

#### I've Never Seen That Weed Before Weed Families & Kin ID



Agriculture and Agri-Food Canada

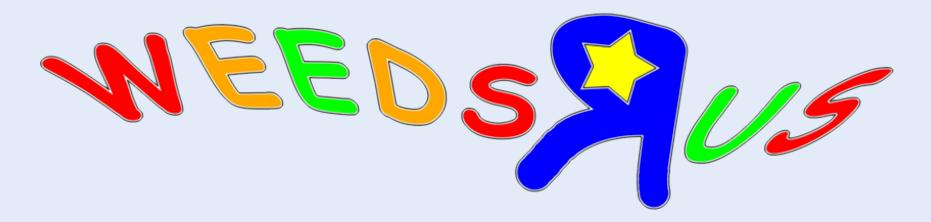
Agriculture et Agroalimentaire Canada



Edmonton, Alberta 26 November 2015







Plants become weeds when they obstruct our plans, or our tidy maps of the world. If you have no such plans or maps, they can appear as innocents, without stigma or blame.

**Richard Mabey** 

# How many weeds?

- About 351,000 species of flowering plants
   over 16000 genera in (about) 620 families
- All are potentially weeds somewhere for someone

# Identification

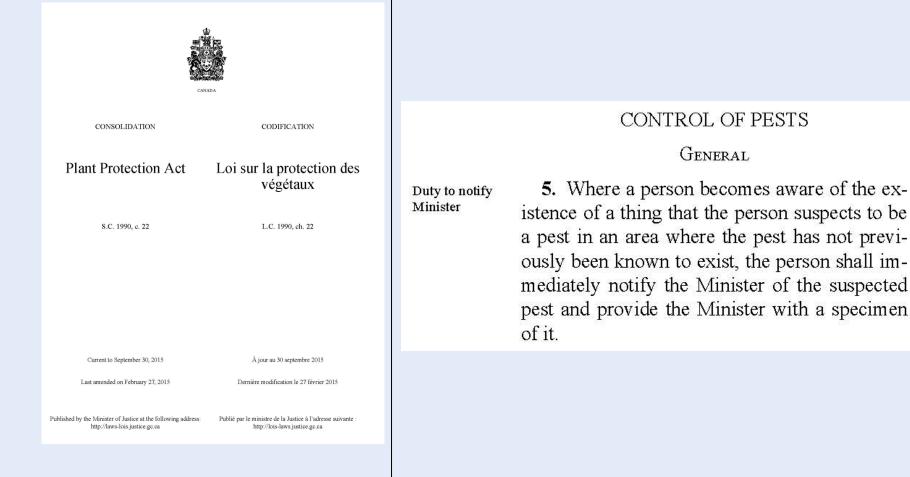
- Hardest job in the world
- Plants in bits, vegetative, seedlings, etc.
- Plants growing under stress
- Herbicide damage

# What is the ID worth?

- How important is it?
- What resources are needed?
- Is it urgent?

It might be worth more to someone else.

# It's the LAW !





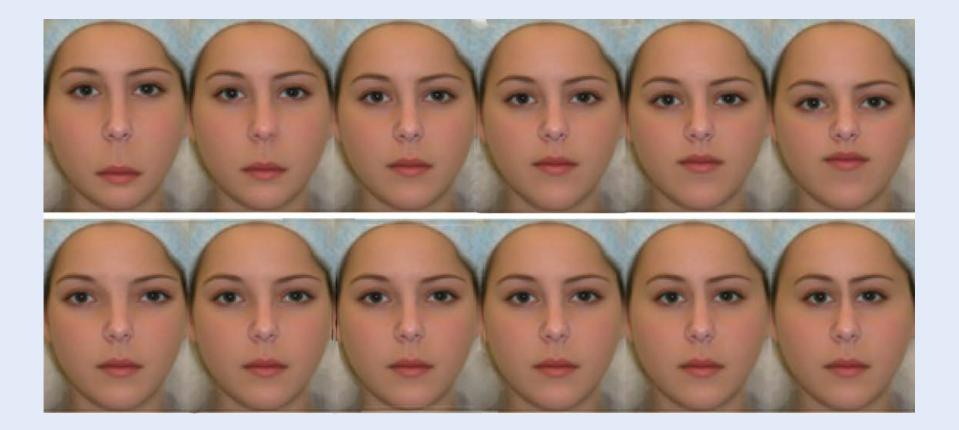
# **Plant Identification**

- recognition
- comparison
- use of keys and similar tools
- expert identification (help!)

#### Recognition of a familiar troublesome weed



### They all look the same to me















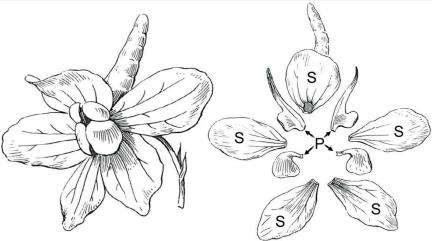




#### The same only very, very different



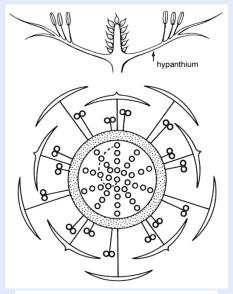




#### The same only very, very different

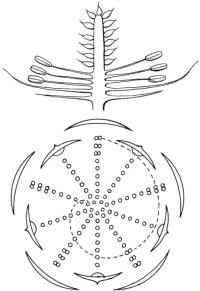






Rosaceae





Ranunculaceae

## Life cycle changes



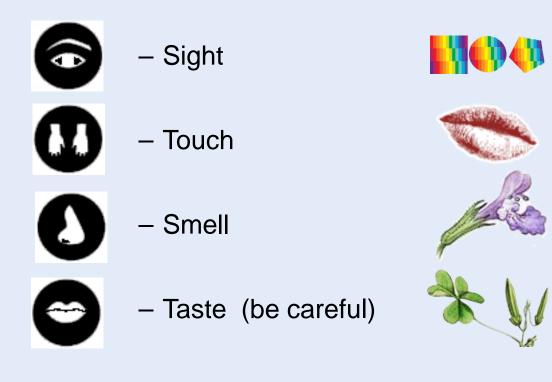




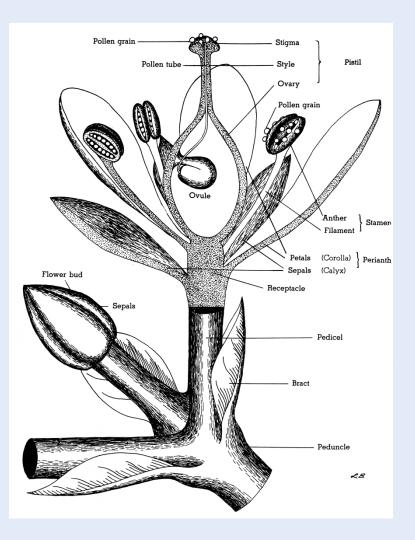


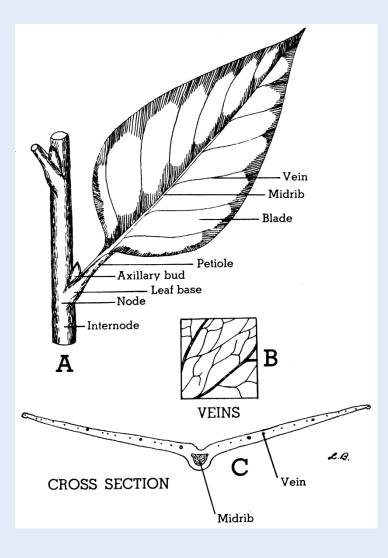
# Character analysis

#### Most senses can provide useful information

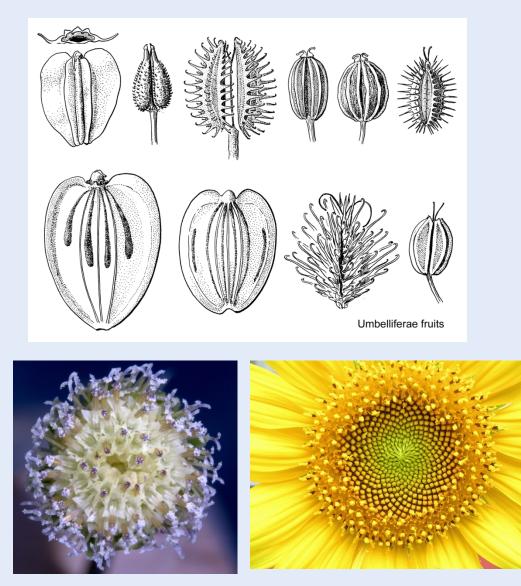


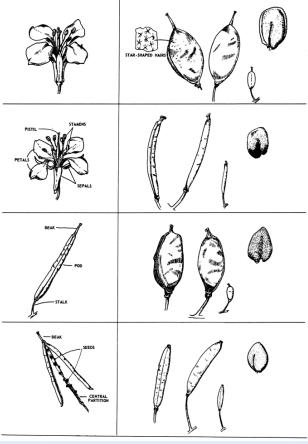
## Know your parts





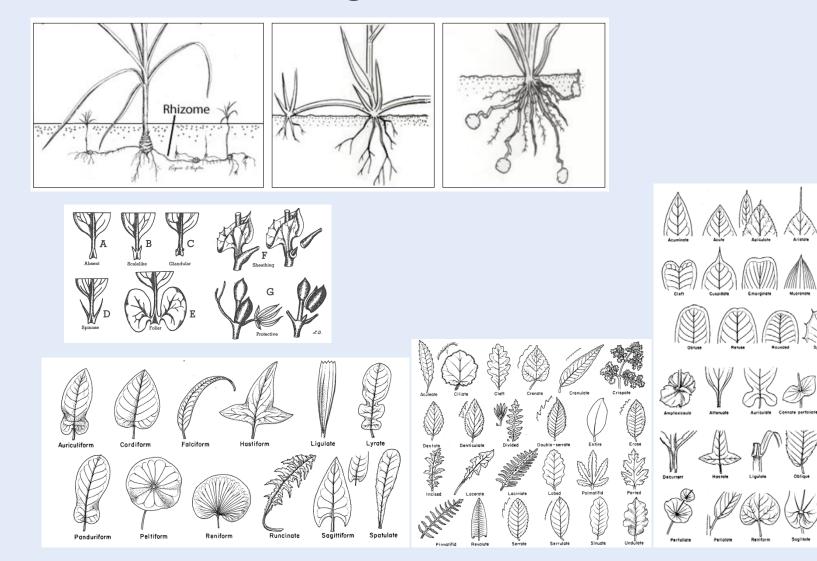
### **Reproductive parts**





Cruciferae fruits

## Vegetative parts



#### Nicandra physalodes



Calyx with 5 overlapping lobes. Ovary with 3-5 cells. Fruit a dry, many-seeded "berry", enclosed by the calyx.

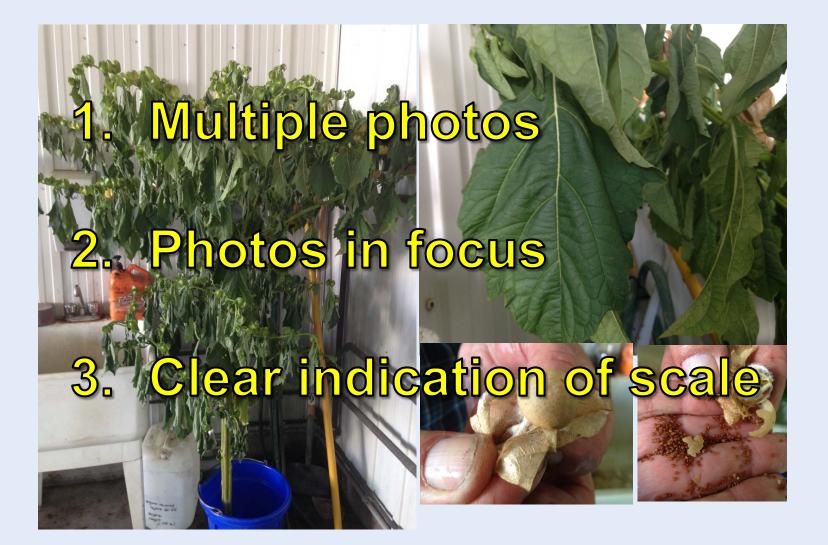
### Resources

- Friends or colleagues
- Texts and floras (± technical)
- Herbaria with associated experts (specimens)
- Online (synoptic) keys and other resources (most "apps" are not much help because of the relatively small coverage)
- Diagnostic centres

#### Many years of experience in the field !



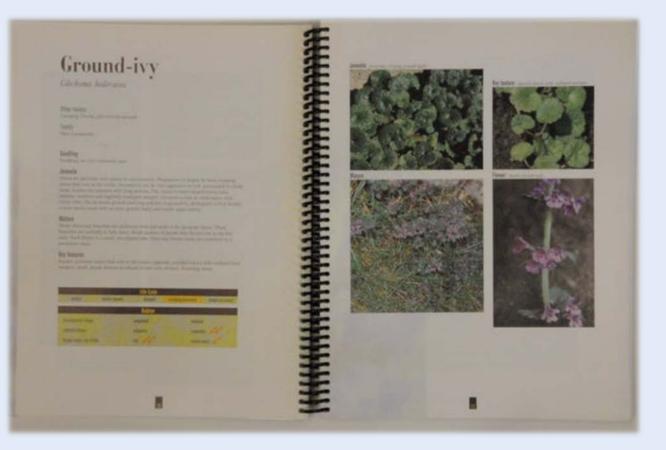
# Sending photos ?



# Sending specimens ?

1. As much of the plant parts as possible Collection data 2. **Collection data** <u>3</u>. POPULAR NAME Indian consegras LOCALITY Colchester Home Lawin DATE 08/15 COLLECTOR K.Obe

#### Low Tech



# Useful tools



10x is very useful, especially with free hands

#### KEY I (Herbaceous Dicots with Bisexual Flowers, Perianth in One Series, & Superior Ovary)

1. Ovaries more than 1 in each flower, the carpels separate at least above the middle of the ovaries
<ol> <li>Stipules conspicuous; leaves pinnately compoundROSACEAE (<i>Poterium</i>) (p. 832)</li> <li>Stipules none or leaves simple</li> </ol>
3. Ovaries united for most of lower half; leaves simple, unlobed
PENTHORACEAE (p. 738)
3. Ovaries distinct; leaves of most species lobed or compound
1. Ovary 1 in each flower (bearing 1 or more styles), the carpels united at least below the
styles
4. Leaves bipinnately compound, fruit a legumeFABACEAE (p. 591)
4. Leaves simple or compound (but not bipinnate); fruit not a legume
5. Plants with a solitary large (ca. 3-5 cm wide) white flower between a single usu-
ally opposite or subopposite pair of long-petioled cauline eccentrically peltate and
deeply lobed leavesBERBERIDACEAE (Podophyllum) (p. 461)
5. Plants with more flowers per stem or, if only one, then leaves not as above
6. Stamens more than twice as many as the perianth lobes or parts
7. Leaves tubular, open at apex and hence pitcher-like
7. Leaves flat, of normal structure, simple or compound but not hollow
8. Perianth small and inconspicuous (stamens more showy); leaves compound
with definite flat broad leaflets
<ol> <li>Perianth well developed, showy; leaves simple or dissected into very nar- rowly linear segments</li> </ol>
9. Leaf blades entire, unlobed except for deeply cordate base; plants aquatic
9. Leaf blades entire, unloced except for deepty contact base, plants aquade 
9. Leaf blades deeply lobed or dissected; plants terrestrial
10. Perianth parts 5; leaves pinnately dissected; sap watery
<b>RANUNCULACEAE</b> (Nigella) (p. 791)
10. Perianth parts 4 or 8; leaves ternately dissected (with watery sap) or
otherwise toothed, spiny-margined, or lobed (with milky or colored
sap)PAPAVERACEAE (p. 730)
6. Stamens only twice as many as the perianth lobes or parts, or fewer
11. Style 1 or none (stigmas may be 2 or more)
12. Stamens more numerous than the perianth divisions
13. Flowers bilaterally symmetrical; perianth colorful (white, yellow, or
pink)PAPAVERACEAE (p. 736)
13. Flowers regular; perianth dull, greenish
14. Leaves opposite; flowers mostly axillary
LYTHRACEAE (Ammannia) (p. 687)
14. Leaves alternate or basal; flowers mostly terminal
BRASSICACEAE (p. 480)
12. Stamens the same number as or fewer than the perianth lobes or parts
15. Leaves alternate or basal
16. Perianth parts (and stamens) 6, 8, or 9BERBERIDACEAE (p. 459)

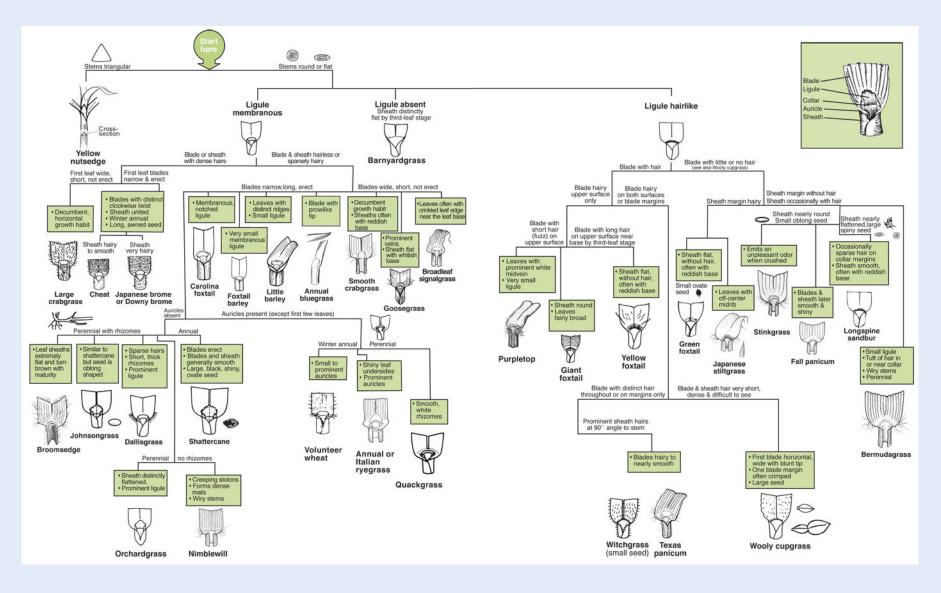
#### Dichotomous (mostly) keys

#### Section 11. Herbaceous Dicotyledons with Perfect Flowers; Calyx and Corolla both Present; Ovaries Two or More in each Flower.

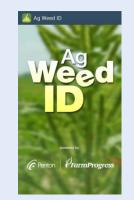
Ovaries 5 or more; leaves alternate; petals separate or barely united at the very base; stamens numerous, Malv.         Ovaries 4; corolla gamopetalous; stamens never monadelphous.       Malv.         Leaves alternate; corolla usually regular; stamens 5.       Boragina         Leaves opposite; corolla usually irregular; stamens 2 or 4.       Boragina         Styles as many as the ovaries, or in some plants not or scarcely developed at all.       Flowers irregular.         Stamens numerous; leaves compound or deeply divided ( <i>Aconitum, Delphinium</i> ).       Ranuncula         Stamens 5; leaves serrate or lobed ( <i>Heuchera</i> ).       Saxifrage         Flowers regular.       Saxifrage	naceae, <b>3</b> : 69. aceae, <b>2</b> : 524. aceae, <b>3</b> : 109. iiatae, <b>3</b> : 139. aceae, <b>2</b> : 155. aceae, <b>2</b> : 267.
Land plants with alternate, pinnately divided leaves. Liminanth- Mud plants with opposite entire leaves and minute axillary flowers ( <i>Tillaea</i> ). Crassult Sepals 3 (actually bracts, but easily mistaken for sepals); petal-like sepals 5–12; leaves all basal, 3–5- lobed ( <i>Hepatica</i> ). Ranuncult Sepals and petals each 4 or more. Petals united for part of their length into a tubular or salverform corolla. Leaves opposite.	aceae, 2: 147. aceae, 2: 494. aceae, 2: 259. aceae, 2: 183. aceae, 3: 69.
Leaves alternate; plants erect; flowers in terminal clusters ( <i>Amsonia</i> ). Apocyn Leaves alternate; plants trailing; flowers solitary on axillary peduncles ( <i>Dichondra</i> ). Convolvu Petals separate. Leaves rotund, centrally peltate; flowers solitary, 12–25 cm. wide ( <i>Nelumbo</i> ). Nymphaea Leaves not centrally peltate; flowers of smaller size. Cauline leaves opposite or whorled	naceae, <b>3</b> : 70. laceae, <b>3</b> : 86. nceae, <b>2</b> : 148.
Causiliary; petals not pinnatifid ( <i>Sedum</i> , <i>Tillaea</i> ). Crassula Cauline leaves alternate, or leaves all basal.	aceae, 2: 266. aceae, 2: 255. aceae, 2: 155.
Leaves simple, entire or serrate. Pistils fewer than the petals. Leaves simple or shallowly lobed. Leaves 3-foliolate or once-pinnately compound; flowers yellow (Agrimonia, Wald- steinia). Leaves ternately decompound; flowers white. Stamens 15 or more; pistils 3-5 (Aruncus). Rosa	ceae, 2: 281. ceae, 2: 255. ceae, 2: 260. ceae, 2: 281. ceae, 2: 287. ceae, 2: 260.

38(17). Joints of leaf sheaths and lamina somewhat pilose......39. + Joints of leaf sheaths and lamina somewhat glabrous.....42.

#### Illustrated key















#### ANGIOSPERM PHYLOGENY

#### **Flowering Plant Systematics**



BORELLALES	Amboraliaceae
MBORELLALES	Cabombaceae Hydatellaceae Nymphaeaceae
STROBAILEYALES	Austroballoyaceae Schisandraceae (incl. Illiciaceae) Trimeniaceae
LORANTHALES	
NELLALES	Canellacese Winteracese
PERALES	Aristolochiaceae Hydnorsceae Piperaceae Saurursceae Caluzathursee Homandiareae Monimiareae
URALES	Calycanthacese Hernandiacese Monimiacese Gomortegacese Siparunacese
AGNOLIALES	Annonaceae Eupomatiaceae Magnoliaceae Degeneriaceae Himantandraceae Myristicaceae
CORALES	Acoraceae Alismataceae (Incl. Limnocharitaceae) Juncaginaceae Ruppiaceae
ISMATALES	Alismateee (Incl. Limitocharitaceae) Junceginaceae Ruppisoteer Aponogronaceae Butonaccee Posidoniaceae Scheuchzerisceae Anaceae Hydrocharitaceae Posismogetonaceae Zosteraceae
TROSAVIALES	Petrosaviaceae
	Burmanniaceae Dioscoreaceae Nartheciaceae Taccaceae Cyclanthaceae Pandanaceae Velloplaceae
LIALES	Alstroemeriaceae Corsiaceae Melanthiaceae Philosiaceae Colchicaceae Etilaceae Petermanniaceae Smilacaceae
	Contracese Lillaceae Petermanniaceae Smiliscaceae Amaryllidaceae (incl. Agagenthaceae, Atlaceae) Hypoxidaceae Indaceae
PARAGALES	Tecophilaeaceae Xanthorrhoeaceae (incl. Asphodelaceae, Hemerocallidaceae)
RECALES	Arecacean
DALES	Bromeliaceae Eriocaulaceae Poaceae Restionaceae Xyridaceae Cyperaceae Juncaceae Rapateaceae Typhaceae (incl Spargeniaceae
OMMELINALES	Commelmaceae Hasmodoraceae Pontederiaceae
BIBERALES	
	Costanze Lowiscess Musicese Zingiturecees Ceratophyllaceae
CULALES	
	Circasasteraceas Lantizabalaceas Papaveraceas Sabiaceas
ALES	Neiumbonaceae Ptatanaceae Proteaceae
HODENDRALES	Trochodendraceae
a la contra c	
	Gunnaraceae Myrothamnaceae
INIALES	Dilleniaceae
FRAGALES	Altingiaceae Daphniphyllaceae Hamamelidaceae Cercidiphyllaceae Grossulariaceae Paeoniaceae Crassulaceae Haloragaceae Saxifragacear
	Crassulaceae Haloragaceae Saxifragaceae Vitaceas
	Krameriaceae Zygophyllaceae
and the second s	Celastrzose (Mr. Hippscratescen, Presidente) Lepidobotryaceae
LIDALES	Brunelliaceae Connaraceae Elaeocarpaceae Oxalidaceae Acharaceae Huaceae Oxalidaceae Acharaceae Euphyshiaceae Raffesiaceae Ochraceae Podostemaceae
LPIGHIALES	Arbartaceae Eughtriteceae Raffestaceae Ochvaceae Podostemaceae Chrysobalanaceae Hypericaceae Passilloraceae Rhizophonceae Chuistaceae Linaceae Phyliotethaceae Saficaceae Erythmorpheceae Majoghaceae Picnotendraceae Violaceae
LES	Fabaceae Polygalaceae Quillajaceae Suriariaceae
SALES	Barbeyaceas Elaeagnaceae Rosaceae Cannabaceae Moraceae Ulmaceae Dirachmaceae Rhamnaceae Urticaceae (vicr Cecropiaceae)
	Dirachmaceae Rhamnaceae Urticaceae (Act Cecropiaceae
CURBITALES	Anisophyllaceae Coriariaceae Cucurbitaceae Datisceceae Tetramelaceae
TS I	Betulaceae Fagaceae Myricaceae Rholpteleaceae Casuarinaceae Juglandaceae Nothofagaceae Ticodendraceae
ACC N	Francoaceae Geraniaceae Ledocarpaceae Melianthaceae
	Combietaceae Myrtaceae Penaisoceae (incl. Ollniaceae) Lythraceae (incl. Punicaceae, Sonieratlaceae, Trapaceae) Melastomataceae (incl. Nemecylaceae) Onagraceae Vochyslaceae
	Crossesomataceas Stachyuraceas
CRAMIN	eissolomatacese Stapityleaceae Stresourgenaceae
£8	And Annual Manual Manual Manual Manual Street
(Last	Bixa Mahacese (incit Bombacosae, Sterollacese, Tilacese) Cistaces Diptercas es Neuralaceae Sphierosepataces Thymelesceae
ALVALES	
RASSICALES	Cieomaceae Moringaceae Tovariaceae Koeberliniaceae Resedaceae Tropaeolaceae
	raceae Misodendraceae Opiliaceae Schoepfiaceae Viscaceae Viscaceae Viscaceae
ARYOPHYLLALES	Artorsse Derotroppisacies Pulyphaces Anarothicos Coryofyboses Milliginoses Polyphaces Anarothicos Didenaces Noperfusions Polyphaces Baselaces Drosophytoces Phytococces Talinoces Corbose Primerse Phytococces Talinoces
	jos: Clienspotiasser Drosensee Mystegiascae Simmontaliassie BaseRaceae Drosephyflaceae Physicaccaee Talinaceae Catlaceae Presideniaceae Phontegiascaee Tamariaasea
ORNALES	Cornecese Grubblacese Lossacese Curtisiacese Hydrangeaceae Nyssaceae
	Actinidiaceae Ericaceae Polemoniaceae Barraceniaceae Balsaminaceae Pointulaceae Brynacaeae Chebraceae Locythidaceae Roidulaceae Theoceae Ebenaceae Myrsinaceae Sapolaceee Theophrastaceae
RICALES	Actinidiaceae Ericaceae Polemoniaceae Barraceniaceae Balaaminoceae Fouquieriaceae Primulaceae Bryracceae Clehtraceae Locythicaceae Roidulaceae Theoceae Ebenaceae Myrsinaceae Sapotaceae Theophrastaceae
ACINALES	Oncothecaceae Icacinaceae
ETTENIUSALES	Metteniusaceae
	Eucommiaceae Garryaceae (Incl.Aucubaceae)
INTIANALES	Appcynaceae (incl. Asclepiadaceae) Loganiaceae Gentianaceae Geisemiaceae Rubiaceae
LANALES	Convolvulaceae (incl. Cuscutaceae) Solanaceae (incl. Nolanaceae Nydroiseae Montiniaceae Sphenocleaceae
	Hydroisaceae Montiniaceae Sphenocleaceae Acanthaceae Lamisceae Orobenchaceae Palotaginaceae Bignoniaceae Lentibulariaceae Paulosmiaceae Scrophulariaceae Bublidaceae Menniaceae Pedaliceae Stithaceae
MIALES	Bublissono Materiacese Pauloemaceae Scrophulariaceae

ALES	Gentianaceae	Aschipiadaceae)	semiaceae	Rubiaceae
LES	Hydroleaceae	incl. Cuscutacese) Mon	Solanac	eae (incl. Notanaceae) Sphenoclesceae
ES	Acanthaceae Bignoniaceae Byblidaceae Gesneriaceae	Lamiaceae Lentibulariaceae Martyniaceae Hydrostachyaceae	Orobanchaceas Paulowniaceas Pedaliaceas Oleaceas Phryma	Plantaginaceae Scrophulariaceae Stilbaceae Iceae Verbenaceae
ALES	Boraginaceae Co Heliotropiaceae	odonaceae Coldeni Hydrophyllacea		hretiaceae (+ Lammune) Wellstediaceae
IALES	Aquifoliacese	Cardiop	teridacese	Stemonuraceae
ES	Asteraceae Calyceraceae Gampanulaceae (k	Merrya	stiaceas i sthaceae	Pentaphragmatacese Roussescese Stylidiacese
ONIALES	Escalioniaceas			
ES	Bruniscese	Columettiaceae (in	ct Desfontainis)	
K.	Apizosze Antilacese		niacese arpacese	Pennantiaceae Pittosporaceae
YPHIALES	Paracryphiaceae			
100	Adoxaceas	Diervillaceae	Linnaeacea	. Valarianaraan

#### **DNA Barcoding?**

#### Animals: cytochrome c oxidase 1 Plants:

Marker	Genomic source	Туре
nrITS	Nuclear	Transcribed spacers and 5.8S gene
nrITS2	Nuclear	Transcribed spacer
atpF-H	Plastid	Inter-genic spacer
matK	Plastid	Protein coding
psbK-I	Plastid	Inter-genic spacer
rbcL	Plastid	Protein coding
гроВ	Plastid	Protein coding
rpoC1	Plastid	Protein coding
trnH-psbA	Plastid	Inter-genic spacer
trnL-F	Plastid	Intron and inter-genic spacer
trnL (P6)	Plastid	Intron









Empowering

the world

We make species IDs easy, reliable & scalable

The Canadian Centre for DNA Barcoding (CCDB) empowers customers by providing access to easy, reliable and scalable species identifications. The CCDB proudly serves clients from private, ment & academic sectors located in over 50 countries around the world. The CCDB is the birthplace of DNA Barcoding and offers unparalleled access to species identifications for over 200.000 animals, plants and molds

0 . . . .

DNA Barcoding is an innovative combination of taxonomy, genetics and computer science that automates the process of obtaining expert species identifications. The process is similar to Human Criminal Forensic DNA Fingerprinting techniques in that a standardized battery of genetic markers is used to identify unknown samples. The novelty of Barcoding is that it is used to tell species apart. For example, we can detect the presence of undeclared ingredients, such as horsemeat which illegally entered the United Kingdom's food supply chain in early 2013.

We invite you to explore this site to learn more about us, our current research & the services that we offer.

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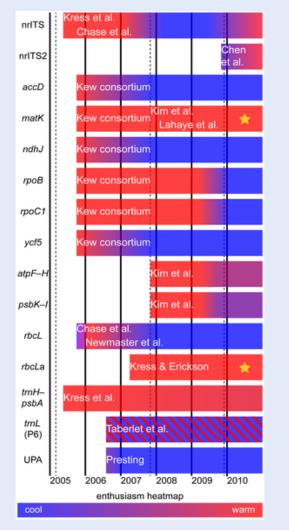
barcoding projects







Schematic timeline of the consideration of different markers as plant barcodes.



Hollingsworth PM, Graham SW, Little DP (2011) Choosing and Using a Plant DNA Barcode. PLoS ONE 6(5): e19254. doi:10.1371/journal.pone.0019254

One of the biggest challenges in reaching agreement on a plant barcode was a lack of comparative data encompassing all candidate markers and a broad taxonomic sample.

