How the Sunflower Moth Emerged as a Key Pest of Commercial Production on the High Plains

J.P. Michaud

K-STATE
Kansas State University

Sunflower Moth

- a subtropical resident with migratory propensity
- each females lays 400 – 600 eggs in 7-10 days
- generation time ~ 30 days (warm weather)
- many wild composite flowers are hosts
- records suggest this pest has become increasingly problematic over the past 20 years

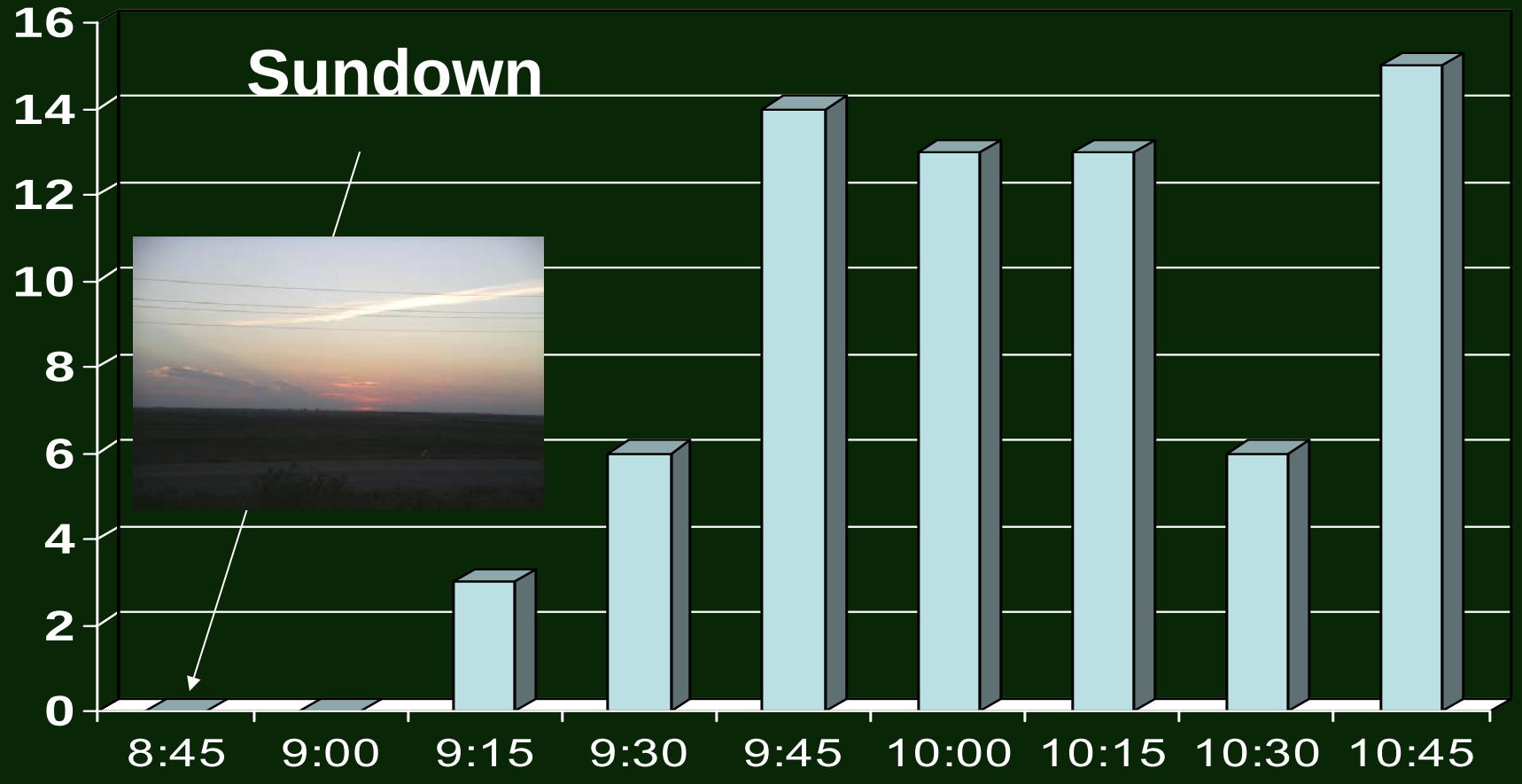
To what extent is this a consequence of increasing commercial acreage?

Management of Sunflower Moth

Currently, IPM of SFM has only 2 components...

- MONITOR with traps or scout crops at appropriate stages
- SPRAY pesticides when economic thresholds are surpassed

Sunflower moths per 100 heads



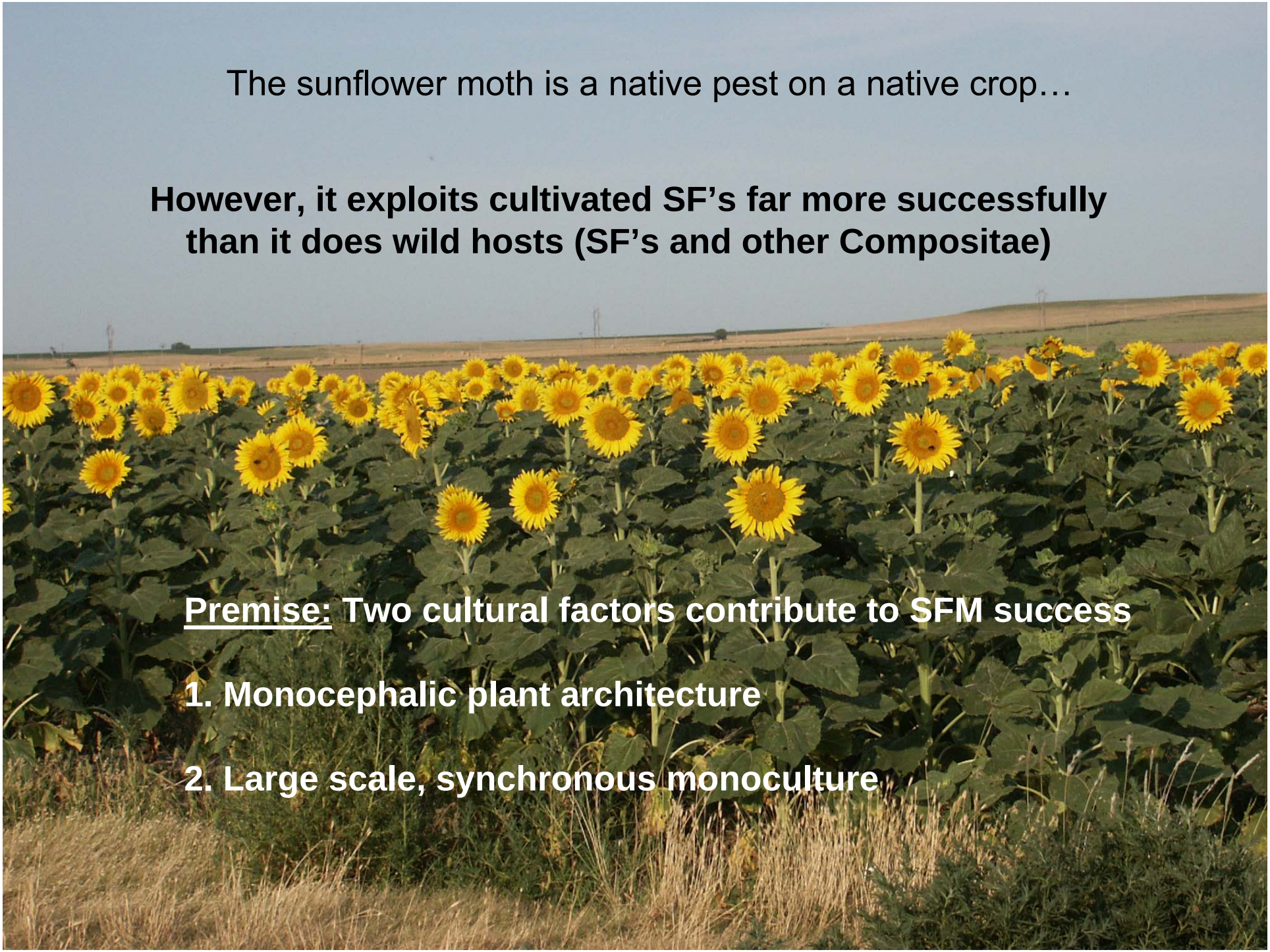
Garden City, KS Aug. 8, 2005

Pollen stimulates oviposition

Early instar larvae feed exclusively on pollen

Rhizopus head rot

Can only infect the head through physical injury



The sunflower moth is a native pest on a native crop…

However, it exploits cultivated SF's far more successfully than it does wild hosts (SF's and other Compositae)

<u>Premise:</u> Two cultural factors contribute to SFM success

1. Monocephalic plant architecture

2. Large scale, synchronous monoculture

Why do Insects Migrate?

- to access seasonally available food sources at latitudes where year-round survival is not possible

- to escape accumulations of predators / parasites

Examples of subtropical moth species that contain migratory genotypes at variable frequencies:

Fall armyworm
Corn earworm
Black cutworm

Very few offspring of migrants need survive the return trip to breed in order for migratory behavior to be maintained in the resident population

Air mass types and typical trajectories

Air mass characteristics and trajectories are quite predictable

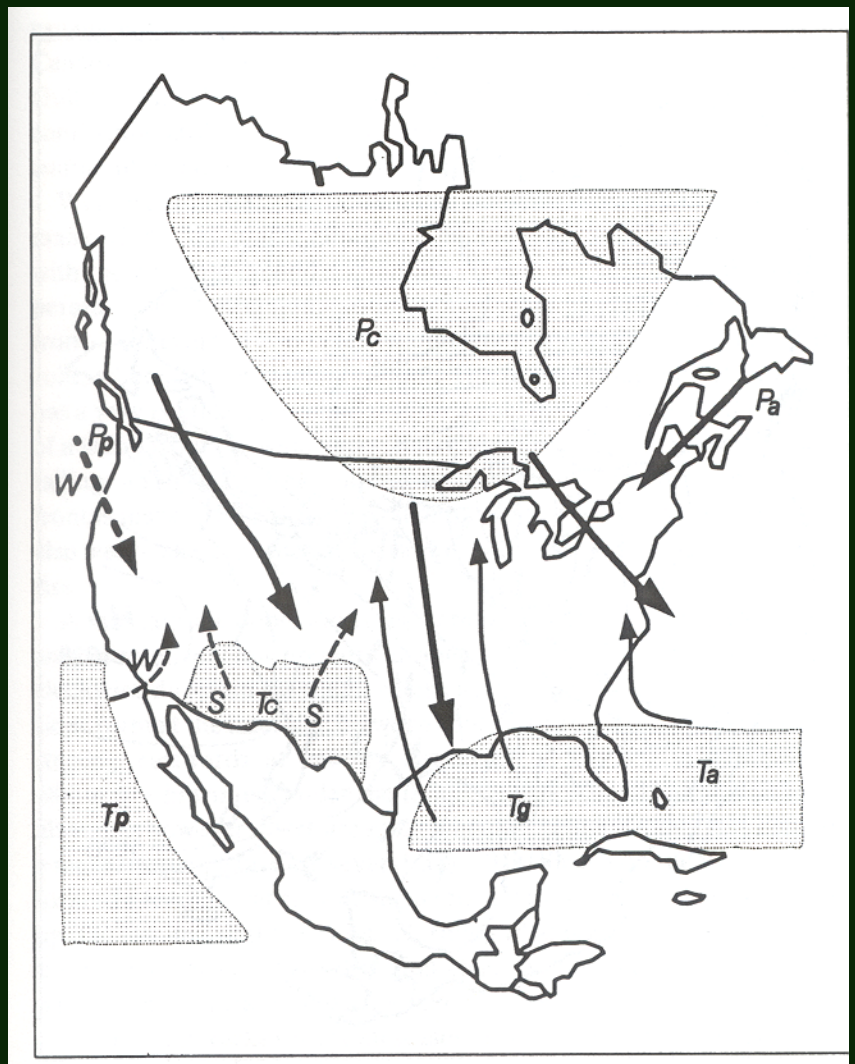


Fig. 2.3. Air masses affecting North America, especially the USA. Continuou
lines indicate flows that occur throughout the year; seasonal flows are show
dashed and are labelled *S* (summer) or *W* (winter); source areas are labelled *P*
(Polar Atlantic), *Pc* (Polar continental), *Pp* (Polar Pacific), *Ta* (Tropical Atlan
tic), *Tg* (Tropical Gulf), *Tc* (Tropical continental) and *Tp* (Tropical Pacific)
(After Visher (1966).)

Polewards Transporting Synoptic Weather Systems

Shaded area ->

"Low-Level Jets"
- ideal for insect transport

< 3000 ft AGL

Insects respond to environmental cues that can indicate transport opportunities

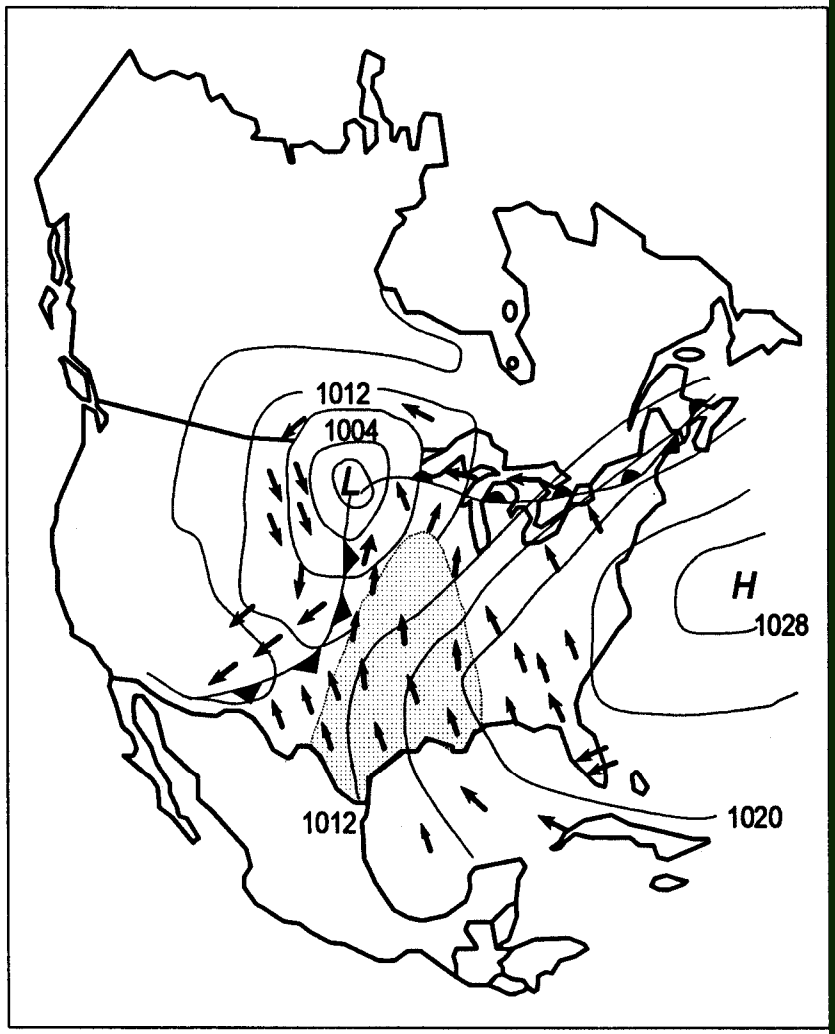
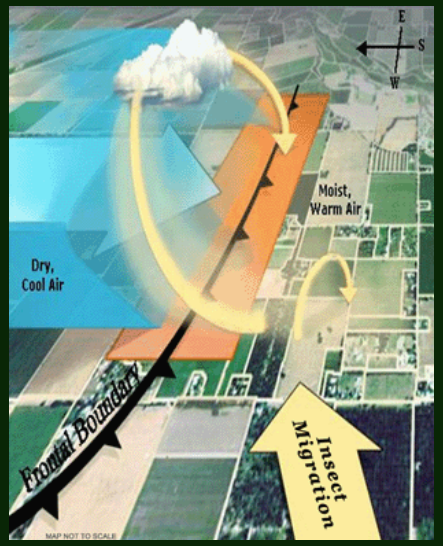


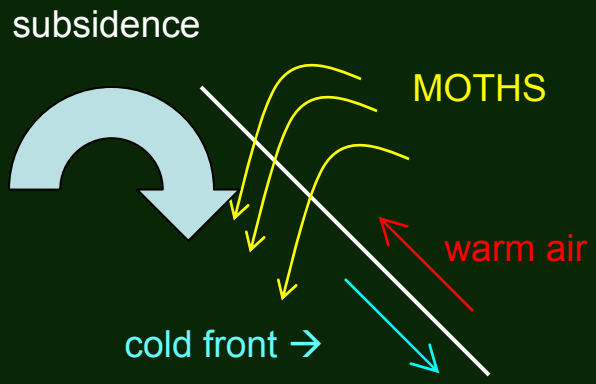
Fig. 2.4. Typical PTSWS (see text) weather situation for North America in spring or early summer, showing the anti-clockwise wind flow around a mid-latitude depression. The shaded area shows the region where low-level jets occur.

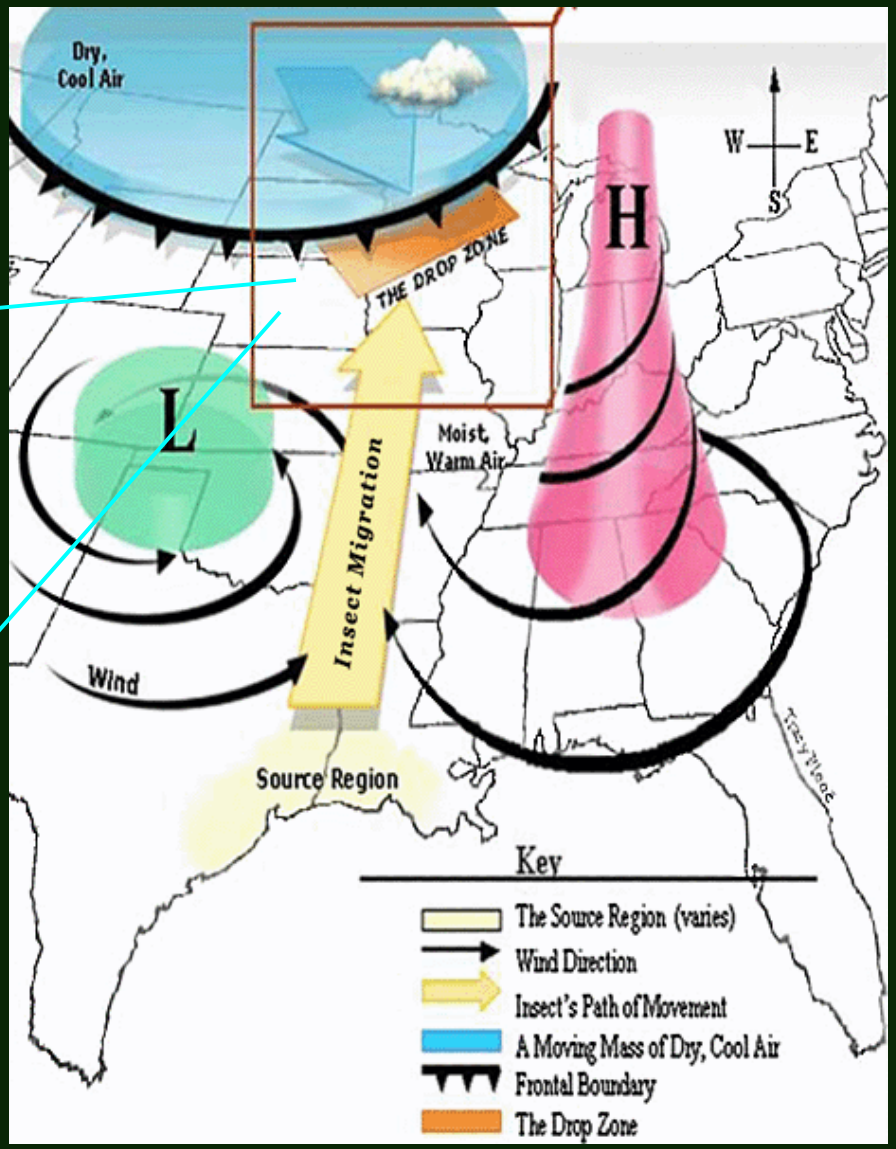
Bermuda High

Typical synoptic weather system responsible for northern transport of migratory moth pests

To what extent do migrants choose landing sites?

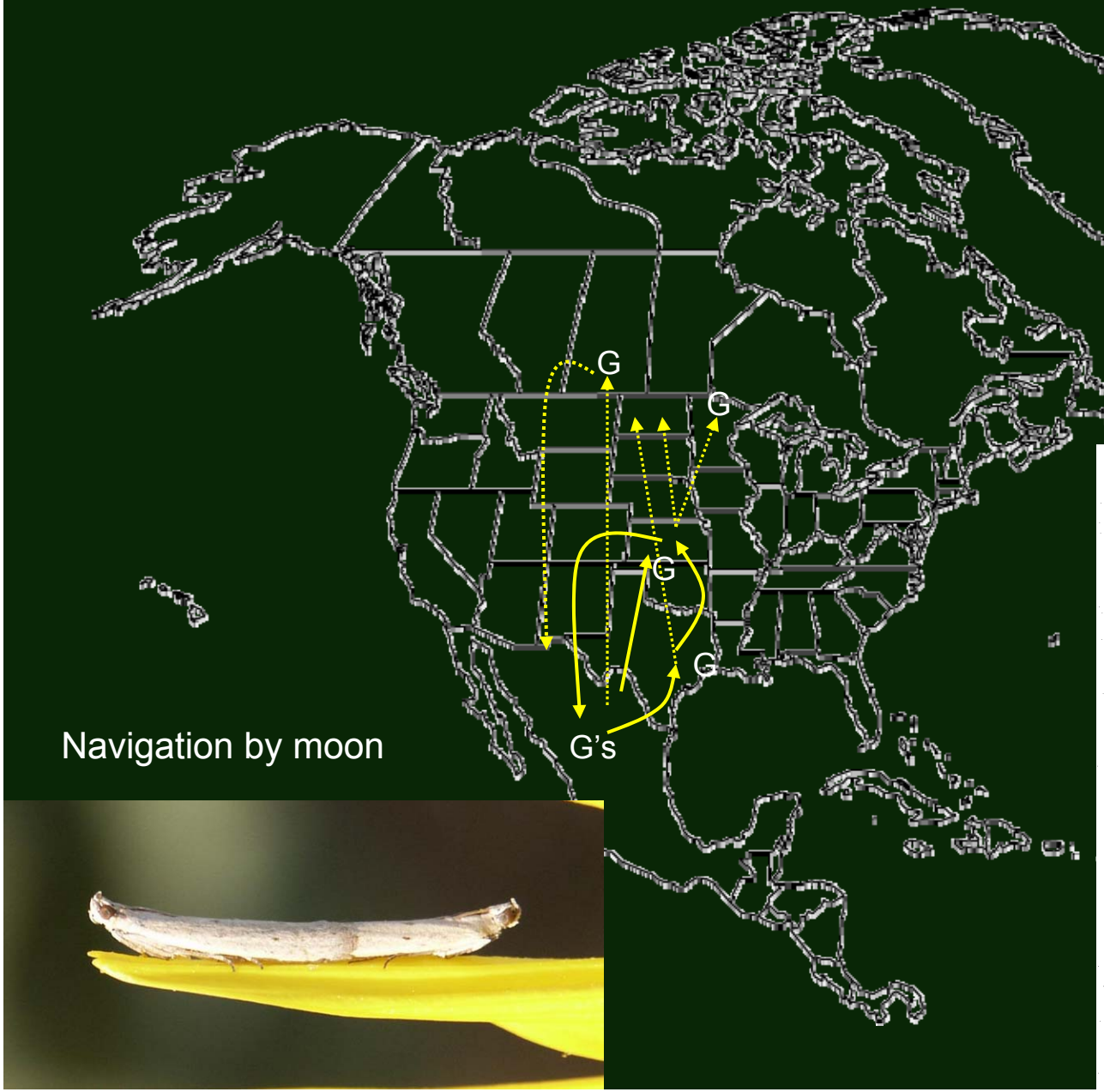






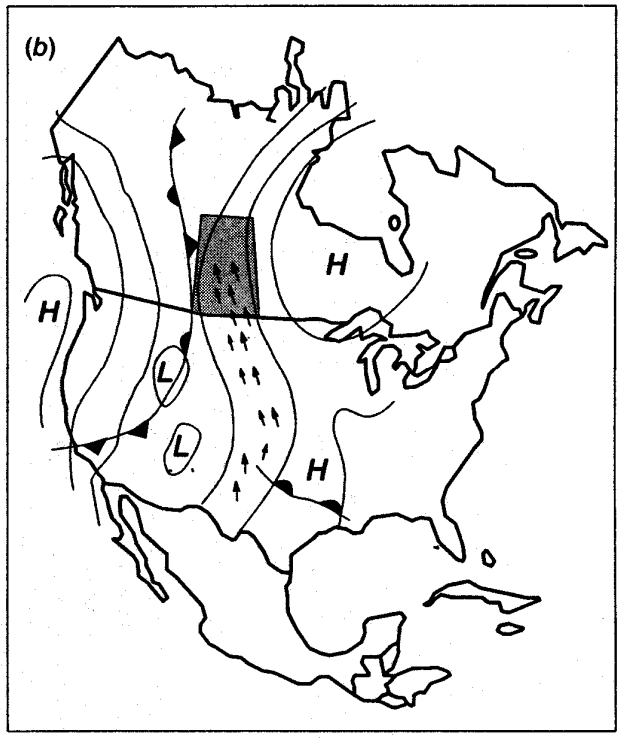
Sandstrom et al., 2007, Plant Management Network

Sunflower moth migration pattern



Navigation by moon

Mexico → Canada in 4 days



Return of summer migrants to winter breeding grounds in autumn is much more difficult

Equatorward transporting synoptic weather systems (ETSWS)
- sporadic in occurrence between August and October

Northerly autumn winds tend to be weak, except when an ETSWS forms

Typical configuration:

High pressure ridge over Rocky Mountains, pushing a cold front eastward
Strong northerly winds develop immediately behind the cold front
Transport of up to 200 miles / night is possible

Temperature becomes very important – window for takeoff
may be only a few hours

Suitable conditions for southerly transport are transient
–a sequence of 3-4 cold fronts may be
required to reach the overwintering range

Patterns of southward migration in autumn

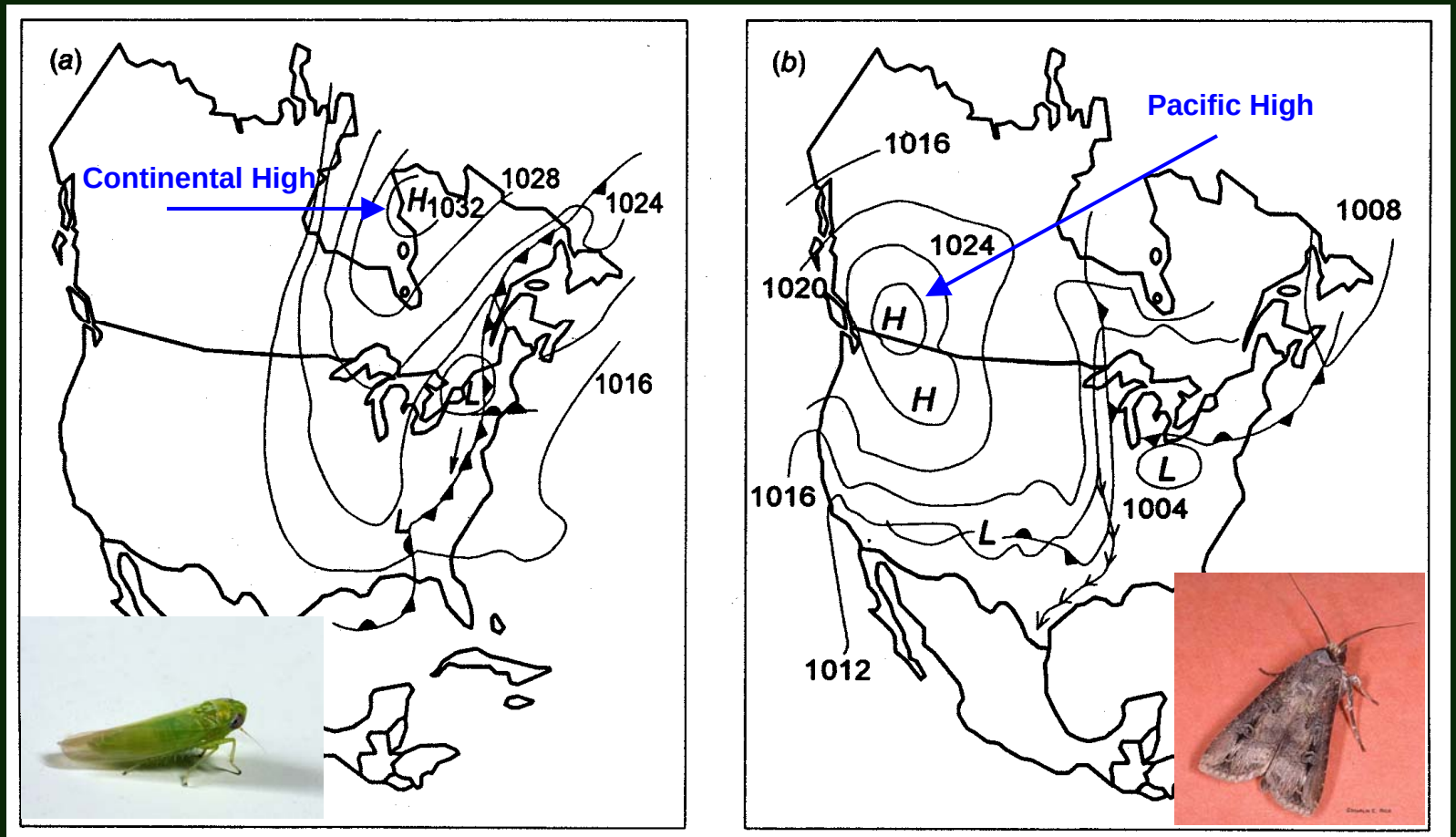


Fig. 2.10. (*a*) Trajectory for an airmass and *E. fabae* originating at State College, Pennsylvania immediately after a cold front passed on 6 September 1981. (After Taylor & Reling (1986).) (*b*) Backtrack of marked *A. ipsilon* from recapture site in Brownsville, Texas around 25 September 1987 to release point in Ankeny, Iowa on 17 September 1987, with synoptic weather map for 18 September 1987 superimposed. (After Showers *et al.* (1993).)

Potato leafhopper

Black cutworm

Breeding for agronomically desirable traits has diminished many natural sunflower defences

< 1 larva / flower

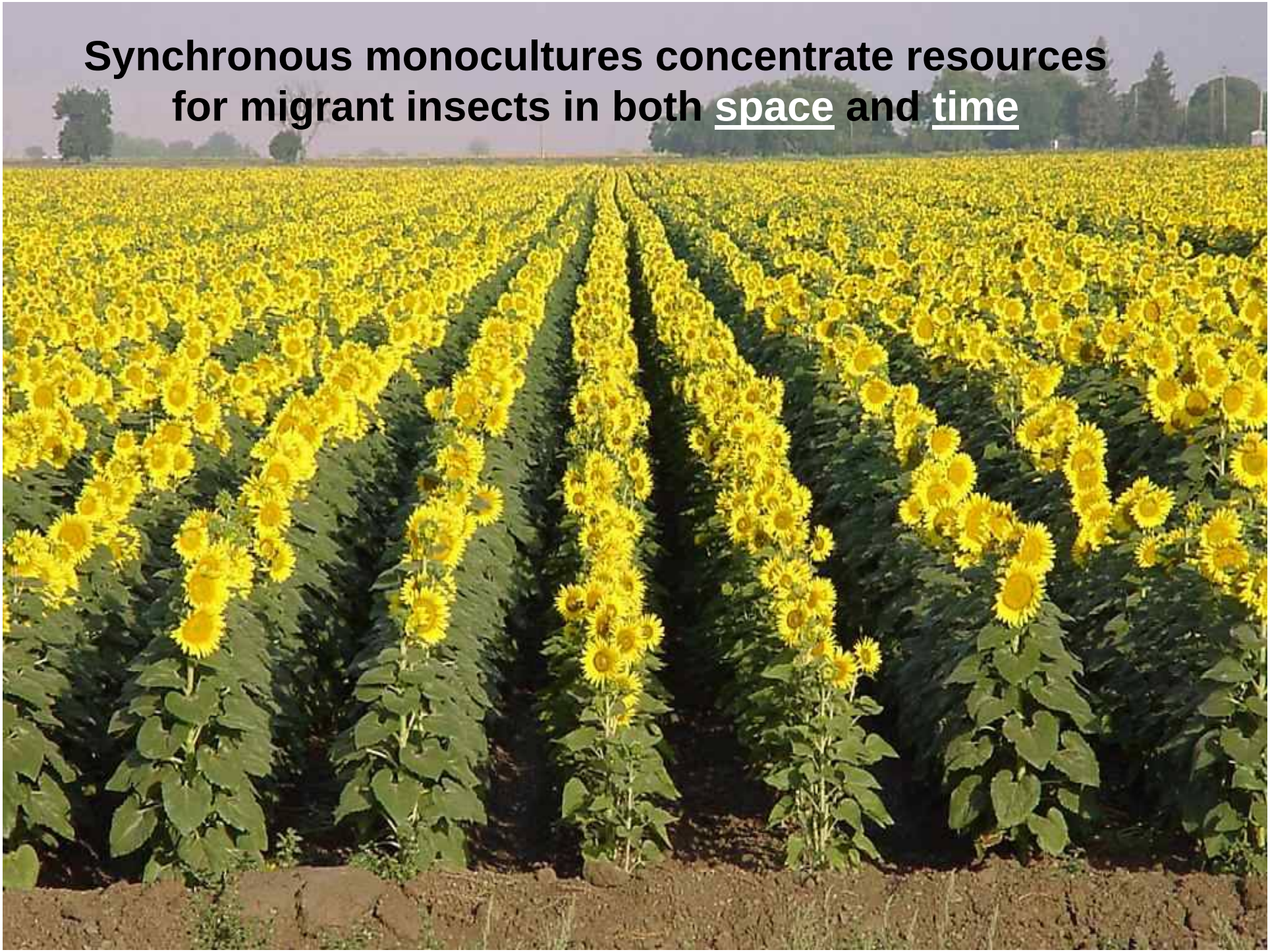
≈ 50% parasitized

Helianthus annuus (wild)

Helianthus annuus (cultivated)

Up to 800 larvae / flower

≈ 1.0 - .01% parasitized


Synchronous monocultures concentrate resources
for migrant insects in both space and time

Migratory moth ‘cafeteria’

QUESTIONS ?

K-STATE
Kansas State University
Research and Extension