Flight of the Western Bean Cutworm:

Population Patterns of a Noctuid Pest Over the Past 30 Years

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Introduction

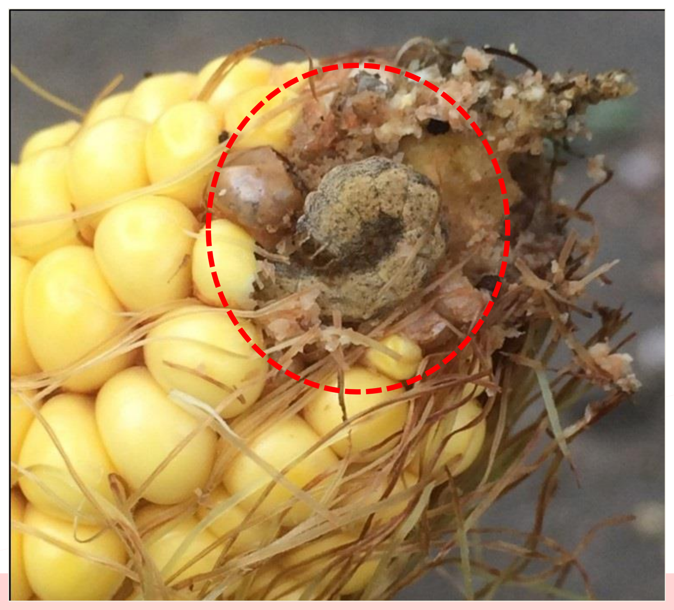

Figure 1. Western bean cutworm caterpillar in maize.

- ***Striacosta albicosta*** **(Smith), the western bean cutworm** (WBC), is a noctuid pest of maize and dry beans native to North America.
- Larvae can cause substantial kernel damage (Fig. 1), up to 60% in some cases, and can introduce secondary fungal infections into ears.
- The original distribution of this pest was the west central region of the United States; since approximately 2000, its range has expanded eastward into the Corn Belt and Great Lakes Regions.
- Peak flight, which is followed by high levels of oviposition, occurs in mid-July in most regions.
- Because larvae inside ears are not exposed to insecticides, applications must occur between oviposition and larval entry into ears.
- As such, we can improve the timing and efficiency of field scouting and treatment decisions by better understanding WBC flight behavior.

The goal of this study was to characterize the flight patterns of WBC over 30 years of observations at three sites in Nebraska.

Methods

- Black light traps (Fig. 2) were used to monitor WBC flights near maize fields at three field sites (Concord, Clay Center, and North Platte) in Nebraska from 1981 – 2017 (Fig. 3).
- Moths were trapped at Concord from 1981-2017 (35 years total), at Clay Center from 1994-2017 (21 years total, missing 1998, 2010, 2011), and at North Platte from 1985-2017 (30 years total, missing 2000, 2004). For each year, the total number of moths captured, the length of the moth flight (i.e., the number of days from the first to the last trap capture), and the date when peak flight occurred were calculated for each site.
- Data were grouped into 5-year periods for analysis. Separate analyses of variance (ANOVA) were used to compare the 1) total number of moths captured, 2) flight lengths, 3) days from first capture to peak flight, and 4) days from peak flight to last capture with site and 5-year period as fixed effects (PROC MIXED; SAS v. 9.4). Post hoc means separations were conducted using Tukey's test (P <0.05). Pearson's Correlation Coefficient was used to characterize the relationship between total accumulated moths and flight length.

Figure 2. Light trap commonly used for collecting moths.

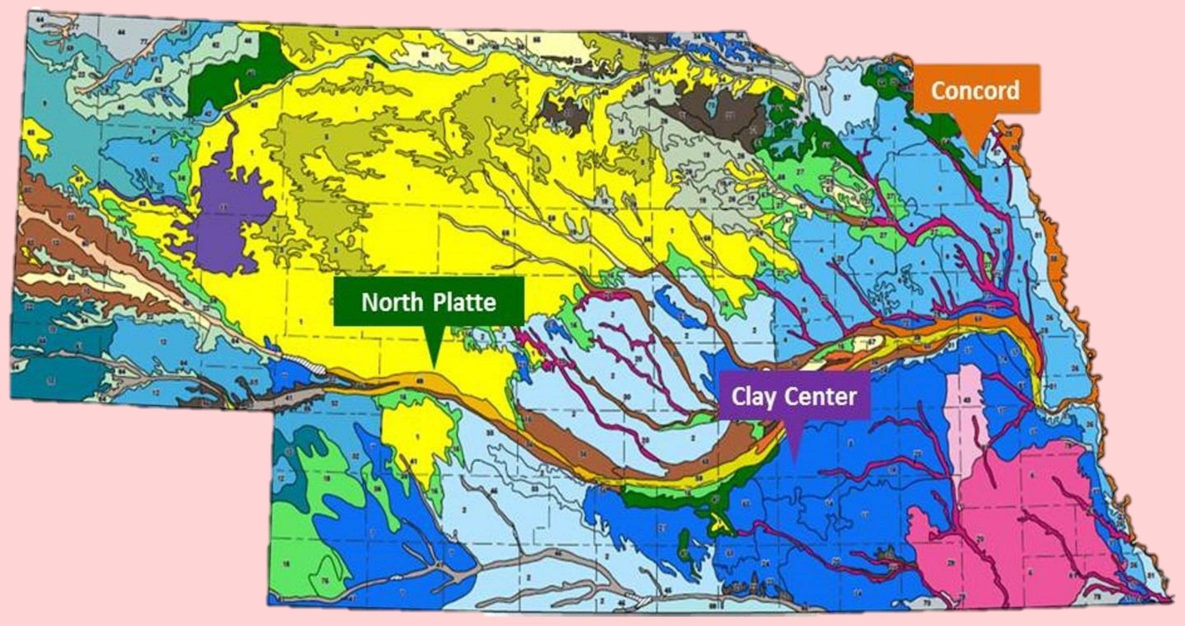

Figure 3. Map of Nebraska showing the different soil types found across the state, with the Concord, Clay Center, and North Platte sites highlighted to show where western bean cutworm moths were trapped. The yellow color on the map is associated with soils formed dominantly in eolian sands and alluvium in sandhills, the blue color (light and dark) means soils formed dominantly in loess.
Map adapted from https://esdac.jrc.ec.europa.eu/content/general-soil-map-nebraska

Results

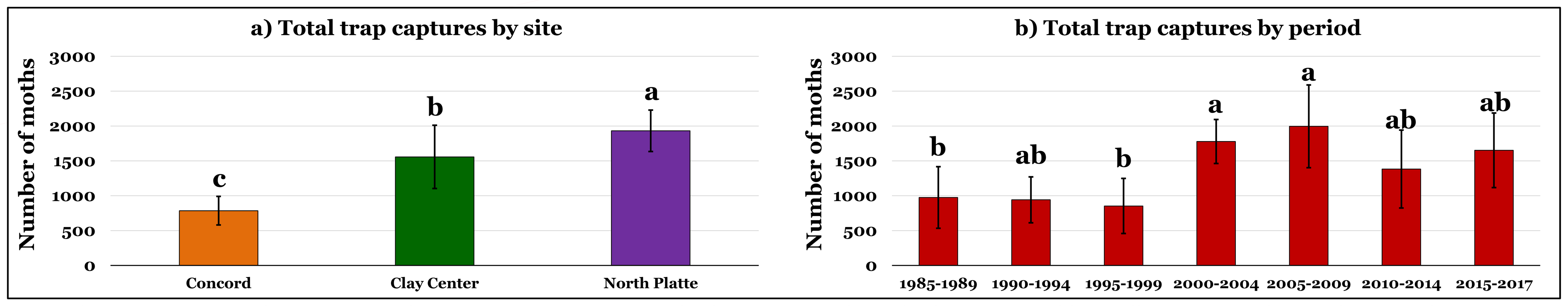

Figure 4. Mean total trap captures from 1985-2017 a) at Concord, Clay Center, and North Platte sites and b) at all sites grouped every five years between different decades. Each bar represents the mean ± SEM; bars with different letters are significantly different based on Tukey's test (P < 0.05). By site: F=17.29, df=2,73, P<0.0001; by period: F=4.87, df=6,73, P=0.0003.

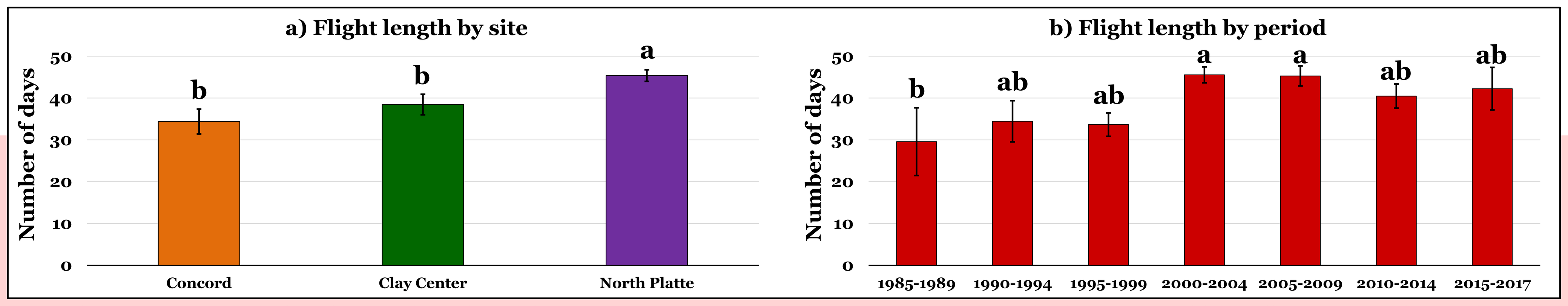

Figure 5. Mean flight length of moths collected from 1985-2017 a) at Concord, Clay Center, and North Platte sites and b) at all sites grouped every five years between different decades. Each bar represents the mean ± SEM; bars with different letters are significantly different based on Tukey's test (P < 0.05). By site: F=9.43, df=2,73, P=0.0002; by period: F=3.97, df=6,73, P=0.0017.

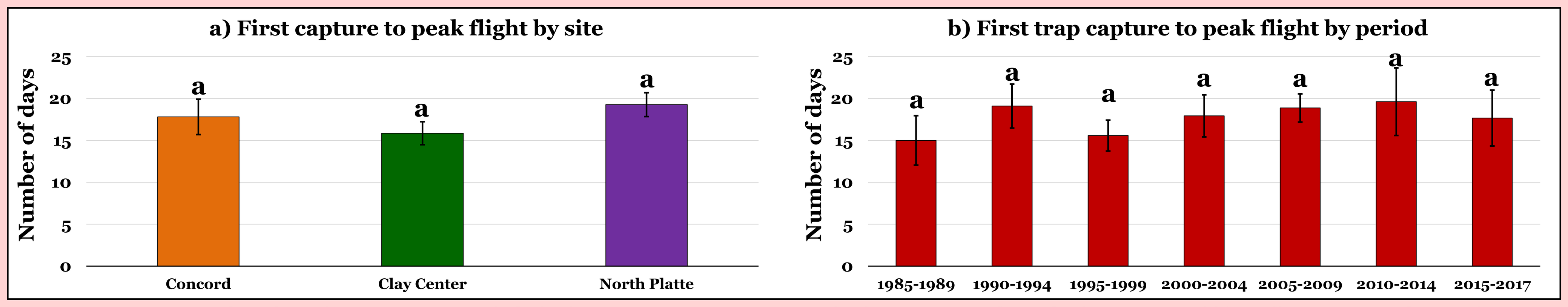

Figure 6. Mean days from first capture to peak flight from 1985-2017 a) at Concord, Clay Center, and North Platte sites and b) at all sites grouped every five years between different decades. Each bar represents the mean ± SEM; bars with different letters are significantly different based on Tukey's test (P < 0.05). By site: F=1.15, df=2,73, P=0.33; by period: F=0.44, df=6,73, P=0.85.

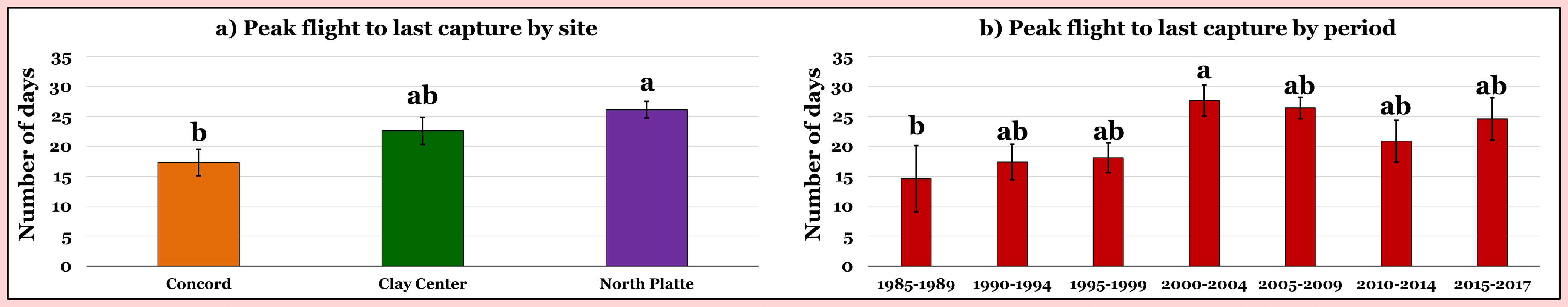

Figure 7. Mean days from peak flight to last trap capture from 1985-2017 a) at Concord, Clay Center, and North Platte sites and b) at all sites grouped every five years between different decades. Each bar represents the mean ± SEM; bars with different letters are significantly different based on Tukey's test (P < 0.05). By site: F=7.89, df=2,73, P=0.0008; by period: F=3.4, df=6,73, P=0.0051.

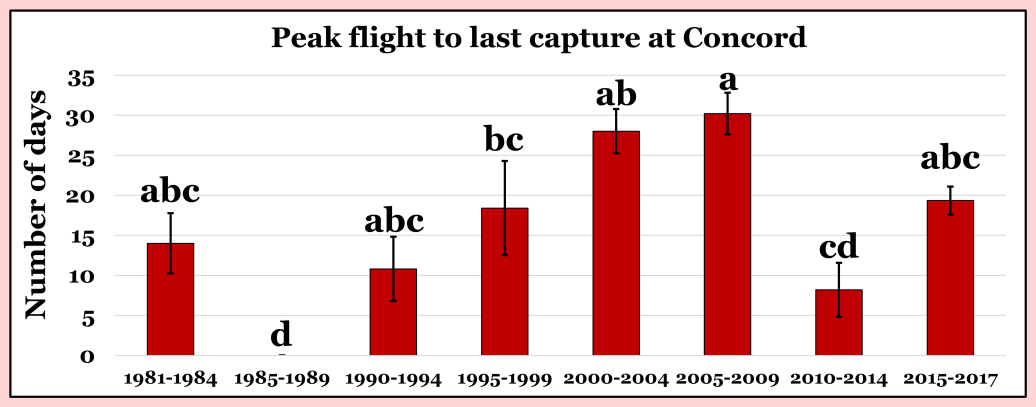

Figure 8. Mean days from peak flight to last trap capture from 1985-2017 at Concord. Each bar represents the mean ± SEM; bars with different letters are significantly different based on Tukey's test (P < 0.05). By period: F=8.73, df=7,27, P<0.0001.

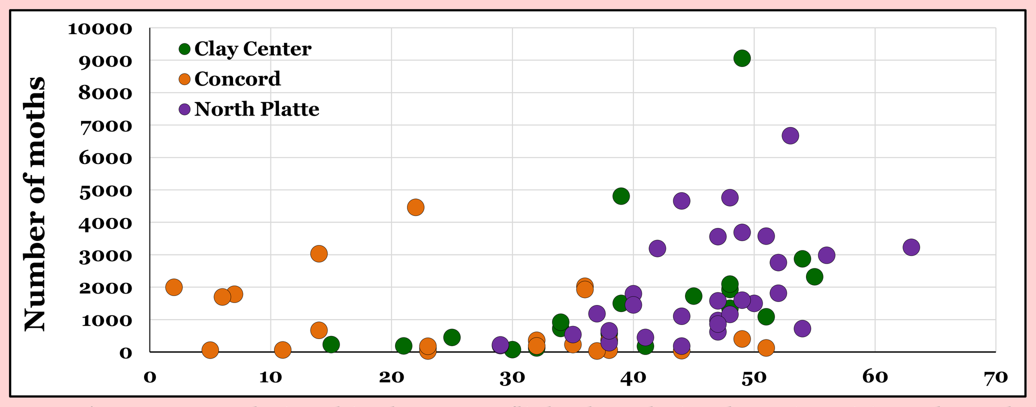

Figure 9. Relationship between flight length in days (x-axis) and total accumulated moths (y-axis) captured at Clay Center (green dots), Concord (orange dots), and North Platte (purple dots) between 1985 and 2017 (N=82, r^2 = 0.5, P < 0.0001).

Results Summary

- ✓ Total trap captures from 1985-2017 were higher at North Platte than at both Clay Center and Concord, and higher at Clay Center than at Concord (Fig. 4a). Overall, more moths were trapped during the 2000s (2000-2004 & 2005-2009) than during the late 1980s (1985-1989) and late 1990s (1995-1999) (Fig. 4b).
- ✓ Flight length from 1985-2017 was significantly longer at North Platte than at Clay Center and Concord (Fig. 5a), while flight length at the three sites was longer in the 2000s than during the late 1980s (Fig. 5b).
- ✓ The number of days from first trap capture to peak flight was not different at the three sites (Fig. 6a) or during the different time periods (Fig. 6b).
- ✓ The time from peak flight to last trap capture was significantly longer at North Platte than at Concord (Fig. 7a) and during the early 2000s than during the late 1980s. These results were likely influenced by flight patterns at Concord (Fig. 8), as patterns at Clay Center and North Platte did not differ between periods.
- ✓ Flight length and total accumulated moths were significantly correlated in this study (Fig. 9).

Discussion

- ✓ WBC flight patterns of North Platte and Concord populations differed the most (based on magnitude, flight length, and peak to final capture), while Clay Center was intermediate; these results reflect site geography.
- ✓ North Platte was the site with the largest number of accumulated moths, which is interesting because the soils in this region are predominately formed by eolian sands and alluvium in sandhills, whereas the soils at Concord and Clay Center are predominately formed by loess (USDA, 2017). WBC prefer to overwinter in sandy soils (Hoerner 1948; Douglas et al. 1957); as such, this behavior may provide one explanation for the differences in flight patterns observed in this study.
- ✓ Degree-day accumulation is also a possible explanation for the differences in flight patterns observed between locations and periods. Models that incorporate degree-days can help growers and pest control advisors more accurately predict pest behavior and make more effective scouting and treatment decisions.
- ✓ Future objectives of this study are to determine whether the shape of WBC flight curves at each site have changed over the past 30 years and whether differences in crop phenology and soil type at each site affect WBC flight patterns.

References

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Douglass, J. R., J. W. Ingram, K. E. Gibson, and W. E. Peay. 1957. The western bean cutworm as a pest of corn in Idaho. J. Econ. Entomol. 50: 543-545.
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Acknowledgements

Thank you to all of the people involved in collecting data in different locations over a period of more than thirty years.