Origin and Status of Kochia in North America


Kansas 2010

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Scientific Classification

- ***Chenopodium scoparium* –** Linnaeus 1753

- ***Kochia scoparia* –** Schrader 1809
  Kochia scoparia (L.) Schrad.
  Family: Chenopodiaceae

- ***Bassia scoparia* –** Scott 1978
  Bassia scoparia (L.) A.J. Scott
  Family: Amaranthaceae

Common names for *Bassia scoparia*

- Kochia
- Burningbush
- Fireweed
- Mexican fireweed
- Belvedere
- Summer cypress
- Mock cypress
- Common red sage
- Poor man's alfalfa
- Others

Description

- Erect herbaceous dicot
- C4 photosynthesis
- Adapted to saline soils and arid to semi-arid conditions
- Flowers are green leaf-like bracts surrounded by hair

Kochia seedlings

Cotyledon stage

Button stage

Morphology

- Alternate linear to narrowly ovate-shaped leaves with fringed hairs on margins
  - lime-green to grayish-green color, turning brown at maturity
  - about 5-6X longer than wide
- Conical shaped plants with many branched stems
  - typically ~1 m high
  - up to 2.25 m high

Morphology

Rooted for Success

- Kochia roots typically extend 1.8-2.5 m deep; ~3-times as deep as tall.
- At Hays, KS during a drought year, kochia rooted up to 3 m deep in upland soils and 4.8 m deep in alluvial soil. Phillips and Launchbaugh, 1958
- Lateral roots ~10 cm below the soil surface extended up to 2.4 m.
- Kochia without competition had a root diameter of 6.7m. Davis et al. 1967

Kochia Weediness and Impact

- Highly invasive/noxious
- May displace desirable vegetation
- High forage value when young but can be toxic to livestock & wildlife
- Seed valuable for upland game birds

Kochia Weediness and Impact

- Crop competition
  - typically up to 30% yield loss
  - crop failure at higher densities
- Harvest interference

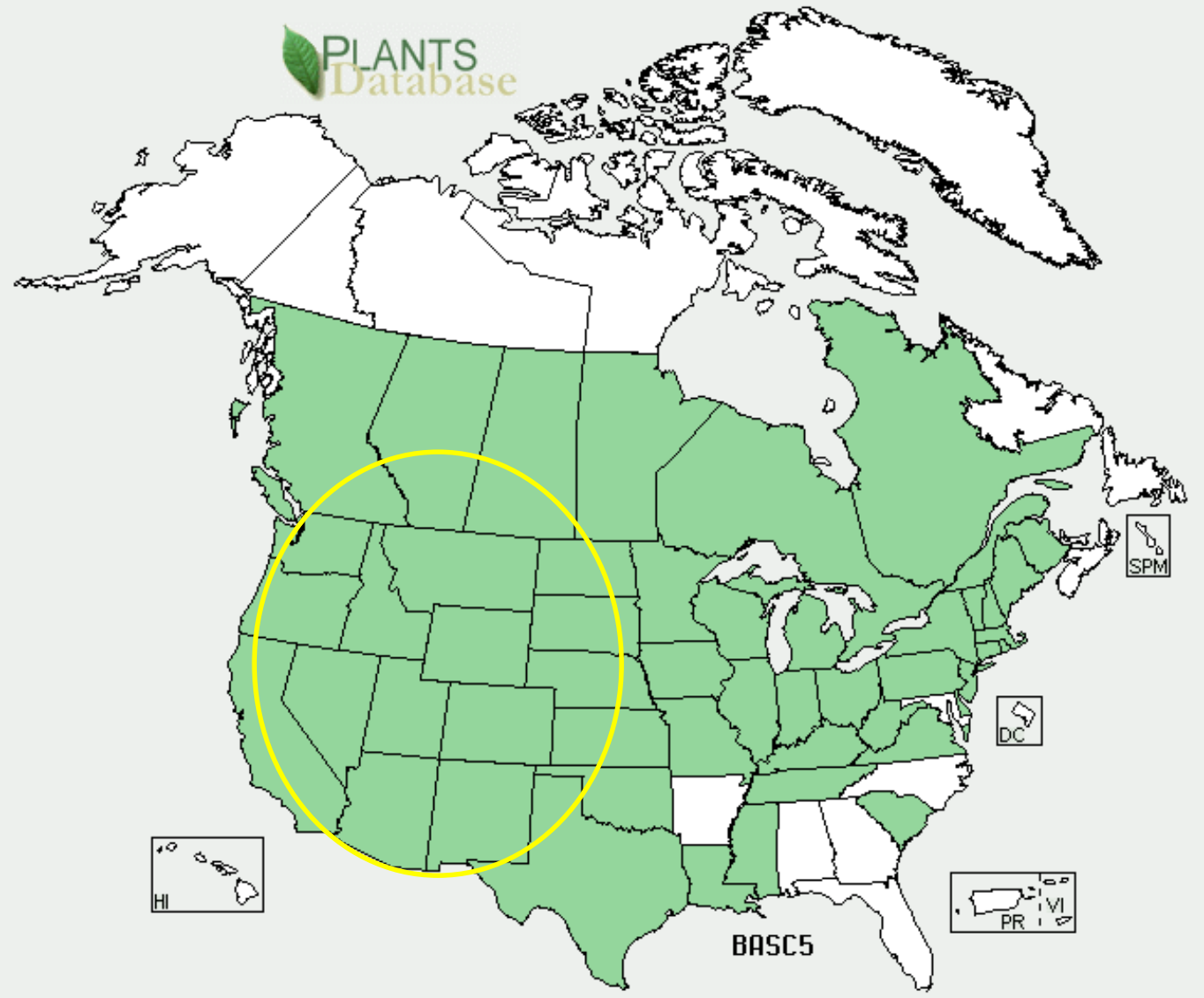
Origin and Distribution

- Native to temperate regions of Eurasia
- Introduced into North America ~1900
- Naturalized in the Northern Great Plains
- Thrived and spread in US & Canada in 1930s
  - considered a serious threat to native ecosystems
  - noxious weed in some states
  - contaminant in similar-sized vegetable seeds
- Africa & South America

Kochia in Australia

- Introduced into Western Australia in 1990 as a fodder plant for saline soils (salt tolerant forage) and escaped.
- Appeared in Tasmania as a contaminant in carrot seed in 1995, 1997, 1998 and was eradicated.
- As of 2000 kochia has been eradicated from Australia and today has remained kochia free.

North American Distribution



http://plants.usda.gov/java/profile?symbol=BASC5

Genetic Diversity

- Genetic diversity and morphological characteristics vary widely.
- Greater diversity within a population (90%) than between populations.
- High genetic diversity is maintained through substantial gene flow, aided by cross pollination, and seed dispersal over long distances.

Mengister and Messersmith, 2002; Christoffers, 2010.

Tumbleweed Seed Dispersal

As plants mature, an abscission layer develops near the soil surface.

Mature plants break loose from the root system and disperse seed as they tumble across the landscape.

Accumulates in depressions, fence rows, shelter belts, etc.

Along I-70 in western KS

More than an inconvenience

Herbicide Resistance in Kochia

- **52 documented cases of resistance**
- **Four herbicide families**
  - Photosystem II inhibitors, e.g. triazines
  - ALS inhibitors, e.g. sulfonylureas
  - EPSPS inhibitors, e.g. glyphosate
  - Synthetic auxins, e.g. dicamba & fluroxypyr
- **Multiple resistance: 2 or more SOA**
- **Confirmed 4 SOA resistance in Kansas**

International Survey of Herbicide Resistant Weeds, 2015 – Ian Heap

Triazine Herbicide Resistance in Kochia

- Triazine-resistant kochia discovered in wheat fields in Idaho in 1975 and Kansas in 1976 Johnson, 2010; Heap, 2015
- Triazine-resistant kochia reported in 10 states Heap, 2015
- Most triazine-resistant plants generally less fit than susceptible plants, though exceptions exist Warwick et al. 2011

ALS Herbicide Resistance in Kochia

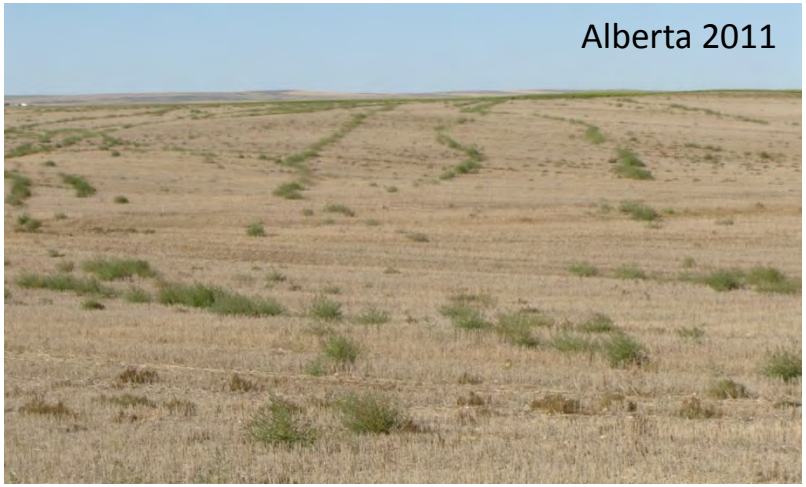
- ALS herbicide resistant kochia discovered in 1987 near Sublette, KS and Reeder, ND
  DuPont, 1988, personal communication
- ALS-R kochia currently in 18 central and western U.S. states and 3 Canadian prairie provinces Heap, 2015
- Germination patterns differed between R and S biotypes but growth rates, seed production, and competitiveness were similar Thompson, 1994

Auxin Herbicide Resistance in Kochia

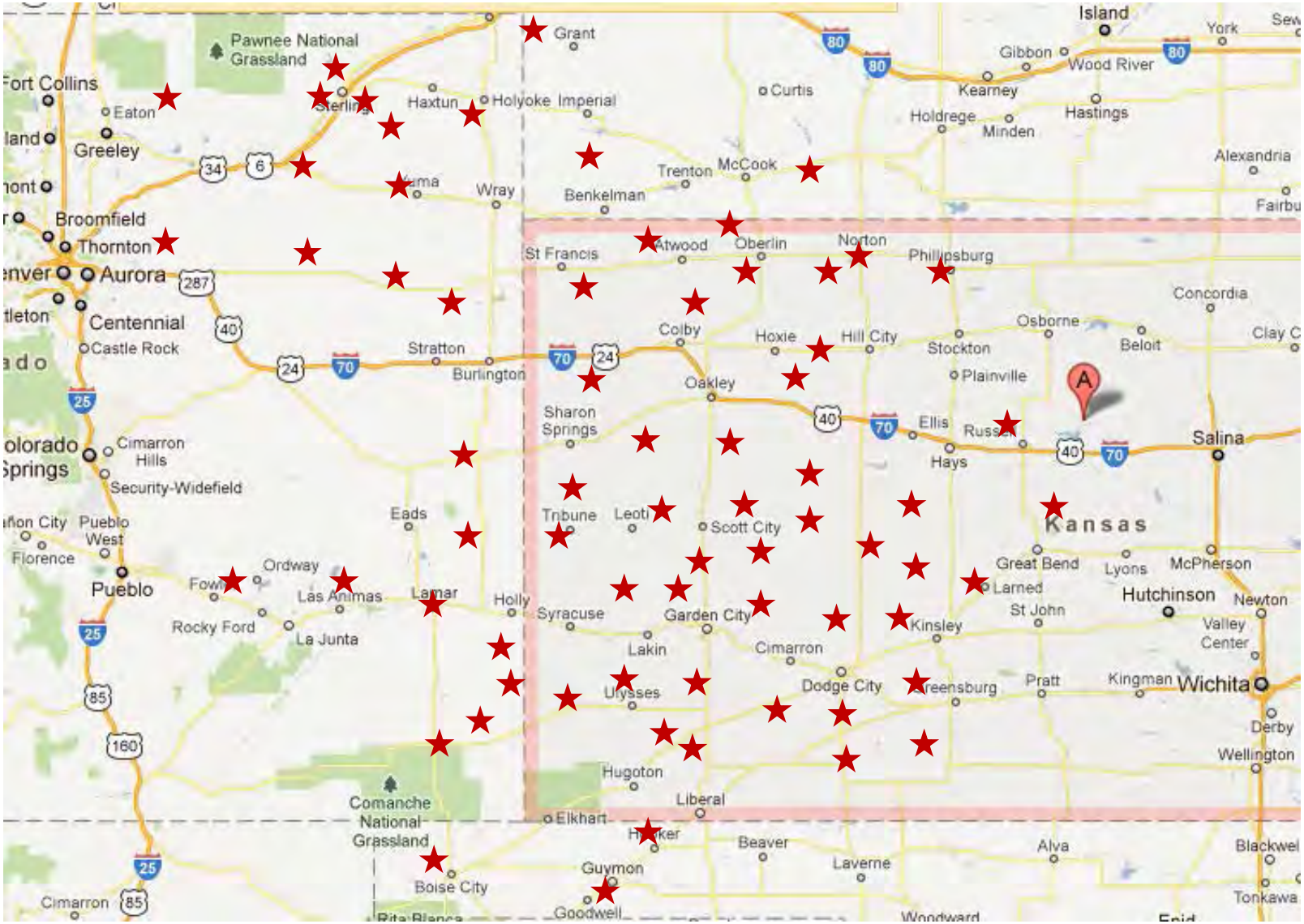
- Dicamba resistance in Montana and North Dakota in 1995, Idaho in 1997
- Dicamba resistance in Nebraska in 2010 and Kansas in 2013
- Fluroxypyr resistance in North Dakota in 2012
- First confirmed resistance to four modes of action in Kansas in 2013
  - PSII inhibitors: altered binding site
  - ALS inhibitors: altered binding site
  - EPSPS inhibitor: gene amplification
  - Synthetic auxins: unknown

Glyphosate-resistant Kochia

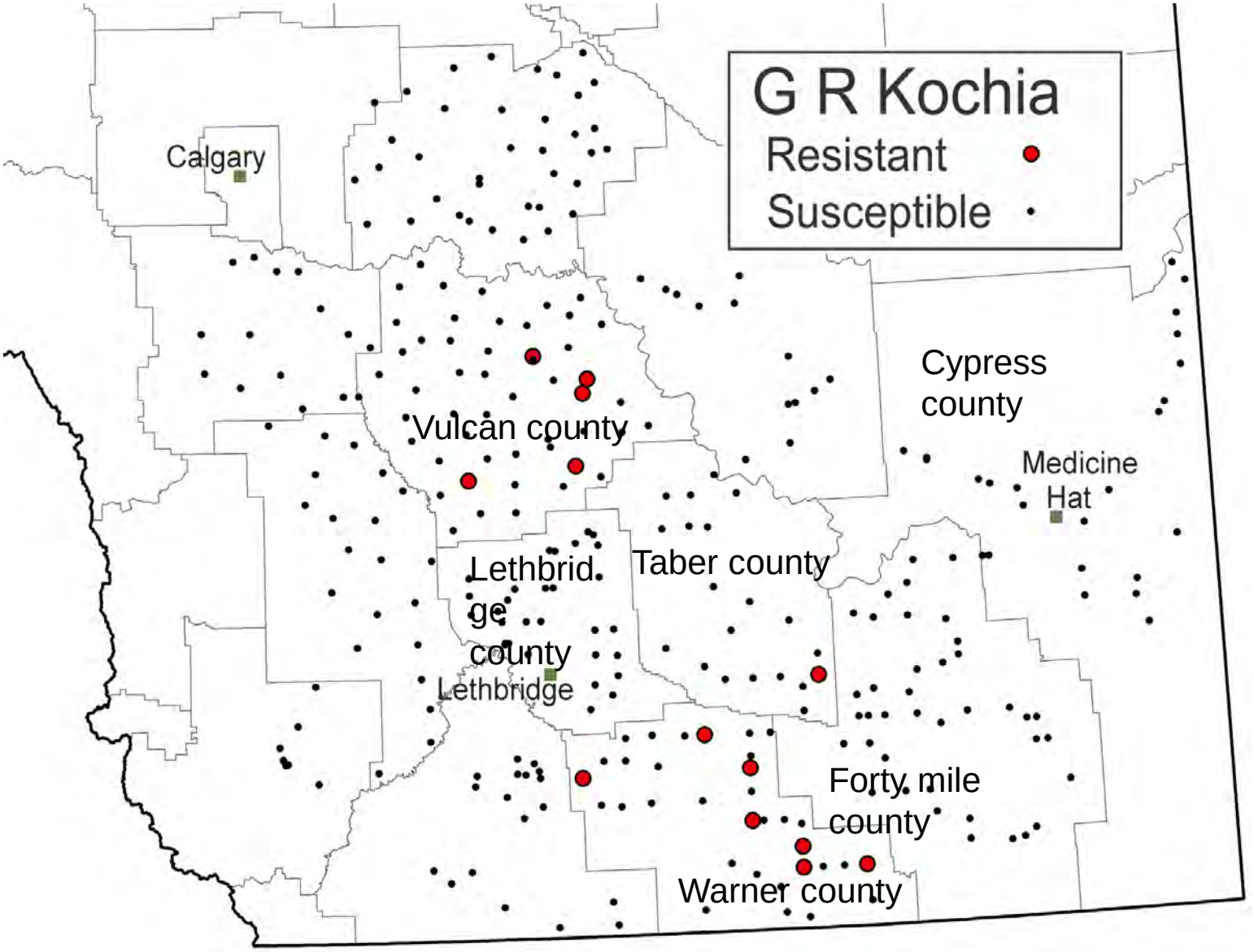
- Four populations in Kansas in 2007; one in South Dakota in 2009
- Widespread lack of control in 2010; several populations confirmed resistant
- By 2012, GR kochia was common from Texas into the prairie provinces of Canada



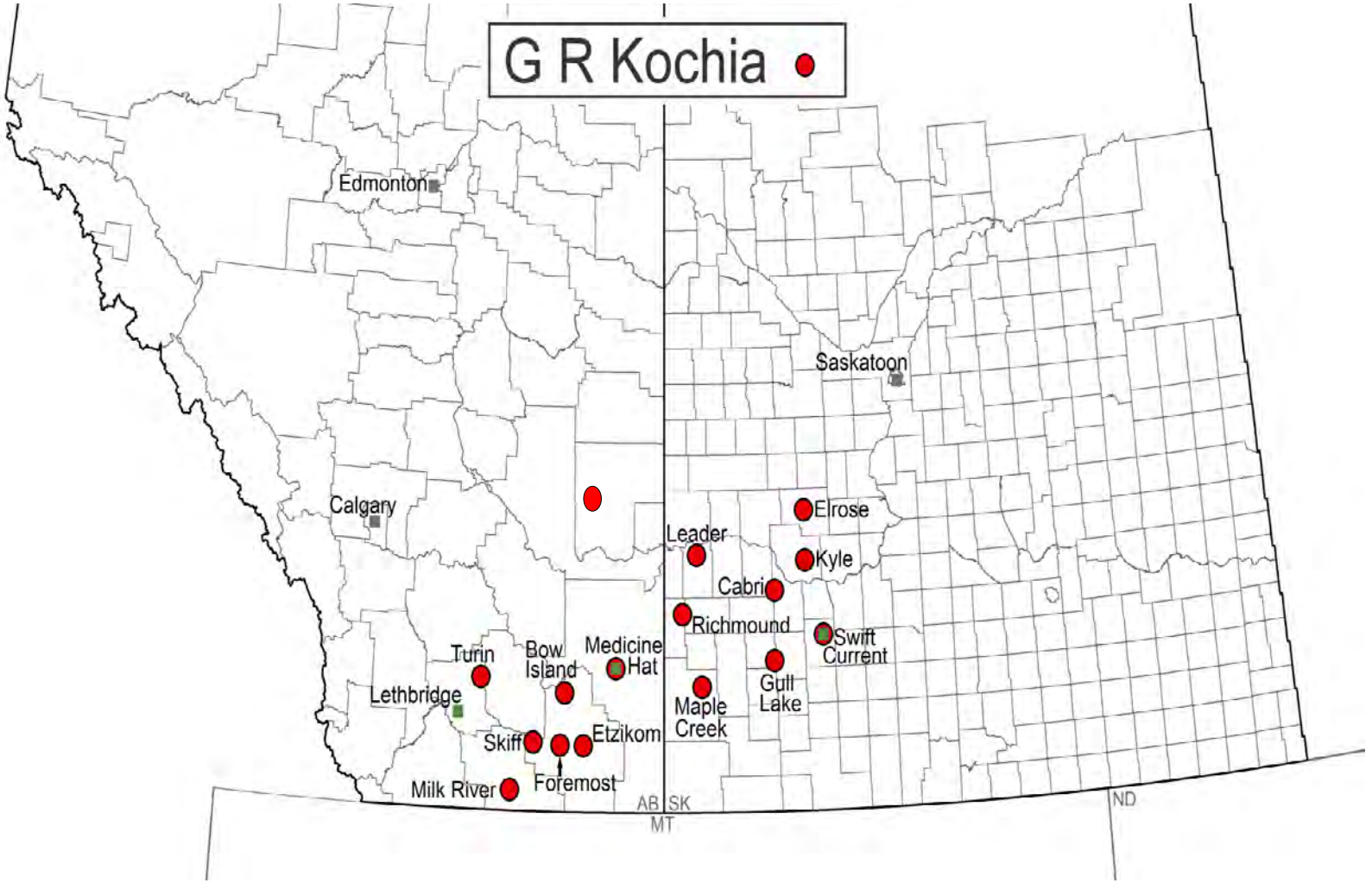
Confirmed GR Kochia, 2012



2012 Alberta: 13 of 309 sites sampled

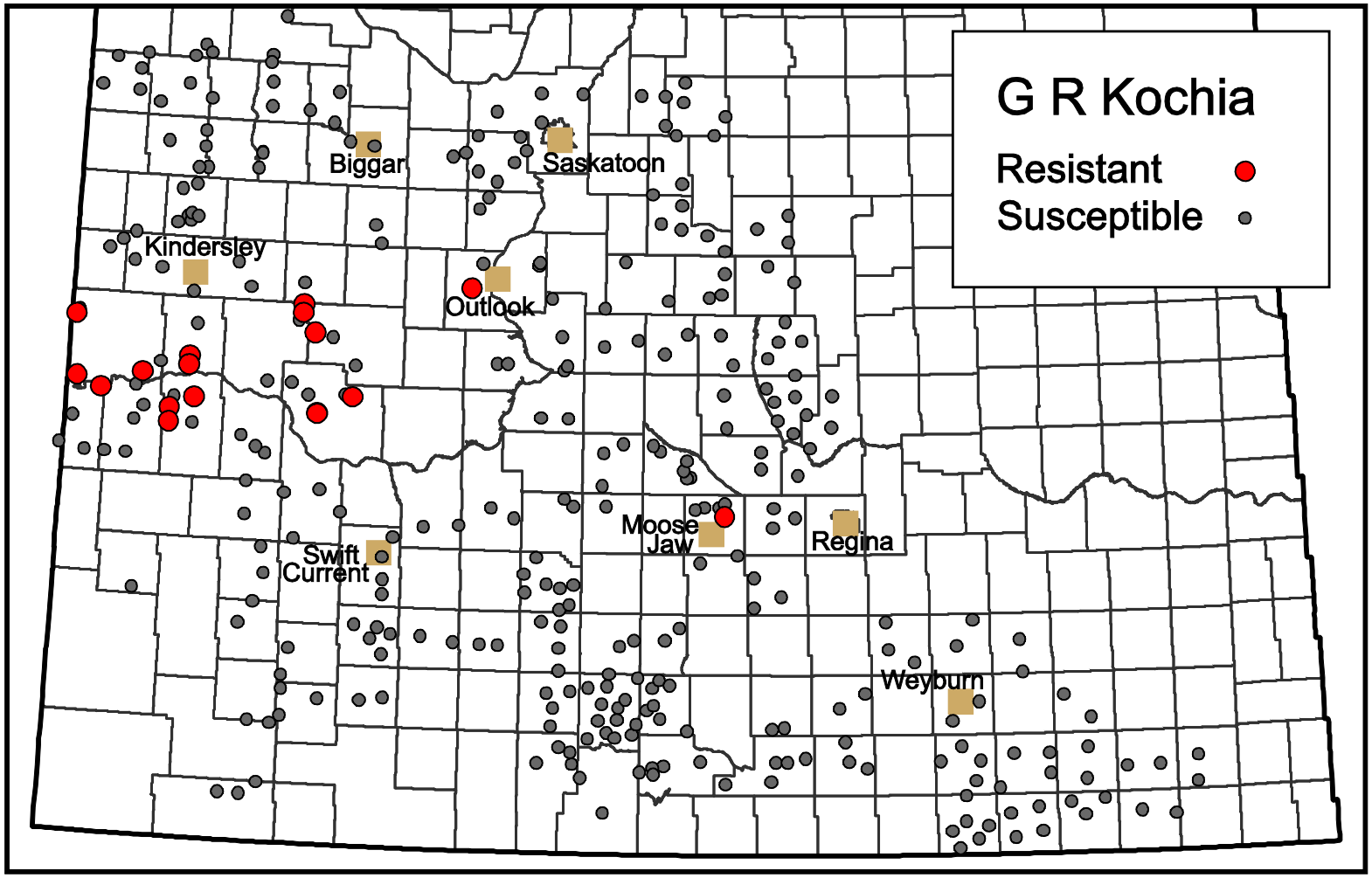


Grower submission samples: 2012



2012: 50+ confirmed resistant sites

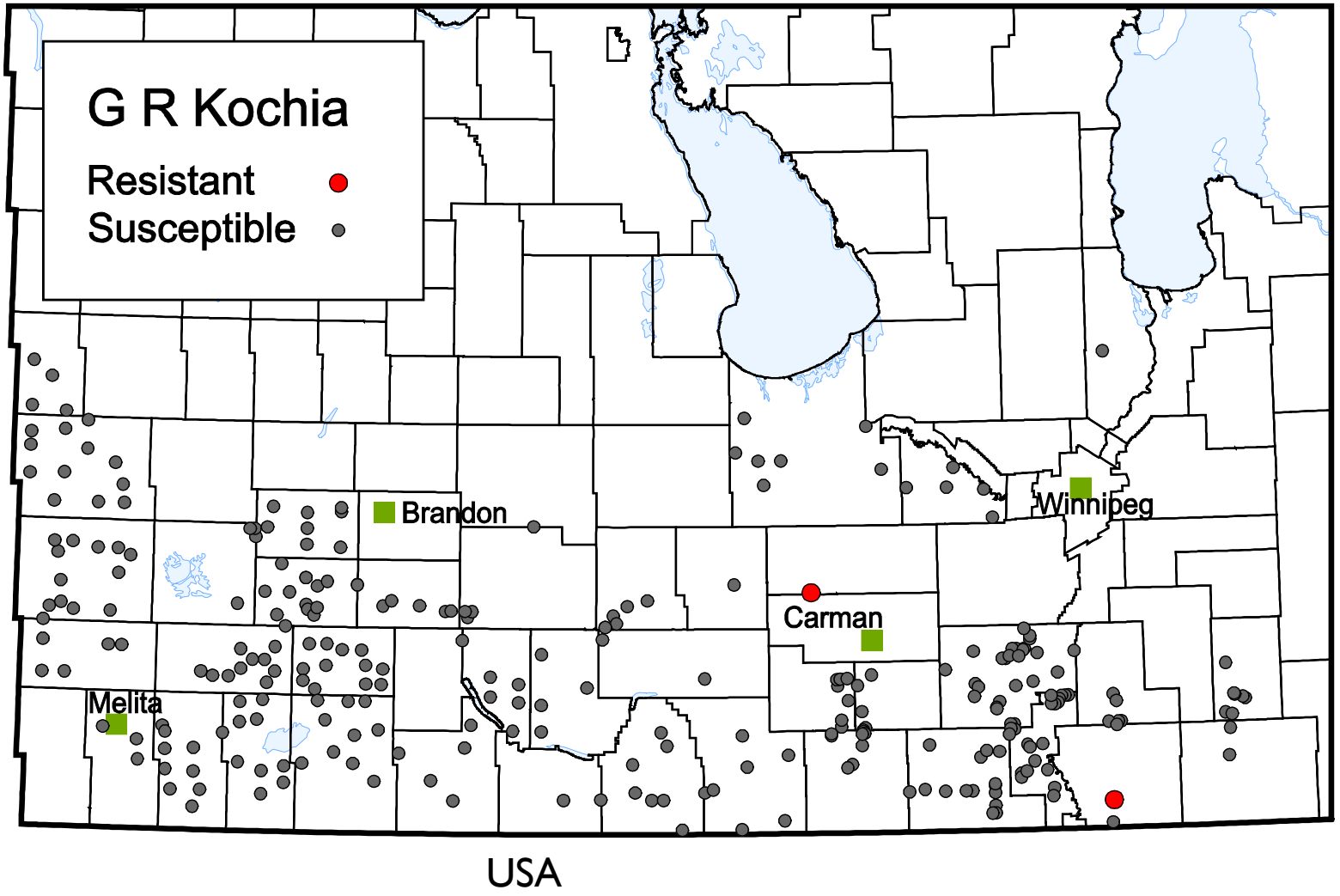
2013 Saskatchewan: 17 of 342 sites sampled



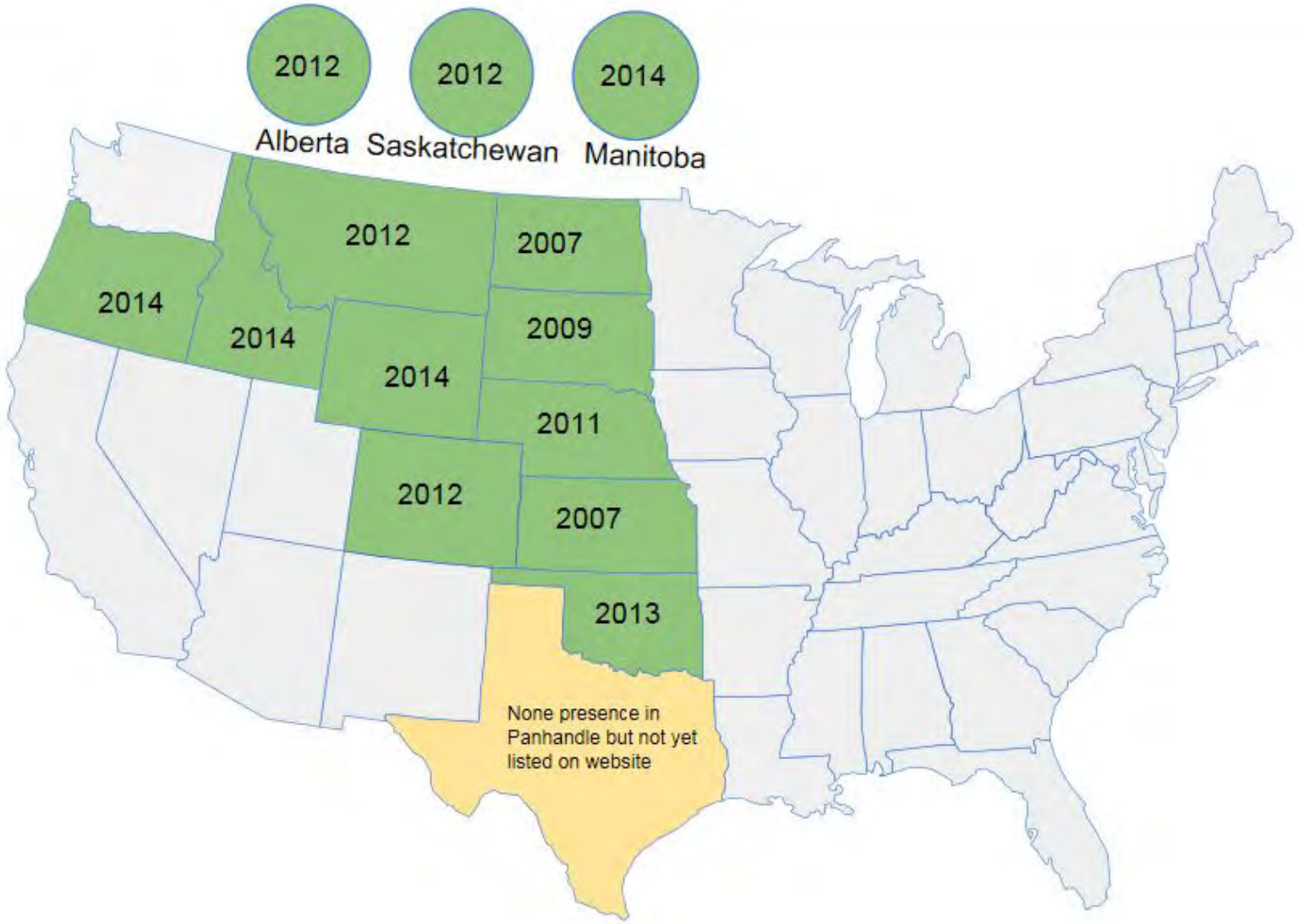
Glyphosate- and ALS-resistant kochia in Saskatechewan, 2012

Beckie et al.

2013 Manitoba: 2 of 283 sites sampled



Glyphosate-resistant Kochia



Logarithmic Progression of Resistance

and in the next years many more,

and soon no room for more.

Questions?