

WASHINGTON STATE UNIVERSITY  
EXTENSION

**WSU Viticulture Certificate Program  
Grapevine Anatomy & Physiology**



me

Grape

Markus Keller



*Vitis vinifera* L.

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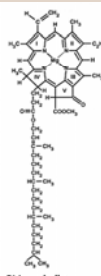
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**WSU Viticulture Certificate Program  
Grapevine Anatomy & Physiology**



**Botany  
&  
Geography**

Markus Keller



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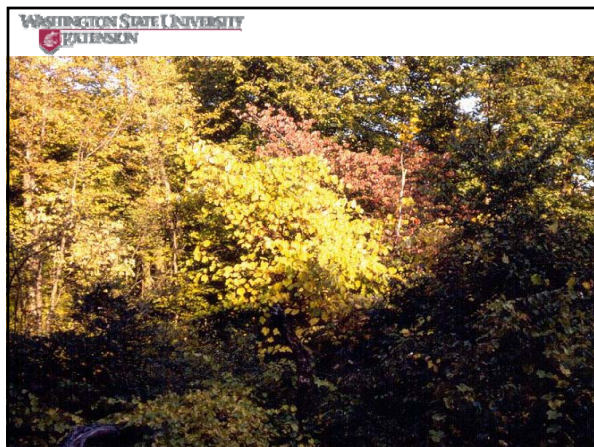
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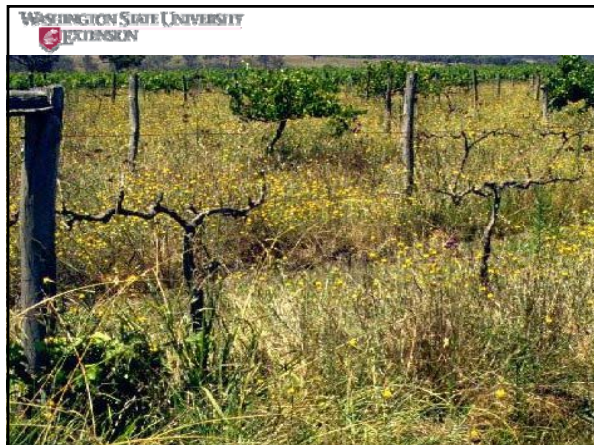
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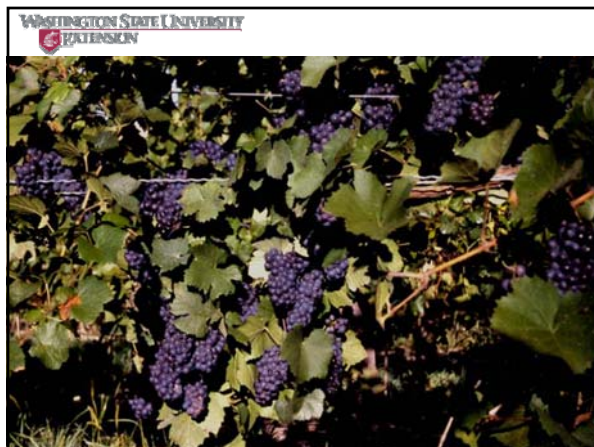
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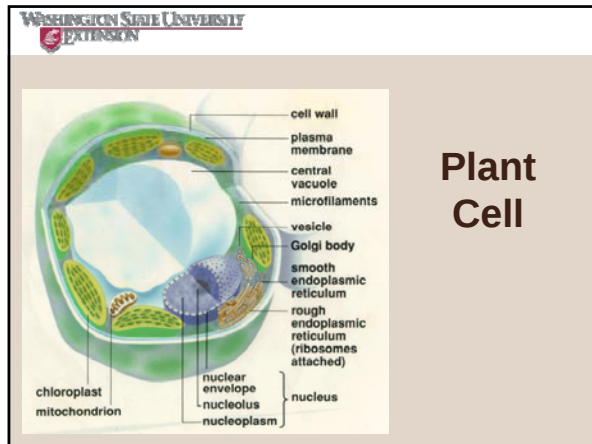
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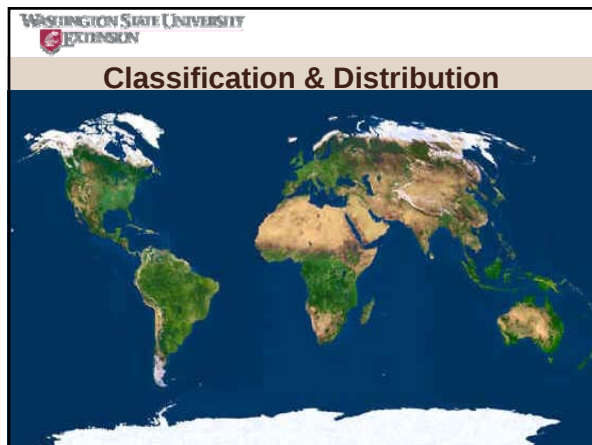
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**Botanical Classification**

- **Species** = Population(s), whose members can interbreed freely with one another under natural conditions, but not with members of other populations (i.e. closed gene pool).
- **Ecospecies** = Population(s) that can be easily distinguished by morphological characters and which are isolated from one another by geographical, ecological, or phenological barriers.

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## Botanical Classification

- **Domain:** Eukarya (sexually reproducing organisms)
- **Kingdom:** Plantae (~ 270,000 species)
- **Phylum:** Angiospermophytae (> 230,000 species)
- **Class:** Dicotyledoneae (~ 200,000 species)
- **Order:** Rhamnales
- **Family:** Vitaceae (~ 1,000 species)
- **Genera:** *Vitis* (~ 100 species)  
*Muscadinia* (3 species)

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## Botanical Classification

### Family Vitaceae

|                    | <i>Muscadinia</i> | <i>Vitis</i>            |
|--------------------|-------------------|-------------------------|
| <b>Chromosomes</b> | 2n = 40           | 2n = 38                 |
| <b>Leaves</b>      | Glabrous          | Hairy                   |
| <b>Tendrils</b>    | Simple            | Forked                  |
| <b>Bark</b>        | Non-shredding     | Shredding               |
| <b>Nodes</b>       | - Diaphragm       | + Diaphragm             |
| <b>Wood</b>        | Hard              | Soft                    |
| <b>Propagation</b> | Layering          | Cuttings                |
| <b>Origins</b>     | SE USA, Mexico    | N America, Asia, Europe |

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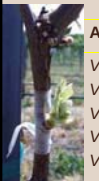
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## Botanical Classification

### Genus *Vitis*

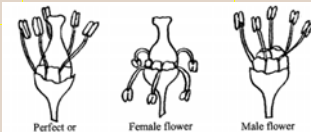


**American group**

- Vitis labrusca*
- Vitis riparia*
- Vitis rupestris*
- Vitis berlandieri*
- Vitis californica*

**Eurasian group**

- Vitis vinifera*
- Vitis silvestris*
- Vitis amurensis*
- Vitis coignetiae*



Perfect or hermaphrodite flower      Female flower (reflexed filaments)      Male flower (no ovary apparent)

• Very diverse  
• All interbreed

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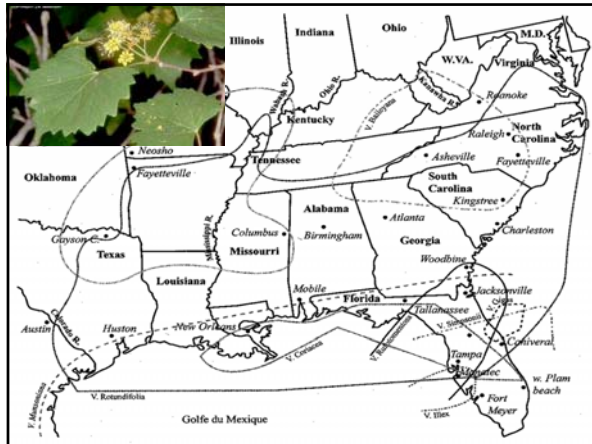
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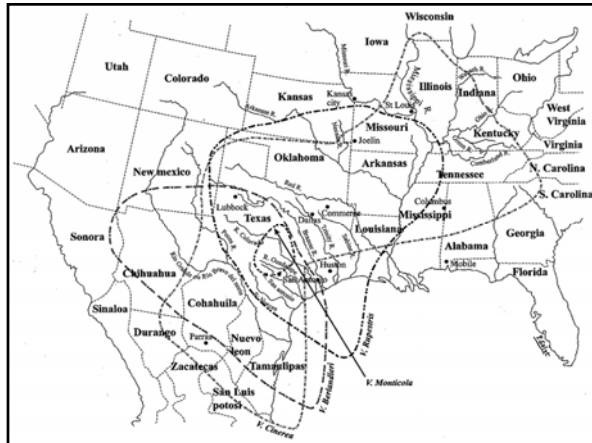
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**Genus *Vitis*, American Group**

***Vitis labrusca***

- Eastern USA, Georgia to SE Canada, west to Indiana
- Vigorous climber with continuous tendrils
- Hybrids with *V. vinifera* (Concord, Niagara, Sunbelt)
- Important juice grape (in USA)
- Foxy flavor (methyl anthranilate)
- Cold tolerant, resistant to powdery mildew
- Susceptible to phylloxera, downy mildew, black rot, and Pierce's disease
- America's gift to Europe!

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### Genus *Vitis*, American Group

#### *Vitis riparia*

- Texas to Canada, Atlantic Ocean to Rocky Mountains
- Tree climber along riverbanks on deep soils
- Important rootstock parent
- Shallow roots, low vigor
- Early ripening
- Cold tolerant, resistant to phylloxera and fungi
- Susceptible to drought, lime, and Pierce's disease

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### Genus *Vitis*, American Group

#### *Vitis rupestris*

- SE USA, Texas to Tennessee
- Vigorous shrub in rocky creek beds
- Important rootstock parent
- Deep roots, but drought susceptible on shallow soils
- Variable lime tolerance
- Resistant to phylloxera, powdery and downy mildew
- Susceptible to anthracnose

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### Genus *Vitis*, American Group

#### *Vitis berlandieri*

- Texas to eastern Mexico
- Tree climber on deep limestone soils
- Important rootstock parent
- Deep roots, drought and lime tolerant
- Latest ripening in American group
- Resistant to phylloxera, fungi, and Pierce's disease
- Very hard to propagate

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### Genus *Vitis*, American Group

#### *Vitis candicans*

- Southern USA to northern Mexico
- Very vigorous climber
- Drought tolerant
- Resistant to phylloxera, powdery and downy mildew, and Pierce's disease
- Hard to propagate
- Natural hybrids with *V. rupestris* and other native species (*V. champinii*, *V. longii*)

→ Very resistant to nematodes

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### Genus *Vitis*, Eurasian Group

#### *Vitis vinifera*

- Asia and Europe, 30-50 °N
- Probably originally from arid Caucasus mountains (Black Sea to Caspian Sea)
- Sometimes split in *V. vinifera* ssp. *sativa/silvestris*
- Wild vines are dioecious, but cultivated vines have perfect (or sometimes female) flowers
- Very important wine, juice, table and raisin grapes
- ~ 9000 cultivated varieties
- Susceptible to phylloxera, fungi, and Pierce's disease

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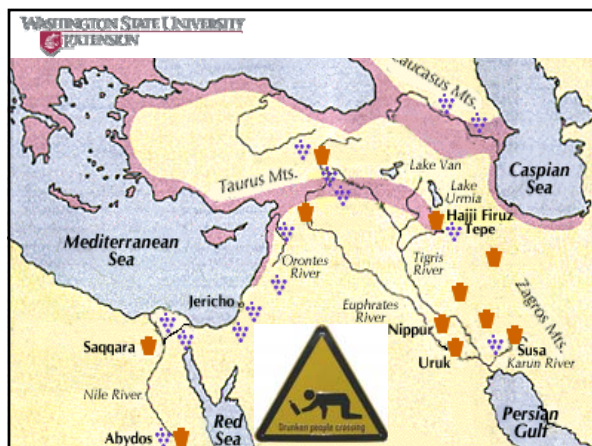
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## Genus *Vitis*, Eurasian Group

### *Vitis silvestris* (?)

- Western Asia and Mediterranean region
- In damp woodlands on alluvial soils

### *Vitis amurensis*

- Siberia to northern China
- Very cold tolerant

### *Vitis coignetiae*

- Japan
- Very similar to *V. labrusca* (used for jam)

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## Variety vs. Cultivar

- **Variety** = Population of cultivated vines composed of a single clone or several similar clones. Grape varieties ≠ botanical varieties (seedlings are not identical copies of parents). 'True-to-type' grape varieties require vegetative propagation.
- **Cultivar** = Clone from a single seedling and subsequently propagated asexually, so that all descendants are genetically identical.
- **Clone** = Group of vines of uniform type propagated vegetatively from an original 'mother' vine.

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## Variety Classification

atico Alicante Bouschet Aligoté Alphonse Lavallée Amigne Aramon Arinto Arvine  
Auxerrois Baco noir Barbera Barbaresco Black Corinth Blaufränkisch Blue  
Portuguese Bondola Burger Cabernet blanc Cabernet franc Cabernet Sauvignon  
Canaïolo Cardinal Carignan Carmenère Catawba Chambourcin Chardonnay  
Chasselas Chenin blanc Cinsaut Clairette Clevner Colombard Completer  
Concord Corvina Cot Crouchen Diana Dolcetto Dunkelfelder Elbling Ermitage  
Flame Seedless Flame Tokay Folle blanche Freisamer Frontignan Furmint  
Gamay  
blanc

### How to group > 9000 varieties?

Lagrein Lemberger Léon Millot Macabeo Madeleine Angevine Malbec Malvoisie  
Marsanne Malvasia Mataro Mauzac Melon Merlot Meunier Monbadon  
Morastrell Mourvèdre Müller-Thurgau Muscadelle du Bordelais Muscat of  
Alexandria Muscat Ottonel Nebbiolo Niagara Orion Ortega Palomino Pedro  
Ximenez Parellada Perlette Pinotage Petite Verdot Pinot blanc Pinot gris Pinot  
noir Piquepoul Primitivo Ramisco Räusching Regent Reichensteiner Riesling  
Rkatziteli Roussanne Ruländer Sabbatiano Sangiovese Savagnin Sémillon  
Sauvignonasse Sauvignon blanc Shiraz Sylvaner Sultanina Sunbelt Syrah  
Tannat Tarrango Teinturier Tempranillo Terret noir Thompson Seedless Tinta Cao  
Touriga Traminer Trebbiano Ugni blanc Valdiguié Verdelho Vermentino  
Vernatsch Vidal blanc Vignoles Viognier Xarello Zalagyöngye Zinfandel Zoruna

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## Variety Classification

- **By region of origin:** e.g. Negrul (Proles = descendants)  
Proles pontica: from Aegean and Black Seas  
to Eastern Europe  
Proles occidentalis: Western European wine grapes  
Proles orientalis: Middle Eastern table grapes
- **By final use:** Wine, juice, table, raisin, distillation
- **By winemaking characteristics:** grape composition, varietal aroma, production costs
- **By time to fruit maturity:** e.g. Gladstones (GDD based)

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## Classification by Maturity

Growing degree days (GDD, 1 April - 31 October, base temperature 10 °C) required to reach acceptable maturity

| Group | GDD (°C) | Red varieties                                               | White varieties                                       |
|-------|----------|-------------------------------------------------------------|-------------------------------------------------------|
| 1     | 1050     |                                                             | Madeline Angevine                                     |
| 2     | 1100     | Blue Portuguese                                             | Chasselas, Muller-Thurgau, Pinot gris                 |
| 3     | 1150     | Pinot noir, Meunier, Gamay                                  | Gewurztraminer, Sylvaner, Chardonnay, Sauvignon blanc |
| 4     | 1200     | Malbec, Zinfandel, Pinotage                                 | Semillon, Muscadelle, Riesling                        |
| 5     | 1250     | Merlot, Cabernet franc, Syrah, Cinsaut, Barbera, Sangiovese | Chenin blanc                                          |
| 6     | 1300     | Cabernet Sauvignon                                          | Colombard, Palomino                                   |
| 7     | 1350     | Aramon, Carignan, Grenache                                  | Muscat of Alexandria, Ugni blanc                      |
| 8     | 1400     | Tarrango, Terret noir                                       | Clairette, Grenache blanc                             |

Gladstones

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## Why use rootstocks?

- Phyloxera resistance
- Nematode resistance  
Root-knot and complexes  
Dagger and fanleaf
- Drought
- Salinity
- Calcareous soils
- Vigor
- Soil depth
- Water holding capacity
- Soil texture
- Fertility
- Future water availability
- Climate and effect on fruit quality
- Marketing fruit or wine
- Required yield

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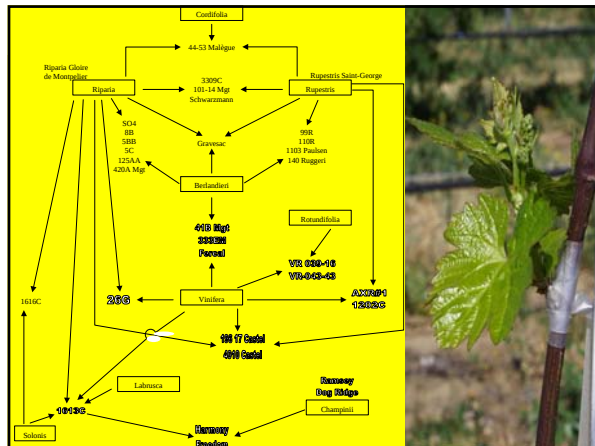
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