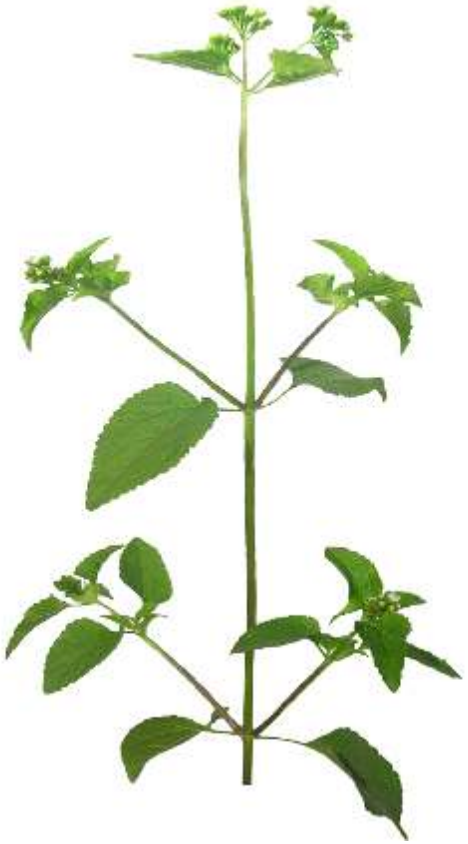
Cotyledons are thick, dark green, bean shaped, sessile. The first true leaf is a compound leaf with 8-10 pairs of small linear-oblong leaflets. The subsequent leaves are opposite, petiolate, alternate with leaflet margins often purplish. The hypocotyl is reddish in colour.





Ageratum conyzoides L.

Cotyledons are round to ovate, green, shiny, finely pubescent. The first true leaves are sessile, opposite, lustre green, covered with fine hairs; margins serrate.







Alternanthera philoxeroides (Mart.) Griseb

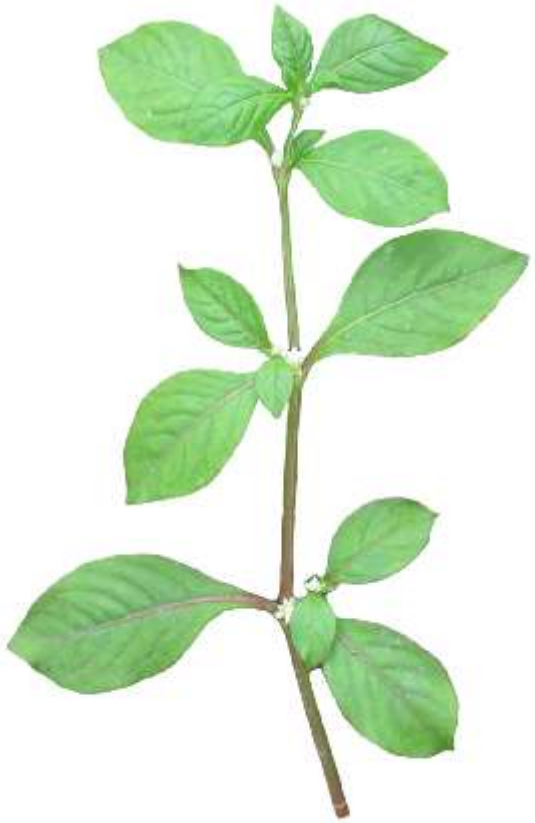
The first pair of leaves are oblong, 0.5 to 1.0 cm long, light green, opposite. Subsequent leaves up the stem are longer than lower leaves and alternate.





Alternanthera polygonoides (L.)R.Br.

Cotyledons are dark green, round to oval, petiolate with dark purple pigmentation at the base of the petiole.The first true leaves are opposite, dark green, shiny, glabrescent, ovate, petiolate. Subsequent leaves are opposite, elliptic, with shining surface.







Alternanthera pungens H. B & K.

The hypocotyl is short and dark purple. Cotyledons are linear-lanceolate with pointed apex, green, pubescent with purplish tint at the base. First pair of leaves are opposite, elliptic, with acute apex, densely hairy. Subsequent leaves are opposite, round to broadly ovate, green, shiny on the surface, finely hairy.





Alternanthera sessilis (L.) DC.

Cotyledons are thick, light green, oval, shiny. The first true leaves are ovate-lanceolate, shining green. Subsequent leaves are elliptic to oblanceolate, sessile and opposite.





Alysicarpus monilifer (L.) DC.

Cotyledons are thick, dark green, shiny, oblong, slightly curved on one margin, sessile. The first pair of leaves are opposite, narrowly cordate with acute apex. Subsequent leaves are alternate, short petioled, cordate, light to dark green and glabrous.





Amaranthus spinosus L.

Hypocotyl is green / reddish in colour, without hairs.
Cotyledons are long and narrow, without hairs.
The first and second true leaves are alternate, petiolate, light green, oval with a notch at apex.
Subsequent leaves are petiolate, ovate, light green wtih sharp, green spines at leaf axils.

Amaranthus viridis Hook. F.

Hypocotyl: light red in color. Cotyledons spread about 14 mm; linear shape, with short petioles; lower surface and midvein on upper surface reddish in color. Leaves are alternate; ovate to oval, with indented tips and medium-long, sparsely trichomatous (with hairlike projections) on petioles; branched midvein.

Ammannia baccifera L.

The cotyledons are ovate-lanceolate, green, thick and shiny on the surface. The first pair of true leaves are opposite, shiny, oblong to ovate-lanceolate. Subsequent leaves are opposite, lanceolate, light to dark green, shiny.





Anagallis arvensis L.

The cotyledons are dark green and triangular. Seedlings of scarlet pimpernel are often mistaken for chickweed (*Stellaria media*), but the seed leaves of scarlet pimpernel are dark green and broader and lack the prominent midrib of the chick weed. The first true leaves are nearly as broad as they are long and are triangular with dark spots on the underside of the leaves. The short leaf stalks are without hairs. The dark spots on the under side of the leaves and the hairless stalks help distinguish scarlet pimpernel from chickweed.





Argemone mexicana L.

Hypocotyl is light to dark reddish in colour. The cotyledons are filform, 0.5 to 1.0 cm long, tapering to a point and dull green.The first true leaf is pinnately lobed wth spinepointed lobes. Subsequent leaves are alternate, runcinate, dull green, with prominently visible white midvine.





Asphodelus tenuifolius Cav.

The seeds show epigeal germination and very often the tip of the seedling still remains in the soil, while the rest of the seedling comes above the ground giving an inverted U or inverted V shape, typical for this species.

Asteracantha longifolia (L.) Nees.

Cotyledons are sessile, opposite, green, broadly cordate with round apex. The first true leaves are oblong-ovate, light green, glabrous, opposite. Subsequent leaves are in whorls, elliptic to lanceolate with prominent white midvine.





Atylosia scarabaeoides (L.) Benth.

Cotyledons are narrowly ovate, thick, dark green, opposite, with prominent viens on the upper surface. The lower surface is dull green.The first true leaf is petiolate, trifoliate compound leaf. The apex leaflet is larger than the lower two.





Avena ludoviciana (L.) Nees.

Leaf blades rolled in round bud shoot; smooth; usually hairless, except ciliate (stiff, bristle-like hairs) often appear along lower edges. Leaf sheath often pubescent (finely and densely hairy); open, with overlapping margins. Collar is broad; smooth. Auricles absent; Ligule membranous, prominent and acute.

Bidens pilosa L.

Hypocotyl is maroon or slightly maroon-tinted and square. Cotyledons green on the upper surface and maroon-tinted on the lower surface. The upper surfaces of the cotyledons have a distinctive midvein. First true leaves are opposite and deeply dissected.





Boerhavia diffusa L.

Cotyledons are round, thick, dull green, fleshy, opposite and petiolate. The first true leaves are opposite, petiolate, round in shape. Subsequent leaves are dull green, ovate-cordate, dark green with shining surface.The petioles and stem are pinkish red in colour.





Boerhavia erecta L.

Cotyledons are round to ovate, petiolate, often tinged with purple colour, opposite.
The first true leaves are narrowly ovate, with wavy margins, light green with prominent purplish viens on the surface. The subsequent leaves are long petiolate, narrowly ovate and dull green with serrated margins.





Borreria hispida (L.) K. Schum.

Cotyledons are light green, round to oval, finely hairy on the suface. The first true leaves are narrowly ovate, thick, covered densely with fine white hairs. The Subsequent leaves are lanceolate, light green, shiny with fine hairs on the surface. At the seedling stage the branching starts at the base of the main stem. The stem is green initially and turns to reddish purple.





Brachiaria erusiformis (J.E.Smith) Griseb.

The first true leaves are small, with purple leaf sheath. The Subsequent leaves are linear, lanceolate with pointed apex; upper leaves are longer than the lower ones.

Brachiaria reptans Gard. & Hubb.

Initailly the lamina is small; arise from the soil, shiny, broady ovate- lanceolate, dark green, at the sheath is tinted red. The subsequent leaves arise from the centre of the previous leaf sheath, linear, with pointed apex.





Caesulia axillaries Roxb.

Cotyledons are shortly petiolate, round to obvate, dark green, with shining surface. The first and subsequent leaves are long, linear-lanceolate, alternate, with shining light green surface, glabrous.





Cardamine hirsuta L.

Cotyledons are round and petiolate. Cotyledons and first true leaves have hairs. Foliage leaves petiolate, reniform, wider than long. Subsequent leaves consist of alternately arranged leaflets, imapripinnate.





Cassia pumila Lam.

The cotyledons are rhomboid, light green, thick and sessile. The first true leaf is a compound leaf with 2-3 pairs of narrowly oblong, dull green leaflets, subsequent leaves are long petiolate ,opposite and paripinnate with terminal pair of leaflets smaller than the lower pair.





Cayratia trifolia (L.) Domin.

The Cotyledons are round to oblong. The first and subsequent leaves are trifoliate. All the leaflets are almost equal in size, light to dark green with sparsely serrated margins. The leaves are long petioled.





Centella asiatica L.

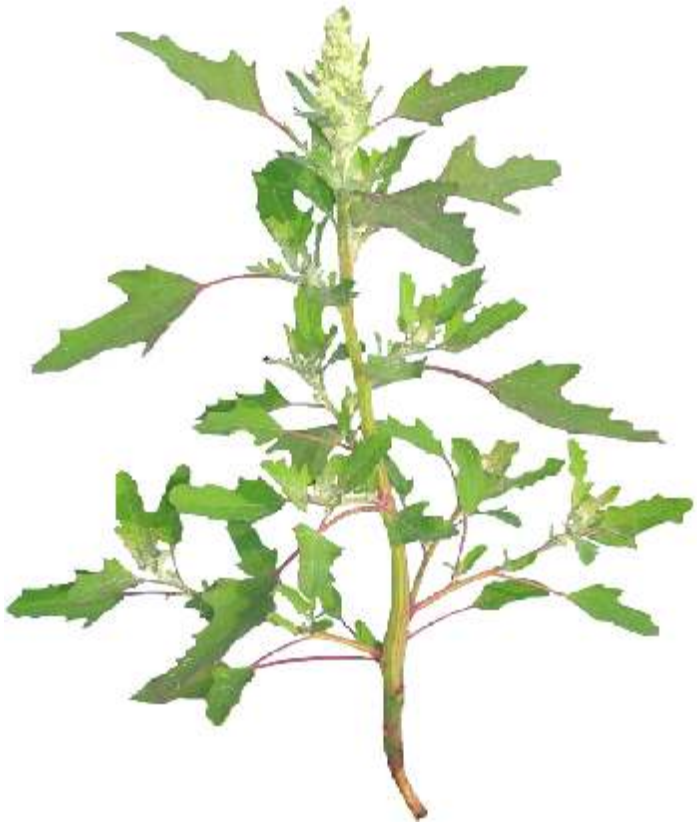
The cotyledons are rounded to oval, short petioled, sparsely hairy, light green in colour. The first and subsequent leaves are round with a deep cleft at the base, thick, light green, with wary margins. All the leaves arise from the centre of the stem giving a rosette appearance.





Chenopodium album L.

Cotyledons elliptic (1.2-1.5 cm long), dull green with a mealy grey cast on the upper surface and maroon on the underside, turning green with age. Hypocotyl is hairless, green or tinged with maroon. The first pair of true leaves is opposite; all the subsequent leaves are alternate. Seedling leaves are triangular and also have a mealy grey cast.







Chenopodium murale L.

The cotyledons are linear 0.75 – 1.25 cm long, dull green with silverish appearance. The first true leaves are ovate, petiolate with serrated margins and covered with whitish pubescence.





Chrozophora plicata (Vahl) A. Juss. ex Spreng

Cotyledons are narrowly linear, dull green, long, sessile. The first and subsequent leaves are ovate with wavy margins, dull purplish green with prominent venation. The petioles are long, reddish purple with white pubescence.





Chrozophora rottleri Klotzsch.

Cotyledons are narrowly oblong or linear, dull green with purplish appearance. The first true leaves are narrowly ovate, light green, with pointed apex and wavy margins. The Subsequent leaves are alternate, broadly ovate, dull green to purplish green, with surface coarse to touch.





Cichorium intybus L.

The cotyledons are light green, twice as long as they are broad and united at the base forming a shallow cup. The first true leaves are alternate and form a rosette encircling the crown. They are irregularly and shallowly lobed around the edges and their leaf stalks are narrowly winged, with a few soft hairs.





Cleome gynandra L.

Cotyledons are round to oval with short reddish petiole, opposite, green. The first true leaves are opposite, trilobed with apex lobe single and obovate and the lower low lobes are elliptic to rhomboid, light to dark green in colour. The subsequent leaves are long petioled with dull reddish purple colour at the petiole base.





Cleome viscosa L.

The cotyledons are petiolate, oval with round apex, light green. The first true leaves are trifoliate, petiolate, opposite, with reddish petioles. The apex leaflet is rhomboid or obovate. The subsequent leaves are long petioled, the lamina and petioles are covered with fine, sticky, white hairs.





Cocculus hirsutus (L.) Diels.

Cotyledons are linear-oblong, thick, shiny green on the upper surface. The first true leaf is cordate, shallowly trilobed. The subsequent leaves are dark green shiny, petiolate, trilobed or palmaltely lobed with the apex lode long and pointing.





Commelina benghalensis L.

The first leaf appears unfolding, broadly oval or ovoid or broadly elliptic in shape. The subsequent leaves emerge form the sheath of the previous leaf and are whorled. The lamina is light to dark green, broadly ovate with a blunt apex.





Commelina diffusa L.

The first leaf arises from the soil singly. The subsequent leaves arise alternatively from the centre of sheath of the previous leaf. The lamina is linear, shighty folded inwards, thick and light green. The leaf sheath and stem are reddish in color.





Convolvulus arvensis L.

The cotyledons are large, nearly as broad as they are long, roundish, notched on the end, and dull green, with readily visible venation. The seed leaf stalks are flattened and grooved on the upper side. The first true leaves are triangular in shape, pointed and deeply lobed at the base. The leaves are dull green, some times with fine granules (bloom) on the surface. The veins are pale green, depressed on the upper surface, and outstandingly on the underside.





Convolvulus pluricaulis Choisy.

Cotyledons are oval and the subsequent leaves arise from the centre giving rosette appearance. The leaves are narrowly elliptic to lanceolate, variable in size with shallowly serrated margins.

Conyza Canadensis (L.) Cronq.

The cotylendons are twice as long as they are wide. They are dull green and their short stalks are sometimes tinged a dull brownish purple, both leaves and stalks are covered with soft, short hairs. In the rosette stage, the true leaves and their margins are covered with hairs, but the underside of these early leaves are smooth.The leaf stalk widen into the leaf blade whose margins are entire or shallow toothed.





Corchorus aestuans L.

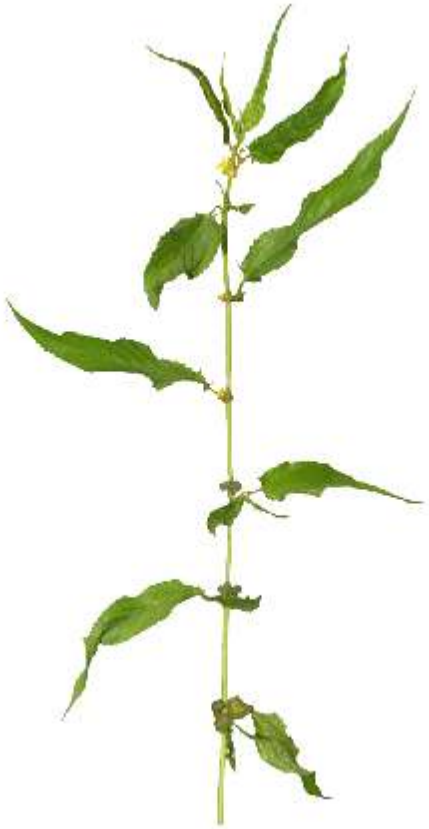
Cotyledons are dull green, round, petiolate, opposite; hypocotyls is reddish. The first true leaf is green, broadly oval, with clear venation and serrated margins. Subsequent leaves are petiolate with reddish petiole, broadly elliptic to ovate in shape with two hair like appendages at the base of the lamina.





Corchorus capsularis L.

Cotyledons are green, petiolate, thick, round to ovate with round apex.
The first and subsequent leaves are petiolate, alternate, elliptic to lanceolate, green with dentate margins and pointed apex.



Corchorus fascicularis L.

The Cotyledons are small, round, green with reddish petioles. The first and subsequent leaves are lanceolate, alternate, green, with reddish petioles and possess two short hair like appendages at the base of the lamina.





Corchorus olitorius L.

Cotyledons are round to ovate, petiolate, with slight pinkish colour on the petioles. The first and subsequent leaves are elliptic-lanceolate, petiolate, alternate, with serrated margins.





Corchorus trilocularis Auct.

Cotyledons are round, dull green, petiolate with reddish petioles. First true leaf is ovate, dull green, petiolate with wavy margins. The subsequent leaves are petiolate, oblong-lanceolate, with reddish petioles and serrated margins.





Cyanotis axillaris Roem. & Schult. F.

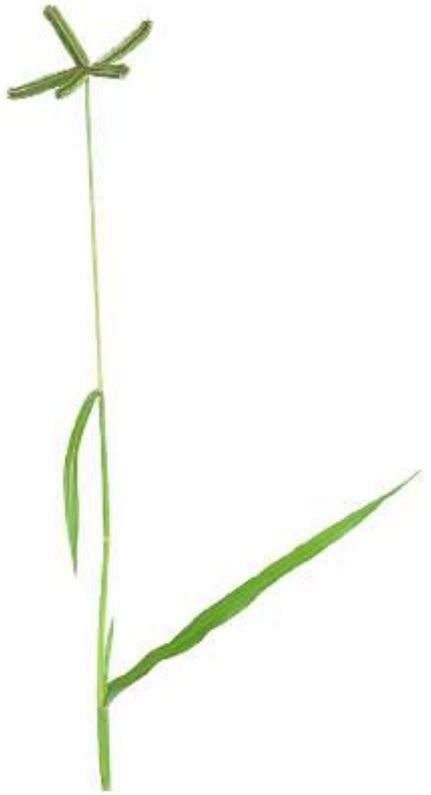
The single leaf arises from the soil initially. It is narrow, linear, thick, shightly purplish red at the base with green surface, and purplish tinged margins. Subsequent leaves are alternate, long, narrowly linear, slightly folded along the midvien, thick and dark green.

Cyperus rotundus L.

The seedling emerges from the soil as a bunch of light green, pointed leaves. The leaves are long, linear with pointed apex. The leaves arise from a single point are alternate and are radiating outwards.

Dactyloctenium aegyptium (L.) Willd

Leaf blades and sheaths are without hair. Leaf margins have long, stiff hairs. Ligule fringed, membranous. The leaf blades are linear with broad base and tapering apex. The seedling branches from the base of the stem radially.







Desmodium laxiflorum. DC.

The cotyledons are dark green, thick, shiny, slightly curved along one margin giving a kidney appearance, sessile or short petioled. The first true leaves are opposite, long petioled, the petioles are light reddish in colour. The lamina are light green, round. Next few leaves are single, long petioled, alternate and heart shaped. Subsequent leaves are trifoliate, the leaflets being broadly ovate-lanceolate with the apex leaflet longer than the lower pair, dull green with prominent midvien.





Desmodium triflorum (L.) DC

Cotyledons are round to ovate, dull green, petiolate, petioles reddish. The first true leaf is single, round, petiolate, appears like a flag. The subsequent leaves are trifoliate, leaflets spathulate, and the apex leaflet is bigger than the lower two.

Digera arvensis Forssk.

Cotyledons are linear, shiny green with short, reddish purple petioles. The hypocotyle is reddish purple. The first and subsequent leaves are long petioled, ovate, dull green to light green, often with purple ting, and wavy margins.

Echinochloa colona (L.) Link.

The first leaves are grayish, dull green, often with several widely spaced purple bands about 5-6 mm wide on leaf blade surface.

Echinochloa crusgalli (L.) Beauv.

Leaves are without hairs (glabrous), auricles, and ligules, and the leaf sheaths are often tinted red or maroon at the base.





Eclipta alba (L.) Hassk.

Hypocotyl is light green to light purple. The cotyledons are spatulate, with a midvein evident on the lower surface, dark green and shiny, glabrous, slightly thickened. The first and subsequent leaves are opposite, petiolate, elliptic. The stem is dark purple very often. The stem and leaves are finely pubescent.





Eragrostis pilosa L.

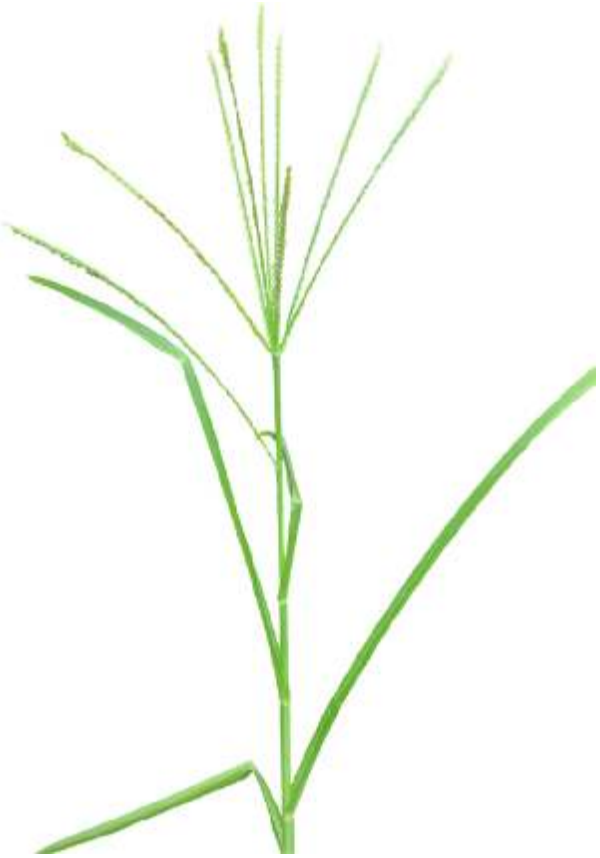
A single, narrow, dull green leaf blade emerge from the soil. Subsequent leaves are alternate, linear, lanceolate with acute apex. Leaf sheath often tinged with dark purple color.





Eleusine indica (L.) Gaertner.

First leaf is 3-5 times longer than wide, and opens parallel to the ground. Leaf sheaths are flattened, smooth, and even on seedlings often are distinctly white to silver at the base



Euphorbia geniculata Orteg.

The hypocotyl is reddish at the base. The cotyledons are linear to linear-lanceolate, opposite, dull green. The first pair of leaves are opposite, elliptic to lanceolate, light green and glabrous. Subsequent leaves are variable in size, broadly ovate-elliptic, dull to dark green.





Euphorbia hirta L.

Cotyledons are round to ovate outline with length little more than breadth, dull green, densely hairy on the surface and margins. The true leaves are opposite, thick, leathery to touch, rhomboid in outline, dark greyish green with serrated margins.





Euphorbia hypersifolia L.

Cotyledons are round in outline with length little more than breadth, dull purplish green, margins hairy. The true leaves are opposite, thin, irregularly oval to rhomboid in outline, light green, born on pinkish purple stem.





Euphorbia thymifolia L.

The Cotyledons are small, round to oblong, dark purplish green with purplish petioles and stem. The first true leaves are opposite, obovate, petiolate and dark purplish green.
The subsequent leaves are compound, paripinnate with leaflets opposite, and in 3-5 pairs.





Evolvulus alsinoides L.

Cotyledons are thick, dark green, oval or ovate, petiolate with dark purplish colour at the base of the petioles. The first true leaves are petiolate, opposite, obovate to spatulate, light green. The subsequent leaves are petiolate, alternate, elliptic, light green and densely hairy on the margins and surface.





Evolvulus nummularius (L.) L.

The early leaves are round to oval or obovate, alternate, closely spaced appears as emerging from a single point. With the elongation of the stem the leaves are spaced apart, rounded to heart shaped with round apex; stem reddish and branches from the base and spreads laterally on the surface.





Gomphrena decumbens Jacq.

The cotyledonary leaves are linear. The first pair of leaves oblong-obovate, opposite. Subsequent leaves are long, narrowly elliptic, opposite, dull green, shiny with prominent midvien and fine hairs on the surface and margins. All the subsequent leaves are opposite but arise from the a single point giving the plant a rosette appearance.





Hibiscus panduriformis Burm. f.

The cotyledons are round to heart shaped, light green, finely hairy, petiolate. The first and subsequent leaves are heart shaped, light to dark green, finely hairy on the surface with pointed apex and shallowly dentate margins. The stem, leaf petioles and leaf surface are covered with stiff white hairs and are rough to touch.





Hibiscus vitifolius Linn.

The cotyledons are thick, dark green with prominent midvien, petiolate, kidney shaped. The first and subsequent leaves are heart shaped, finely hairy on the surface, short petioled with dentate margins, Later leaves are deeply 3-5 lobed, long petioled, dark green in colour, covered with fine hairs.

Hyptis suaveolens (L.) Poit.

Cotyledons are thick, triangular to broadly ovate with a dent on the apex, light green in colour. The hypocotyl is white, finely hairy. The first true leaves are sessile, opposite, broadly ovate with serrated margins and prominent venation on the upper surface. The subsequent leaves are ovate- cordate, opposite, light green with serrated margins and point apex.





Ipomoea hederacea (L.) Jacq.

Cotyledons are notched at the apex, and this notch forms an angle between the lobes that is less than 90 degrees. The cotyledons are only shallowly or moderately indented, and the lobes are usually rounded or only slightly pointed. Cotyledons are notched at the base, and are close to square in outline, with only a slight flare outwards. The first one or few leaves are cordate, petiolate. Subsequent leaves are shallowly to deeply trilobed with long petioles.

Ischaemum rugosum Salisb.

Most of the time the seedlings emerge in pairs because the spikelets (two seeds) fall together. The seedling emerges from the soil as a rolled leaf with a pointed apex. At the initial stage it appears white to light green with purple tinge at the apex. Slowly the leaves rolls out and the leaves are alternate, lanceolate, dark green, with a pointed apex. Leaf sheath and margins are hairy.





Lagascea mollis Cav.

The cotyledons are round in outline with little longer than wide, light to dark green, finely pubescent. First pair of leaves are opposite, short petioled, narrowly ovate-lanceolate. subsequent leaves are petiolate, ovate to triangular in ouline, with slightly wavy margins and finely hairy on the upper surface.





Lathyrus aphaca L.

Initially the seedling emerges with unfolded leaves and appears with dark reddish purple stem and unopened lamina. Later on the leaves are narrowly elliptic to linear. Later the stipules appear as leaves which are triangular to ovate in shape and green in colour.





Lathyrus sativus L.

The stem is dull green with ash coated appearance.
The leaves are bifoliate and the leaflets are linear, dull green.





Leonitis nepetaefolia (L.) R. Br.

Cotyledons are ovate in outline with blunt apex. The leaves are in opposite pairs, short petioled, ovate-cordate with prominent venation, serrated margins and acute apex; light to dark green in colour.





Lepidium sativum L.

Cotylendons are petiolate, deeply 3-lobed, lobes lanceolate to oblong; foliage leaves petiolate, pinnatisect, lobes dentate.

Leucas aspera (Willd.) Link.

Cotylendons are dull green, ovate with round apex, petiolate. The first true leaves are opposite, narrowly elliptic, with shallowly serrated margins, light green in colour.

Ludwigia octovalvis (Jacq.) Raven.

The cotyledons are thin, papery, sessile, opposite, ovate in outline, dull purple. The stem is bright reddish-purple. The first leaves are shiny, green, opposite, shortly petiolate, lanceolate, with reddish purple tinge at the base. The subsequent leaves are alternate, longer than lower leaves.





Ludwigia parviflora Roxb.

The cotylendons are small, opposite, light green, dimond shaped. The first pair of leaves are opposite, light green, ovate with round apex. The subsequent leaves are alternate, broadly ovate to lanceolate with shallowly dentated margins.





Malvastrum coromandelianum (L.) Garcke.

The cotyledons are cordate with blunt apex, light green.The first true leaf is round, margins toothed, light green. Subsequent leaves are alternate, round to ovate with prominent venation on both the surfaces and toothed margins. The petioles are light purplish green.





Martynia annua L.

Cotyledons are oblong, thick, dark green in colour, opposite and sessile. First pair of leaves are ovate-cordate, opposite with pinkish purple venation and shallowly wavy margins. Subsequent leaves are opposite, large, broadly ovate-cordate, petiolate, petioles are pinkish-red in colour.





Mecardonia procumbens (Mill.) Swall.

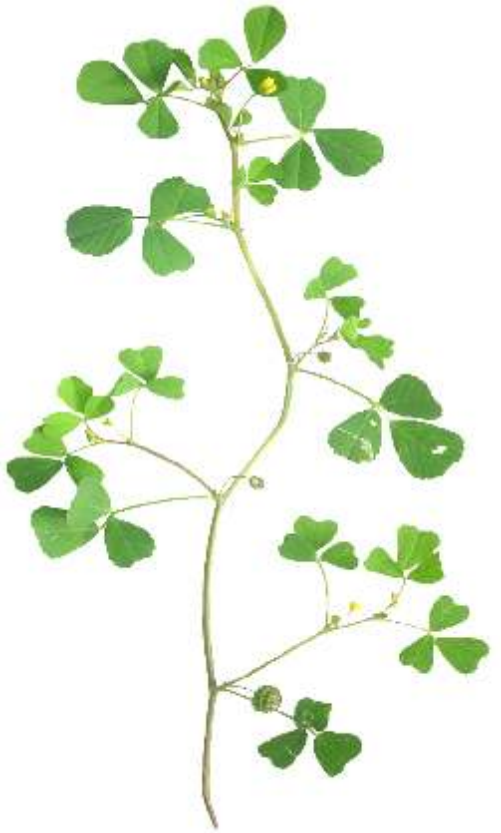
Cotyledons small, round to oval, sessile, dull green with light purplish at the base. First true leaves are small, short petioled, opposite, ovate in outline. Subsequent leaves are broadly ovate-cordate, light green with prominent veins and dentate margins.





Medicago denticulata Willd.

The cotyledons are twice as long as they are broad, oval shaped, dull green on the upper surface, and paler on the under side. The first true leaf is a roundish single leaflet. The second and later true leaves all have three leaflets that often have reddish tinged mid-veins and stalks. These leaflets are somewhat wedge shaped with toothed margins and indented tips. Each rises from the same point at the end of the leaf stalk. Small leaf like structure (stipules) with long irregular teeth are present where the leafstalk join the stem.







Melilotus alba Medikus.

Cotyledons are dark green, twice longer than broad, with short reddish petioles. The hypocotyl is dark reddish. The first true leaf is long petioled, flag like, round to ovate, dark green on the upper surface and light green on the lower sides. The second and subsequent leaves are long petioled, trifoliate, leaflets are almost equal in size, spatulate in shape, shallowly dentate along the margins.





Melilotus indica (L.) All.

The cotyledons are light green, longer than wide; sessile or very short petioled. The first leaf in a unifoiate flag like leaf, long petioled, the petiole is light to dark reddish in colour. The second and subsequent leaves are long petioled, trifoliate, leaflets light green, spathulate, with shallowly dentated margins. The upper surface of the first leaf and the subsequent leaflets have reddish tinge along the midvien.





Melochia corchorifolia L.

The cotyledons are round, petiolate, shiny green and finely hairy on the surface. First leaf is round to cordate with round apex, clear venation, and serrated margins. Subsequent leaves are long petioled, ovate-cordate, light green, shightly hairy on the petioles.





Merremia emarginata (Burm. f.) Hall. F.

The pair of cotyledons are like a butterfly in outline, thick, initially purplish green with purplish venation and then turn to light to dark green, petiolate, hypocotyl and petioles are light reddish in colour. The first true leaf is cordate, apex round, petioles reddish in colour. Subsequent leaves are alternate, round to cordate in outline, light to dark green with shallowly wavy margins.





Mimosa invisa C. Mart.

Cotyledons are thick, dark green, oval, glabrescent. Hypocotyl is short and white. The first and subsequent leaves are compound leaves, long petioled, petioles reddish in color; Leaves are paripinnate with 5-10 pairs of leaflets. Leaflets are narrowly oblong, light to dark green, glabrous.





Mimosa pudica L.

The hypocotyl is short, mostly not visible. The cotyledons are thick, shining green, glabrous, round with a shallow notch at apex. The first and subsequent leaves are compound with long reddish petioles, and with 5 to many pairs of leaflets. Leaflets are linear to oblong, light green and sensitive to touch.





Mollugo nudicaulis Lam.

Cotyledons are small, narrowly ovate, light green, glossy on the surface, glabrous, sessile, with light reddish tinge at the base. The first and subsequent leaves are variable in size, round to obovate, light to dark green, glossy, arising from the base of the stem forming a rosette.





Mollugo pentaphylla L.

Cotyledons are thick, light reddish green, shiny, narrowly oval in outline. The first pair of leaves is sessile, round, light reddish green, shiny. Subsequent leaves arise from the centre of the stem, bright green, sessile, elliptic to obovate, smooth and shiny on the surface. Later leaves arise from the elongated stem.





Murdannia nudiflora (L.) Brenam.

A single, folded leaf blade arises from the soil. It is light green, thick, narrow. The subsequent leaves arise from the centre of the leaf heath of the previous leaves. The leaf blade is linear, somewhat thick, brittle, slightly folded inwards along the length.





Oldenlandia corymbosa L.

The cotyledonary leaves are small, dull green, lanceolate. The leaves are in opposite pairs, sessile, linear-lancolate, glabrous, light to dark green, shining on the upper surface, acute.

Operculina turpethum (L.) Silva Manso.

The hypocotyl is reddish in colour. The cotyledons are deeply lobed giving 'V' shape in outline, light green, petiolate, petioles reddish. The first and subsequent leaves are alternate, narrowly cordate, with long reddish petioles.





Oxalis corniculata L.

The seed leaves (cotyledons) are oval, one to one and half times as long as they are broad. Hypocotyl is very short, scarcely above the soil. The first true leaf has three separate green leaflets that are folded downward and have prominent midribs.





Parthenium hysterophorus L.

Cotyledons oval, petioled, about 4-5 mm long, 3-4 mm wide. The first foliage leaf is entire like the cotyledons, but in addition hairy.
The following two leaves are sinuate, all further leaves pinnatifid.





Pedalium murex Linn.

The cotyledons are thick, silvery, green, sessile, oblong to narrowly ovate in outline with prominent white midvein and shining surface. The first pair of leaves are opposite, sessile, round, light green. Subsequent leaves are in opposite pairs, petiolate, grayish green to dark green with undulating surface and wary margins.

Phalaris minor Retz.

A dull green leaf blade with purplish leaf sheath appears above the ground. subsequent leaves arise from within the leaf sheath, linear with acute apex. Upon clipping the seedling leaves a purplish sap oozes from the cut part.





Phaseolus trilobus auct.

Cotyledons are ovate to heart shaped with a blunt or notch at the apex; they are dark green, shortly petioled, glabrous with prominent midvein. The first true leaf is trifoliate. Leaflets round to obovate, almost equal in size, dark green, with clear midvein and entire margins. Subsequent leaves are alternate, petiolate, trifoliate, and light to dark green in colour.





Phyllanthus madraspatensis L.

Hypocotyl is reddish in colour. The leaves appear as a group of 4-5 at the apex of the stem. Leaves are initially linear, thick, papery, dull green. Later on the leaves become oblong to narrowly obovate, alternate, born spirally on the stem. The leaves up the stem are small, spatulate, thick, papery, dull green and glabrous.





Phyllanthus niruri L.

The cotyledons are dull green, sessile, narrowly ovate in outline; The hypocotyl is light green. The first pair of leaves are sessile, opposite, light green, spatulate. Subsequent leaves are compound leaves with 2-5 pairs of leaflets. Leaflets oblong. light to dark green.





Phyllanthus urinaria L.

Hypocotyl is reddish in color. 6-8 purplish green, spathulate cotyledonary leaves appear at the hypocotyls apex. The first and subsequent leaves are compound leaves, paripinnate with bright red petioles and 5-10 pairs of leaflets. Leaflets are light to dark green, sessile, alternate, oblong and glabrous.





Physalis minima L.

The cotyledons are 3 times as long as they are broad, lance shaped, and rounded at the tip. The first true leaves are much broader than the seed leaves and are either smooth or wavy around the edges. They are greyish green and have very short, fine hairs, although some are hairless.





Plumbago zeylanica L.

The cotyledons are light green with shiny surface and a prominent midvein, oblong. The first true leaves are alternate, short petioled, ovate in outline, light green and glossy on the surface.





Portulaca oleracea L.

The seed leaves (cotyledons) are thick, succulent, tinged with red and two to three times as long as they are broad. The first true leaves are fleshy, shorter and much broader than the seed leaves and rounded at the tip. The leaves and young stem often have considerable red or purple colour in the seedling stage. The upper most leaves of the young plant are closely flattened in the bud.





Portulaca quadrifida L.

Cotyledons and subsequent leaves are similar in appearance. Leaves are small, thick, oval to lanceolate, purplish green, opposite. Later leaves up the stem are in pairs, one opposite to the other.





Psoralea corylifolia L.

The cotyledons are thick, sessile, green, shining, oblong, bean shaped in outline. The first pair of true leaves are opposite, oval to ovate in outline, dark green with widely shaped dentate margins. Subsequent leaves are ovate - lanceolate, petiolate, alternate, dull to dark green.

Rungia pectinata (L.) Nees.

The cotyledons are small, round. The first pair of leaves are irregularly round, opposite; The subsequent leaves are opposite, light to dark green, sessile, broadly ovate in outline with round apex, minutely dentated margins and clear venation on the upper surface, branching starts at the base of the stem at the seedling stage.





Scoparia dulcis L.

Cotyledons are small, dull to dark green, ovate in shape, thick. First pair of leaves are sessile, ovate-cordate, dark green with shallowly dentate margins. Subsequent leaves are short petioled, ovate-lanceolate, light to dark green, margins dentate on the upper ¾ of the lamina.





Sida acuta Burm. f.

Cotyledons are petiolate, heart shaped; light green. The first leaf is round to oval in outline, green, with dendate margins and prominent venation. Subsequent leaves are alternate, petiolate, elliptic to lanceolate, dark green with prominent midvien and internal viens, and serrated margins and acute apex.





Sida cordata (Burm.f.) Borssum.

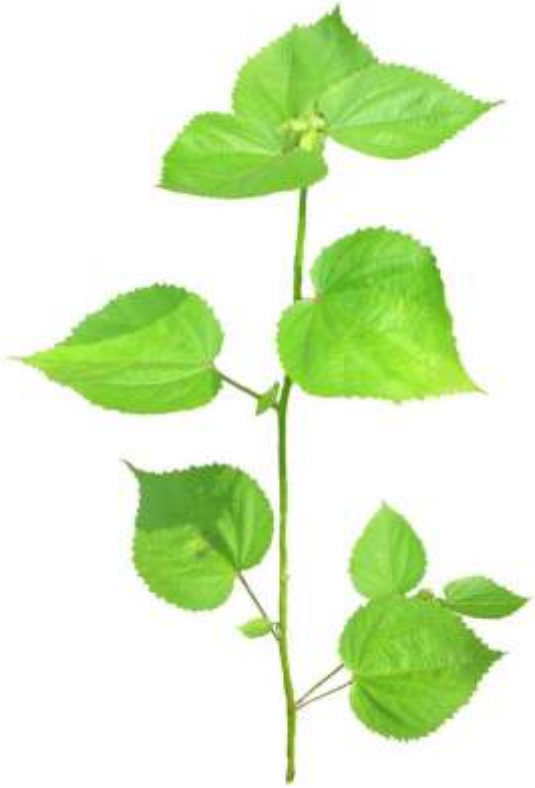
The cotyledons are round to cordate with blunt tip, short petioled, light green, thick, glabous. The first true leaf is cordate, light green, emarginate. Subsequent leaves are long petioled, alternate, cordate, finely hairy on the surface and margins and light to dark green in colour.





Sida cordifolia L.

Cotyledons are heart shaped, petiolate, light green, glabrous. The first true leaf is petiolate, cordate, light to dark green, finely hairy on the surface and margins. Margins are toothed, subsequent leaves are long petioled, alternate.







Sida rhombifolia L.

Both cotyledons are generally heart-shaped with a small indentation at the apex. The first true leaves are widest above the middle and tapering toward the leaf base (rhombic in outline). The subsequent leaves are alternate, short petioled, broadly rhomboid, dull green with dentate margins.





Solanum elaeagnifolium Cav.

The hypocotyl is dark purplish black in color. The cotyledons are dull green, linear with acute apex. First one to two leaves are ovate-lanceolate in outline, dark green. Subsequent leaves are linear-lanceolate with wavy margins, silvery green and pubescent.





Solanum nigrum L.

Cotyledons are covered with short hairs along the margins, midribs evident on lower surface, and petioles are also covered with hairs. Stems below the cotyledons (hypocotyls) are hairy and green in color. The true leaves are alternate, ovate to triangular in outline, densely hairy on the surface and margins, light to dark green.





Solanum xanthocarpum Scharad. & Wendl

Sonchus asper (L.) Hill.

The cotylendons are roundish, or 1-1.5 times as long as broad, and are greyish green, coverd with a whitish powerd (bloom).The first true leaf is also roundish, stalked and has delicate prickles around the margins. It is pale powdering green on the underside. A milky frice flows from the midvein of the fourth leaf and later leaves when they are crushed.





Sonchus oleraceus L.

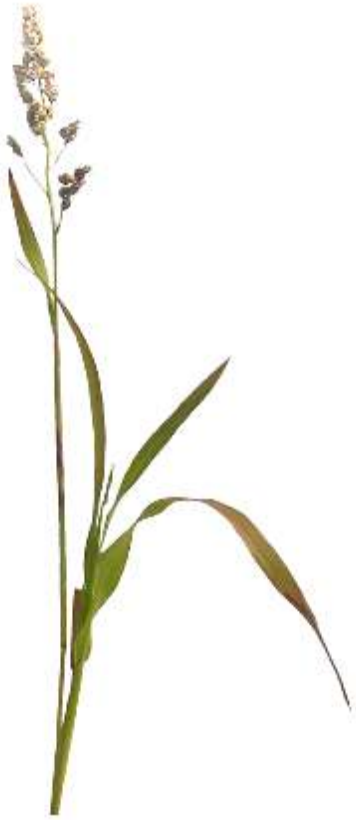
The cotylendons are smooth with a light grayish, powdering bloom. The first true leaves are broad at the top and tapes rather abruptly at the base. The leaves are dull, pinkish grey colour with a few thick, white hairs and are paler on the underside. Sometimes the leaves have soft rounded prickles.





Sorghum halepense (L.) Pers.

Leaves are rolled in the shoot, auricles are absent, and the ligule is membranous and may be toothed at the top. Leaf blades are without hairs (glabrous) on both surfaces and develop a prominent white mid-vein with maturity.







Spilanthes acmella (L.) L.

Cotyledons are round to oval, sessile or short petioled, light green, and sparsely hairy. The first and subsequent pairs of true leaves are short petioled, opposite, broadly ovate in outline with blunt apex; light to dark green and course to touch.





Spilanthes calva DC.

Cotyledons are small, round, somewhat longer than broad. True leaves are opposite, light green with minute hairs on the surface. The leaves are short petioled, narrowly ovate, light green in colour.





Stachytarpeta indica (L.) Vahl.

The cotyledons are heart shaped, light green, glabrous. The first pair of leaves are opposite, sessile, ovate-cordate with toothed margins. Later leaves are petiolate, light to dark green, broadly ovate with round apex and toothed margins.





Trianthema portulacastrum L.

The seed leaves (cotyledons) are thick, succulent and nearly as long as broad. The true leaves are fleshy, succulent, oval shaped or roundish and consistently opposite on the stem. The pairs of bright green leaves are unequal in size and occasionally have reddish tinge. The stems are often reddish or magenta tinged. The leaf stalks are widened at the base with two toothed stipule like expansions.

Tribulus terrestris L.

Cotylendons are thick, 2-3 times as long as wide, and brittle. The leaf stalks are pinkish. The blades are dark green above and greyish on the undersides. The blades are creased in the middle along the prominent vein, and rough to the touch, especaily on margins.





Trichodesma indicum (L.) R. Br.

The cotyledons are 1.5 time longer than broad, densely hairy on the margins. The first pair of leaves are opposite, initially ovate, and later expand to oblong-obovate, hairy on the margins and on the surface also. Subsequent leaves are opposite, lanceolate, light to dark green, hairy on the margins with clear midvein and lateral veins, and pointed apex.





Trichodesma zeylanicum (Burm f.) R. Br.

Cotyledons are almost round to somewhat square in outline, 1.25-1.5 times longer than broad, light to dark green, slightly hairy on the surface and margins. Subsequent leaves are in opposite pairs, lanceolate, light to dark green, densely hairy, course to touch.





Tridax procumbens L.

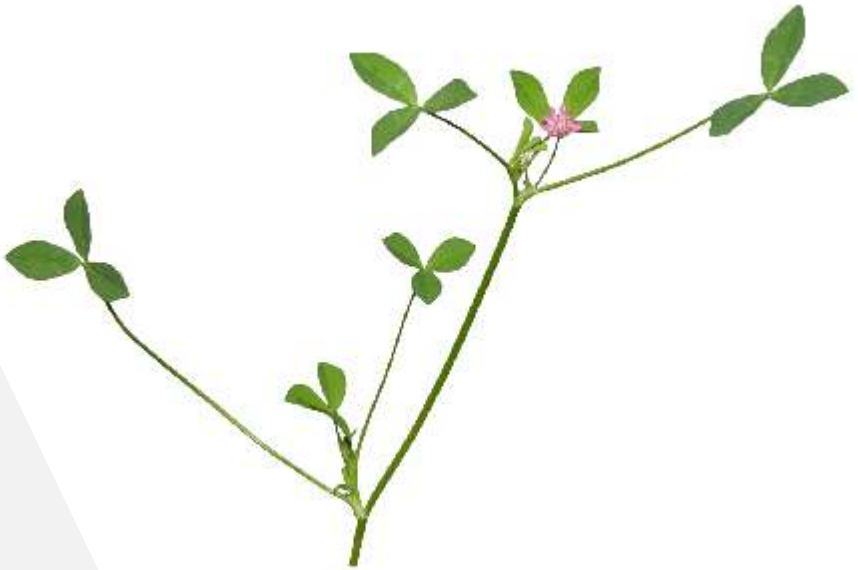
The cotyledons are not visible. The first pair of leaves are linear lanceolate, sessile, densely hairy. Subsequent one to two pairs of leaves are opposite, thick, dull green, densly hairy, narrowly ovate in outline, margins entire. Later leaves are sessile or short petioled, hairy, thick, dull green with wavy or shallowly lobed margins.





Trifolium fragiferum L.

Cotyledons are dull to dark green, sessile, oblong, and twice longer than broad. The first leaf appears as flag with long petiole and a round to cordate lamina with round to acute apex. The second and subsequent leaves are trifoliate, long petioled, leaflets are almost equal in size, elliptic with serrated margins.







Triumfetta rhomboidea Jacq.

The cotyledons are round to square in outline, bend downwards, light green, petiolate; petioles slightly reddish in colour. The first and subsequent few leaves are rhomboid in shape with dentate margins; short petioled. Later leaves are long petioled, alternate, rhomboid to shallowly trilobed with pointed apex.





Vernonia cinerea (L.) Less.

The first pair of leaves are round to oval in outline, opposite, light to dark green, seldom light purplish tinged. Subsequent leaves ore variable in size, alternate, ovate, petiolate, petiole winged. The leaves arise from are single point giving rosette appearance.





Vicia hirsuta (L.) S. F. Gray.

The cotyledons are not visible.The seedling arise from the soil with folded leaves which are dark reddish purple in color. The stem (epicotyl) in reddish purple in colour. The leaves unfold and light green; and are compound with 2-4 pairs of linear to narrowly oblong leaflets; tendrils borne on the top of the compound leaf.





Vicia sativa L.

The cotyledons are not visible. The epicotyl is dull purplish green with folded leaves a top. The leaves unfold to a pair of bifoliate leaves, the leaflets are narrow, linear and dull to dark green. Later on the leaves are compound with 4-5 pairs of opposite leaflets which are oblong, light to dark green with a pointed tip at the apex. Long, slender, light green, coiling tendrils arise from between apex pair of the leaflets.





Vollutarella divaricata Benth & Hook.

The basal leaves form a rosette.Initial leaves are obovate, dull green to greyish green with winged petioles and shallowly serrated margins. Subsequent leaves are petiolate, deeply discected, and greyish green with whitish midvein.





Xanthium strumarium L.

Hypocotyl is purple at the base and often green in the upper portion. Cotyledons are linear to oblong in outline, waxy, smooth, fleshy, thick, approximately 0.75 to 1.75 inches long and usually no more than 0.5 inch wide.
The first true leaves are opposite, while all subsequent leaves are alternate. The leaves are long petioled, irregularly cordate with wavy margins.





Zornia gibbosa Spanoghe.

The cotyledons are small, round to oval, light green, petiolate. The first and subsequent leaves are alternate, petiolate, bifoliate. The leaflets are lanceolate, glabrous, light to dark green, with acute apex.





Glossary

Acute	:	Sharp or pointed.
Alternate Leaves	:	One leaf attached per node. Newest leaf is of smaller size.
Auricles	:	Small appendages that project from the base of the leaf blade and appear to wrap, at least partially, around the grass stem.
Axil	:	The angle between one part of a plant and another part, e.g. a branch and a leaf.
Blade	:	Part of the grass plant that is above the sheath; the expanded portion of the leaf.
Broadly	:	Having a length:breadth ratio between 6:5 and 1:1; if the ratio is less then the shape is described as very broadly.
Collar	:	Junction of grass blade and sheath.
Cordate	:	A 2-dimensional shape; heart shaped in outline, i.e. having the base broad and distinctly notched.
Cotyledon	:	Seed leaves; the first pair of leaflike structures, usually paired, appearing above ground in most dicotyledonous plants.
Dentate	:	With sharp, spreading, rather coarse teeth standing out from the margin.
Elliptic	:	A 2-dimensional shape; oval in outline and with a length:breadth ratio between 3:2 and 2:1.
Emarginate	:	Having a broad, shallow notch at the apex.

Entire	:	Without any incisions or teeth.
Hypocotyl	:	Stem below the cotyledons.
Lanceolate	:	Lance shaped, much longer than wide, the widest point below the middle.
Leaflet	:	One of the ultimate segments of a compound leaf.
Ligule	:	A projection at the base of the leaf blade on most grasses; it may be either membranous or a tuft of hair.
Linear	:	A 2-dimensional shape: narrowly rectangular with parallel sides and a length:breadth ratio of at least 12:1.
Lobe	:	A division or segment of a leaf.
Margin	:	The edge of the leaf blade.
Mealy	:	Covered with a small, white bran-like bloom.
Midvein	:	The central vein of a leaf
Narrowly	:	Having a length:breadth ratio between 3:1 and 6:1; if the ratio is more than 6:1 then the shape is described as very narrowly, except in the case of very narrowly oblong which is termed linear.
Node	:	The part of the stem from which leaves or branches arise.
Oblanceolate	:	Lanceolate, with the more pointed end at the base.

Oblong	:	A 2-dimensional shape; rectangular with a length:breadth ratio between 3:2 and 2:1.
Obovate	:	A 2-dimensional shape: similar to ovate but attached at the narrower end and with a length:breadth ratio between 3:2 and
Opposite leaves	:	Leaves attached at the same node on opposite sides of the stem. Newest leaf pair are of similar size.
Ovate	:	A 2-dimensional shape; resembling a section through the long axis of an egg, attached near the broader end and with a length:breadth ratio between 3:2 and 2:1.
Ovoid	:	A 3-dimensional shape; egg shaped; ovate in outline.
Palmate	:	Three or more lobes or veins arising from one point.
Paripinnate	:	Pinnate with an even number of leaflets and without a terminal leaflet. A tendril may be terminal on the leaf.
Petiole	:	The stalk of the leaf.
Pinnate	:	Lobes or veins arranged on two sides of the midvein.
Rolled	:	Grass leafbud that appears wrapped around and around.
Rosette	:	A basal cluster of leaves in a circular form without discernable upright stem.
Serrate	:	Toothed so as to resemble a saw; with regular, asymmetric teeth pointing forward.
Sessile	:	Without a stalk.

Sheath	:	The lower part of the leaf blade that encircles the stem and younger leaves.
Spathulate	:	Spoon shaped; broad at the tip and narrowed towards the base.
Spine	:	A stiff, sharp, pointed structure, formed by modification of a plant organ.
Stipule	:	One of a pair of leaf-like, scale-like or bristle-like structures inserted at the base or on the petiole of a leaf or phyllode.
Tendril	:	A slender organ formed from a modified stem, leaf or leaflet which, by coiling around objects, supports a climbing plant.
Toothed Margins:		Sawtoothed or irregularly notched leaf edges.
Trifoliate:		Having three leaves.
Whorled:		Three or more leaves attached at the same node, often arranged in a whorl around the stem.