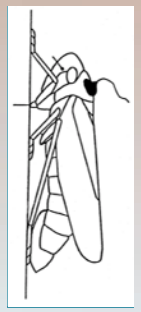
EPG Work-shop



EPG Data Analysis 101

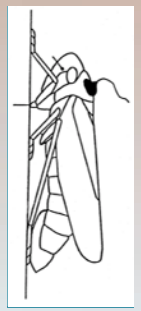
Introduction

by
T.A. Ebert

Outline: Overall Organization

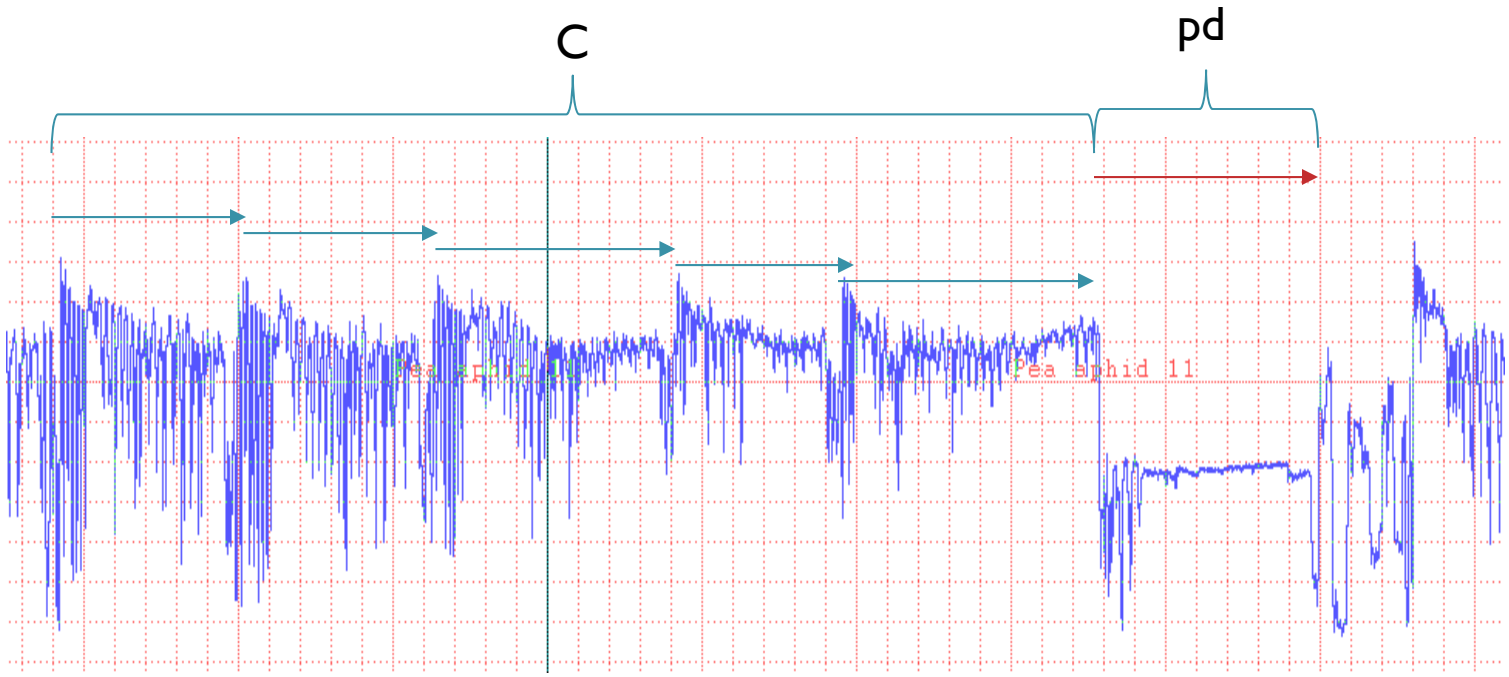
- What are the data?
- Assumptions
- Calculating Variables
- Different options for Data Analysis
- Using Ebert 1.0
- Extracting Results using Excel

EPG Work-shop



Outline: What are the data?
Aphid Waveforms

- A waveform is a repetitive pattern distinguishable from other patterns.



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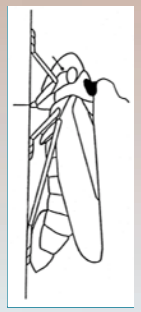
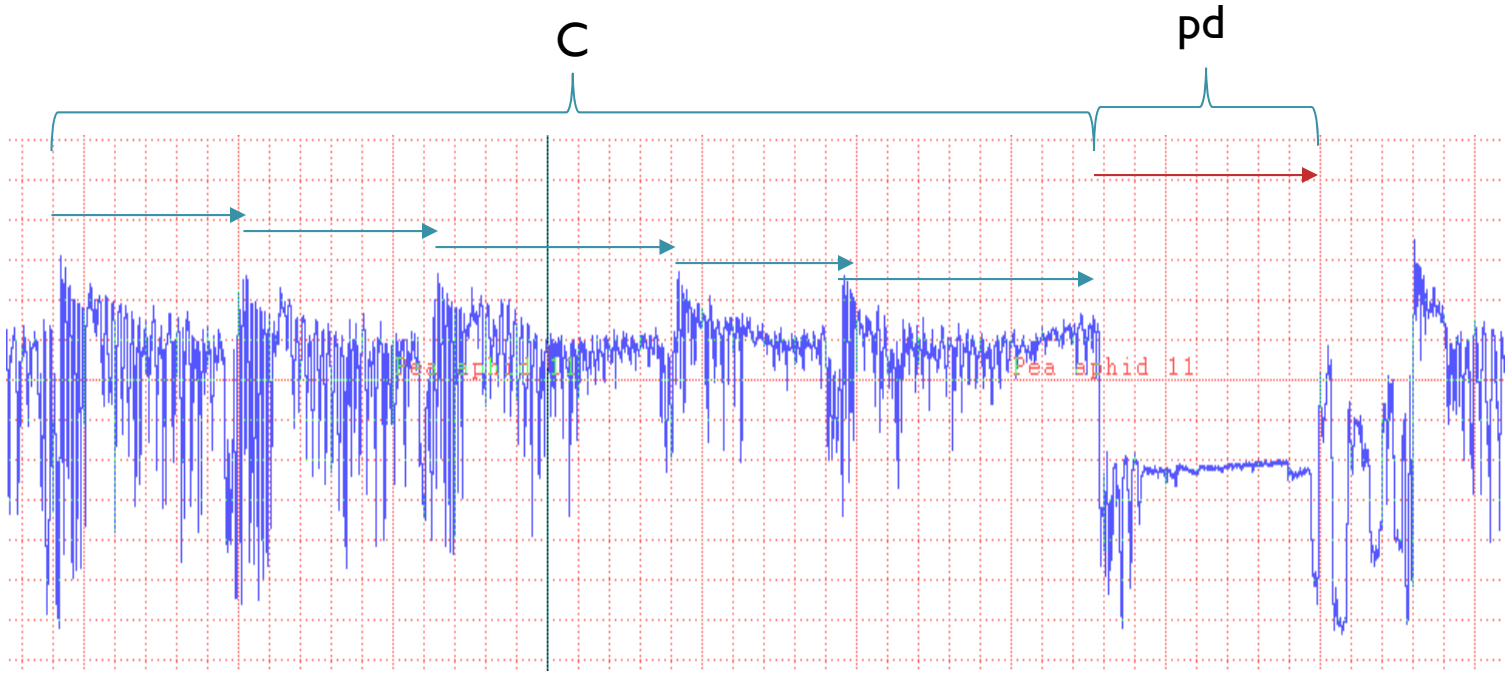


Aphid Waveforms

- Waveforms have context



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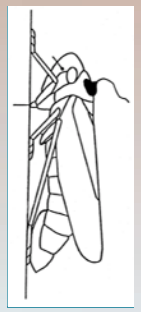
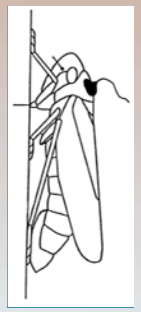


Aphid Waveforms: splitters

- Np: non-probing, resting, moving, other
- A: stylet contact with plant
- B: salivary sheath formation
- C: pathway activities
- pd: stylet tip puncture cell membrane (results in a drop in voltage)
  - pd I: decending edge of pd
  - pd II: maintained low potential
  - pd III: ascending edge of pd
  - pd L: a long duration pd
  - Pd S: a short duration pd
- E1: salivation into sieve element
- E2: ingestion from phloem
- G: ingestion from xylem
- F: stylet misalignment
- E1e: Extracellular salivation
- E1E2: Sometimes E2 is mixed with E1.

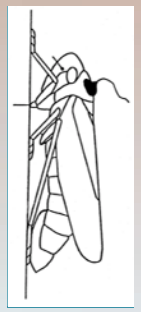
EPG Work-shop



Aphid Waveforms: Lumpers

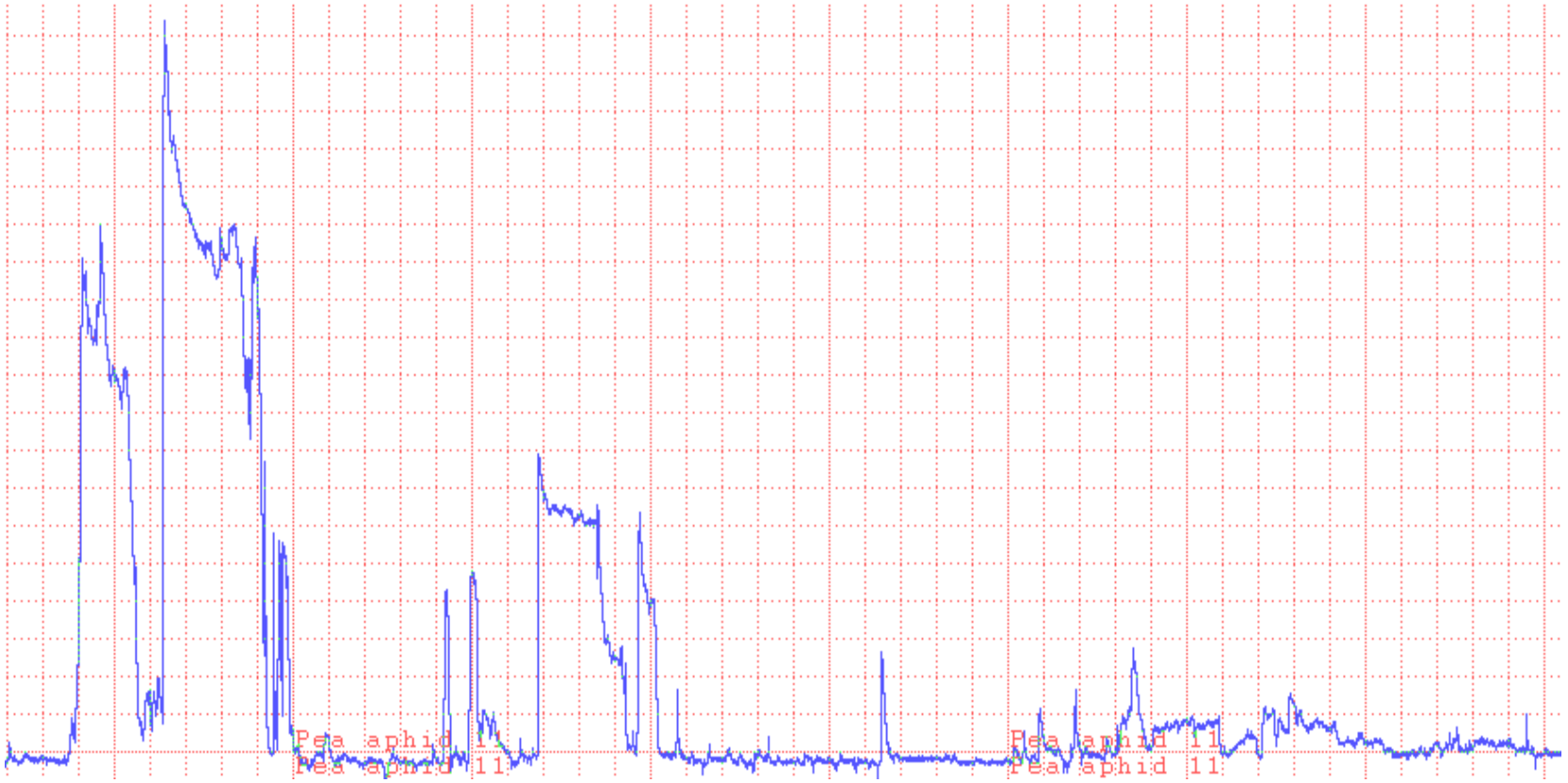
- Np
- C: a combination of A, B, and C.
- pd: No distinction made between subphases.
- E1
- E2
- G
- E1e
- F

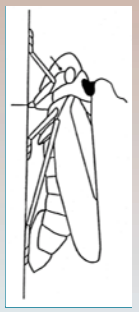
EPG Work-shop



Aphid Waveforms: Np

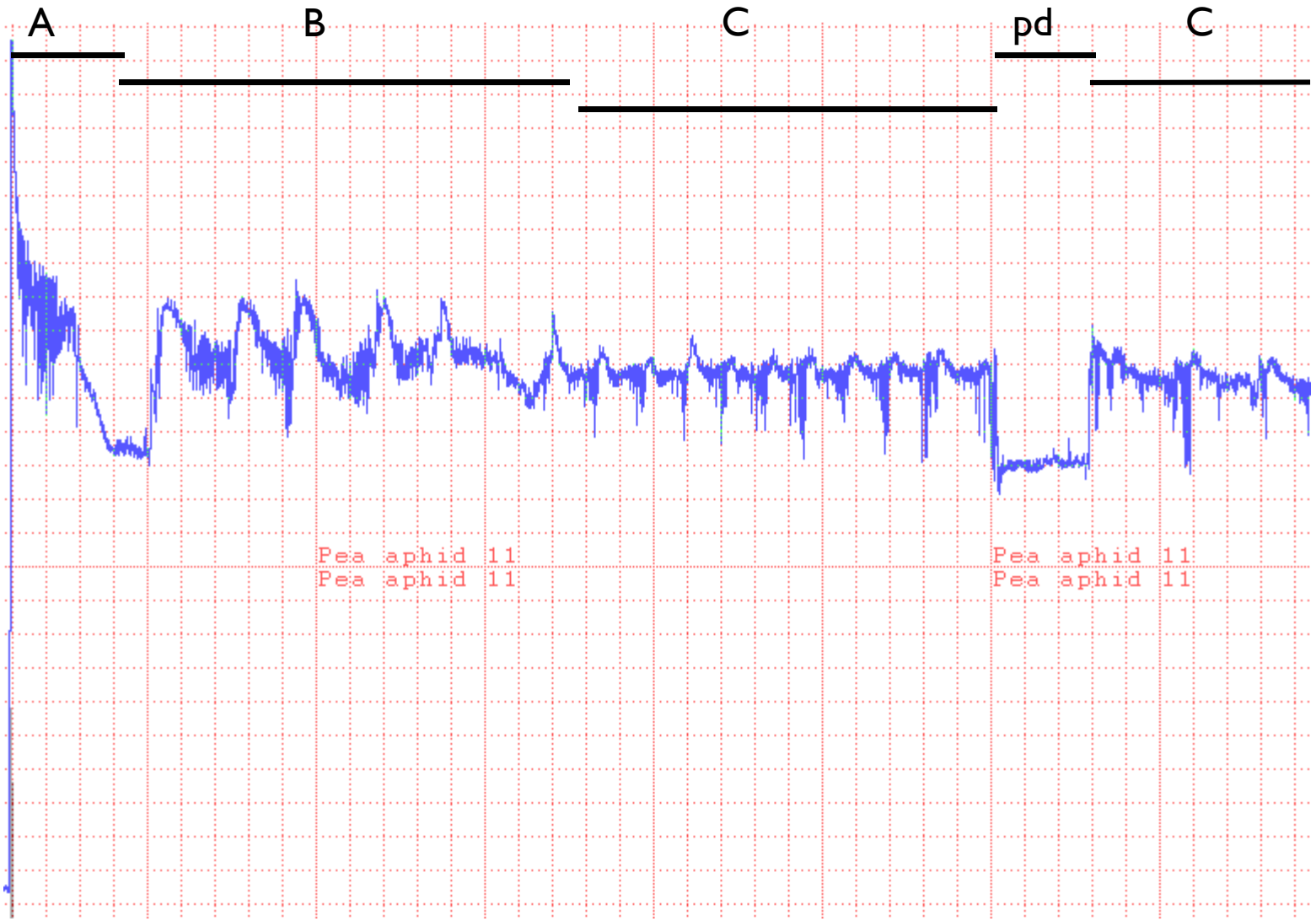
EPG Work-shop





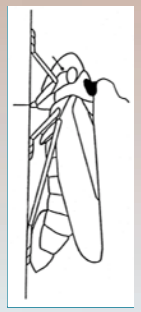
Pea Aphid #11
1 second/division
4x magnification
7911.6 TBF

Aphid Waveforms: A, B, C, and pd



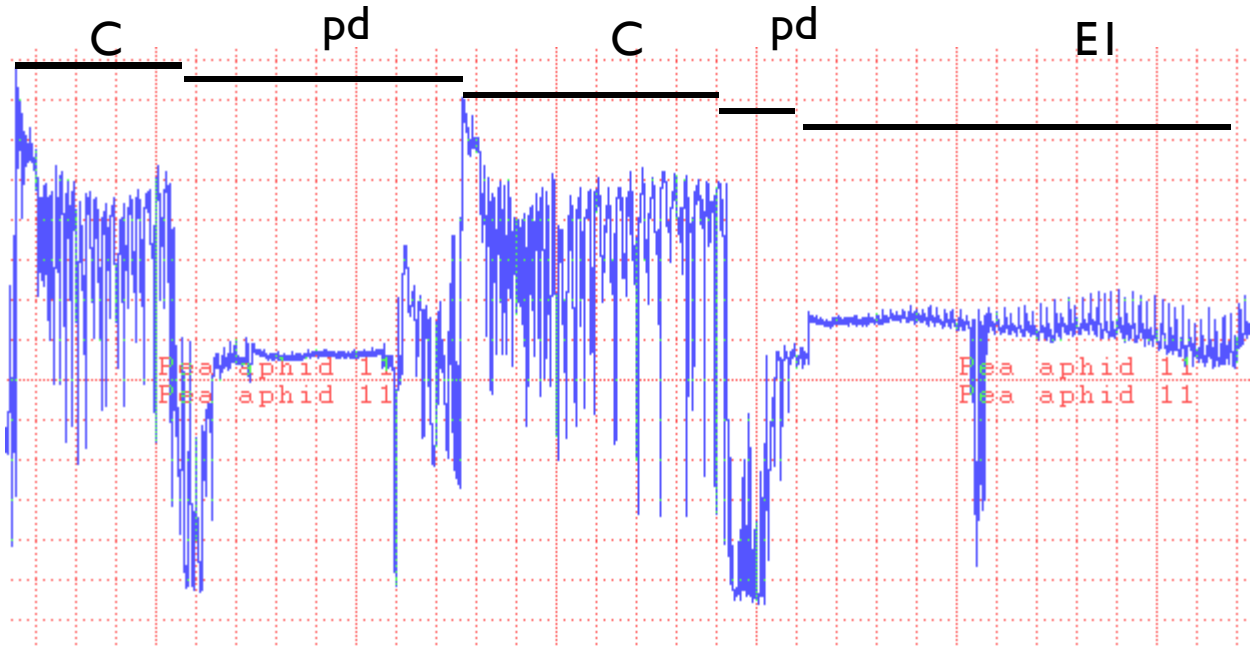
Pea Aphid #11, 2 seconds/division, 4x magnification, 8262 TBF

EPG Work-shop



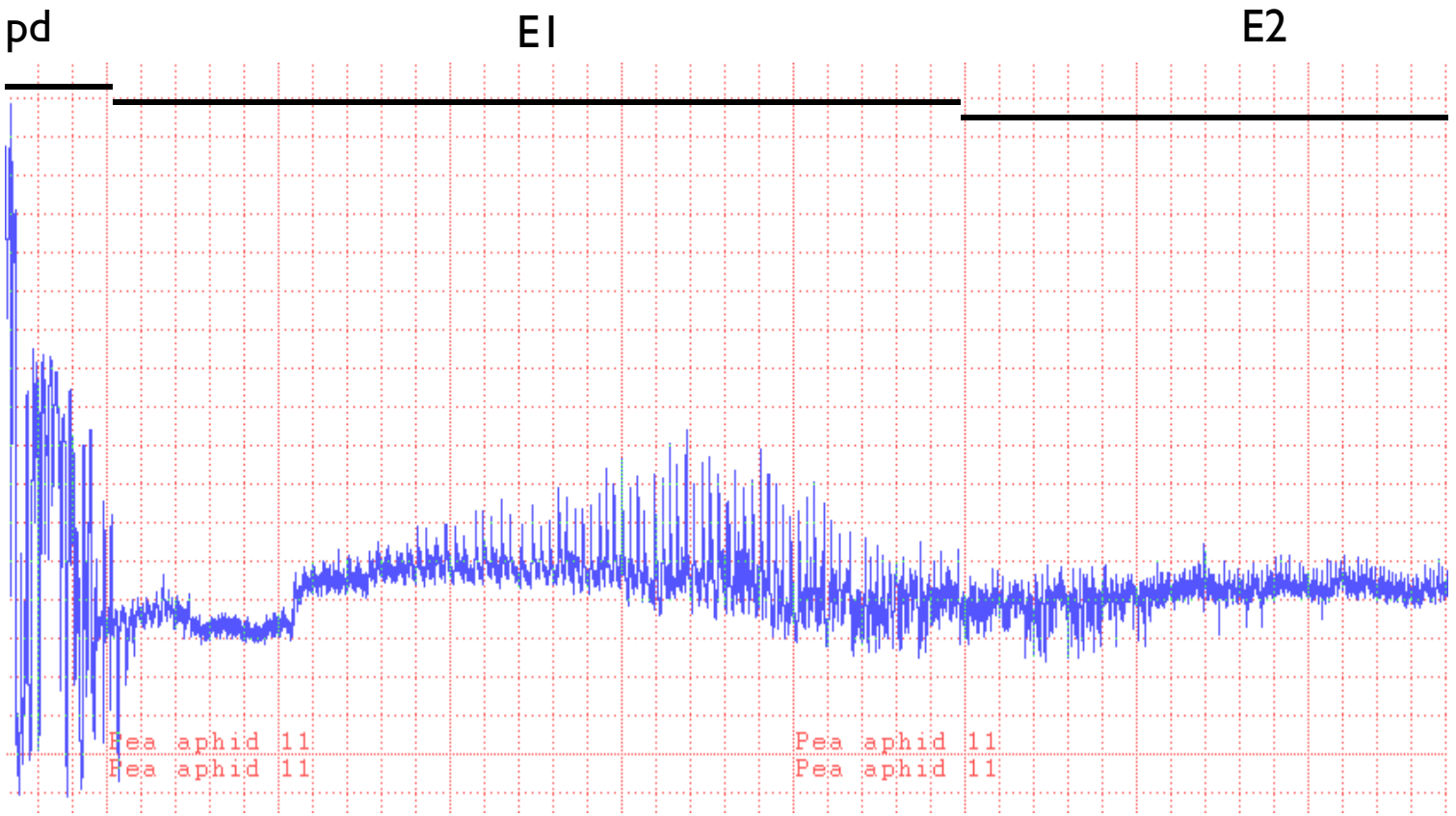
Aphid Waveforms: C, pd, E1

EPG Work-shop



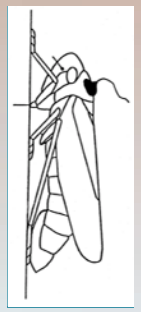
Pea Aphid #11, 2 seconds/division, 8x magnification, 18592 TBF

Aphid Waveforms: E1 and E2



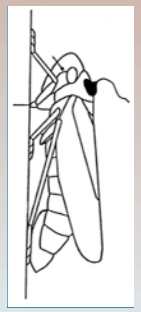
Pea Aphid #11, 1.6 seconds/division, 16x magnification, 54146 TBF

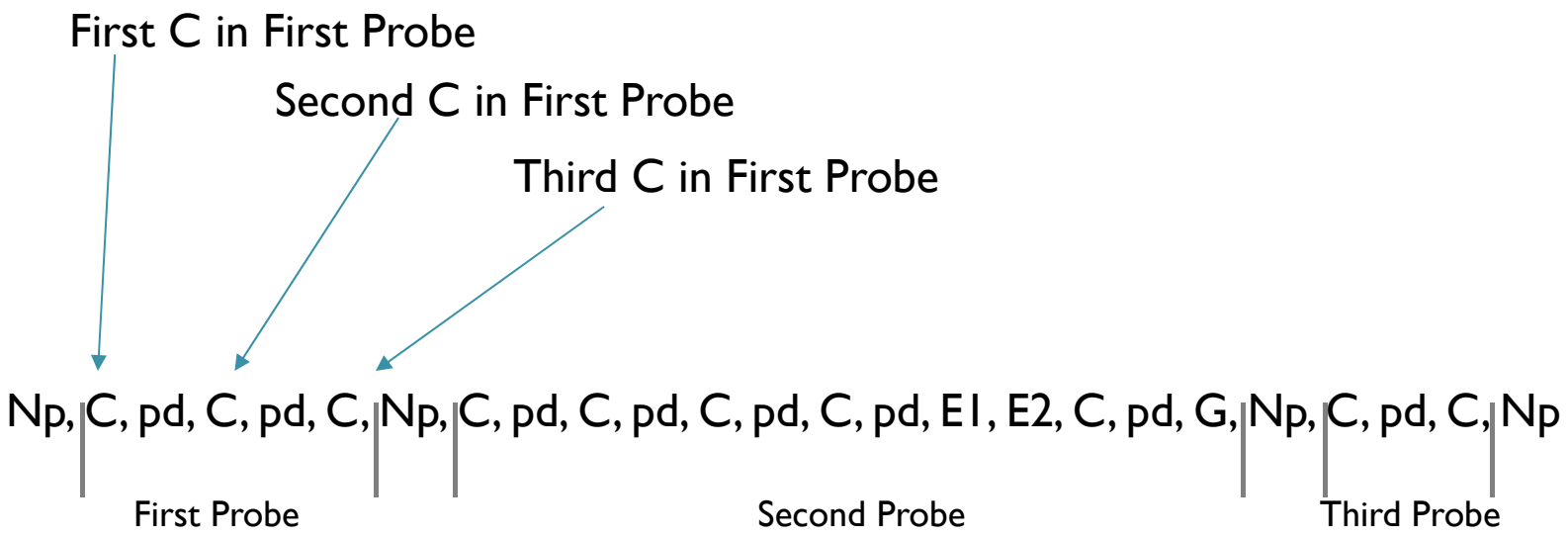
EPG Work-shop



Aphid Waveforms: A sequence

EPG Work-shop

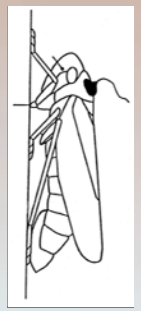




Non-Aphid Waveforms

- Psyllids
  - Np, Z: walking or labial dabbing, and standing still respectively.
  - C: same as aphid, but no pd
  - D: first contact with phloem
  - E1, E2, G: same as aphid
  - Currently, no pd, E1e, or F.
- Thrips:
  - P: mandibular leaf penetration
  - Q: insertion of maxillary stylets
  - R: ingestion of cell contents
  - S: unknown
  - T: a single mandibular thrust, a subphase of R
  - U: end of probe
- Each system is unique to each group of insects.

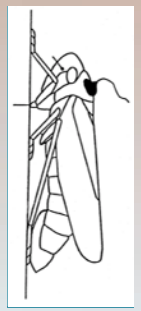
EPG Work-shop



Aphid Data: Assumptions

- The only behavior allowed after Np is A.
  - Unless A is recorded as part of C.
- The only behavior allowed before E2 is E1.
- The only behavior allowed before E1 is pd
- This only applies to aphids, other insects will have different restrictions.

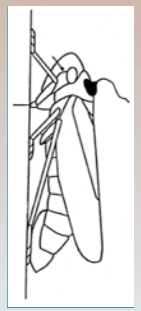
EPG Work-shop



Aphid Data: Assumptions

- No consecutive waveforms with the same behavior. Np, C, C, pd, C is not allowed.
- There can only be one non-probing behavior. There are work-arounds for this in some cases.
- All recordings start with the non-probing behavior.
- All durations are positive.

EPG Work-shop



Conclusion

- There are 8 basic aphid waveforms, that can be further subdivided
- A recording is a temporal sequence of these waveforms.
- Only some transitions from one behavior to another are allowed.

EPG Work-shop