

EPG Data Analysis 101

Introduction

by
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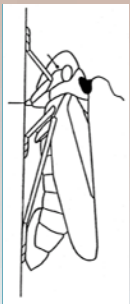


Outline: Overall Organization

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

Note: We begin with aphid waveforms. The psyllid waveforms are similar.

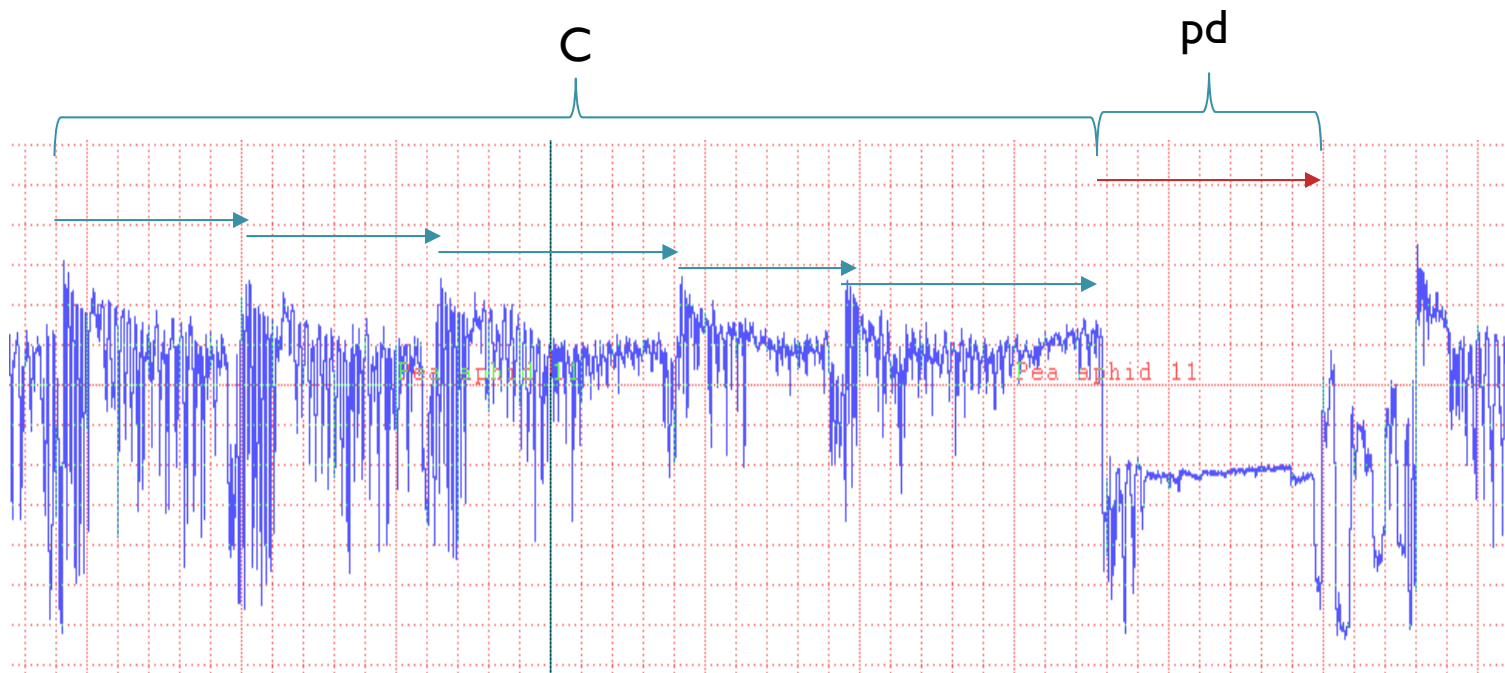
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Outline: What are the data?

Aphid Waveforms

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

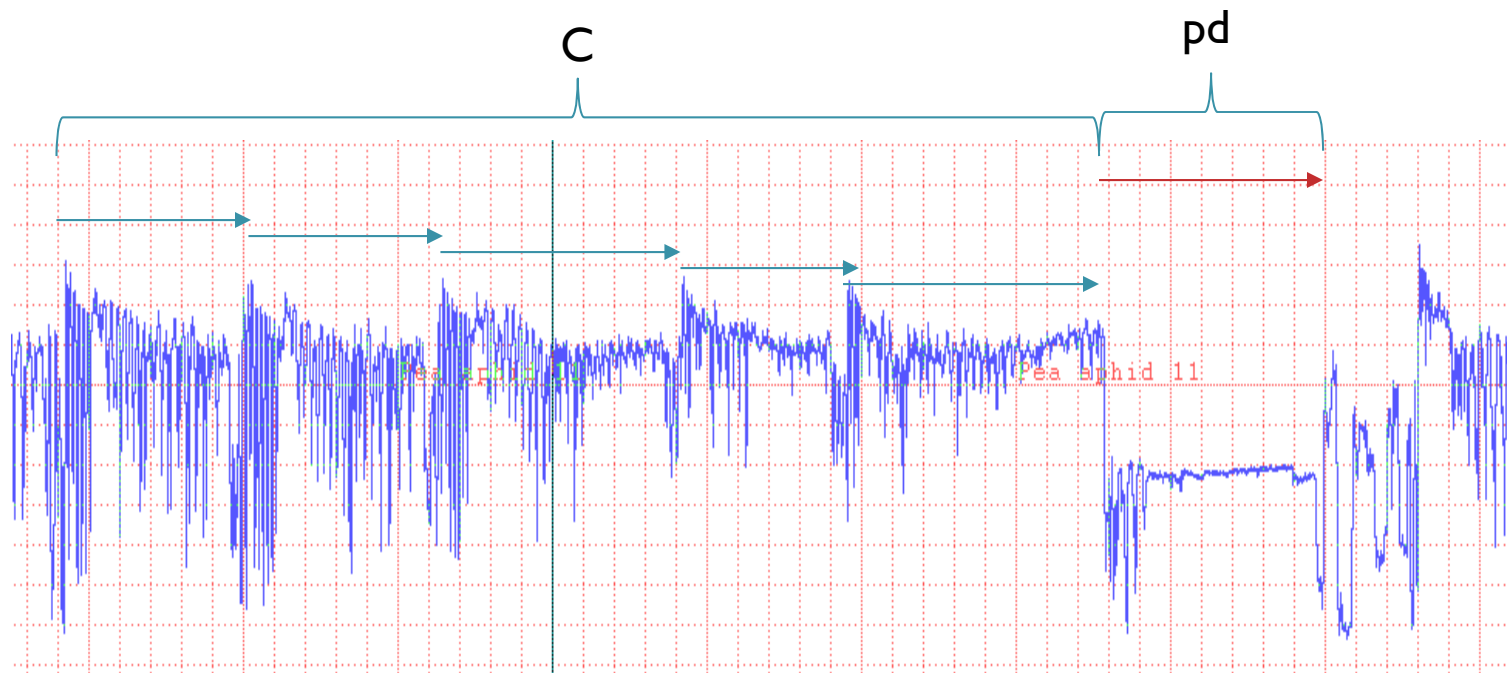


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Aphid Waveforms

- Waveforms have context
- pd is recognizable because we can see C



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Aphid Waveforms: splitters and lumpers

- There is a great deal of detail in these recordings.
- Splitters record all the details.
- Lumpers take a broader overview.
- How does aphid feeding behavior change on cotton versus watermelon? The large number of morphological and biochemical differences between the plants potentially change all behaviors. Thus one might want to look at all behaviors.
- What level of imidacloprid prevents the aphid from contacting phloem in cotton within the first 12 H? In this problem some details can be overlooked.

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.

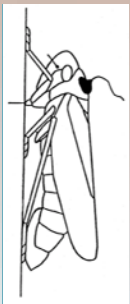
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Aphid Waveforms: Lumpers

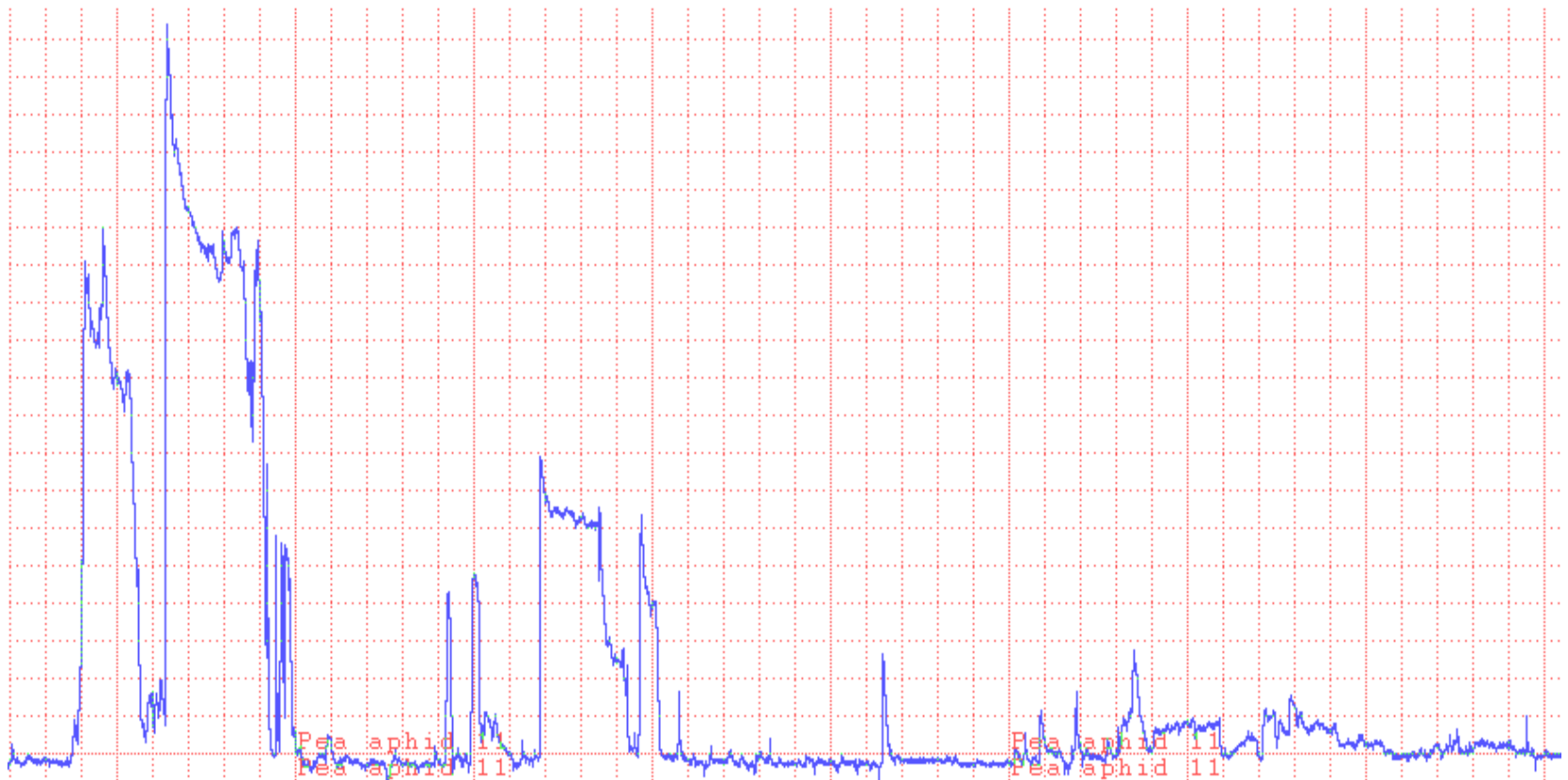
- Np
- C: a combination of A, B, and C.
 - In analysis, pd may also be included
- pd: No distinction made between subphases.
- E1
- E2
- G
- Ele
- F

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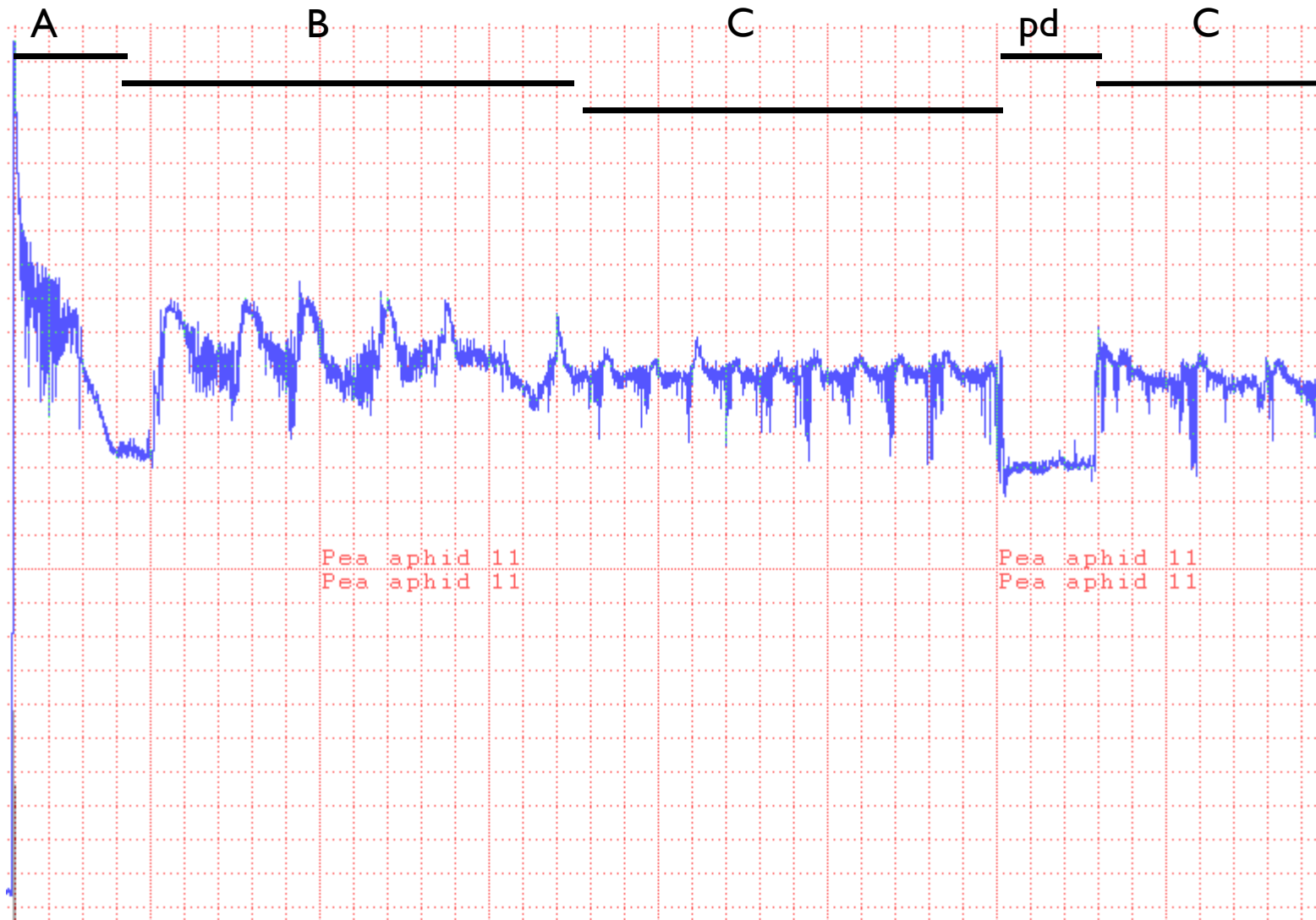
Aphid Waveforms: Np

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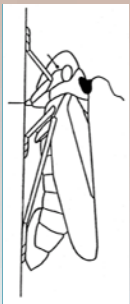
Pea Aphid #11
1 second/division
4x magnification
7911.6 TBF

Aphid Waveforms: A, B, C, and pd

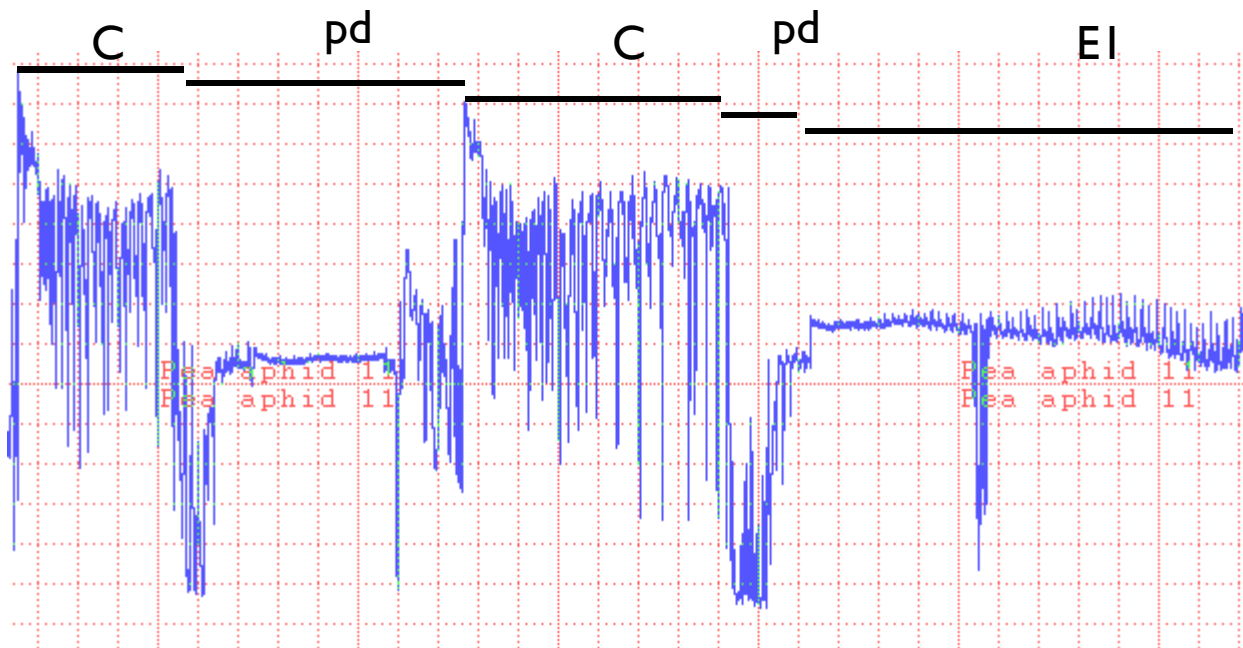


Pea Aphid #11, 2 seconds/division, 4x magnification, 8262 TBF

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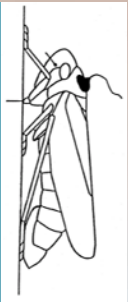


Aphid Waveforms: C, pd, EI

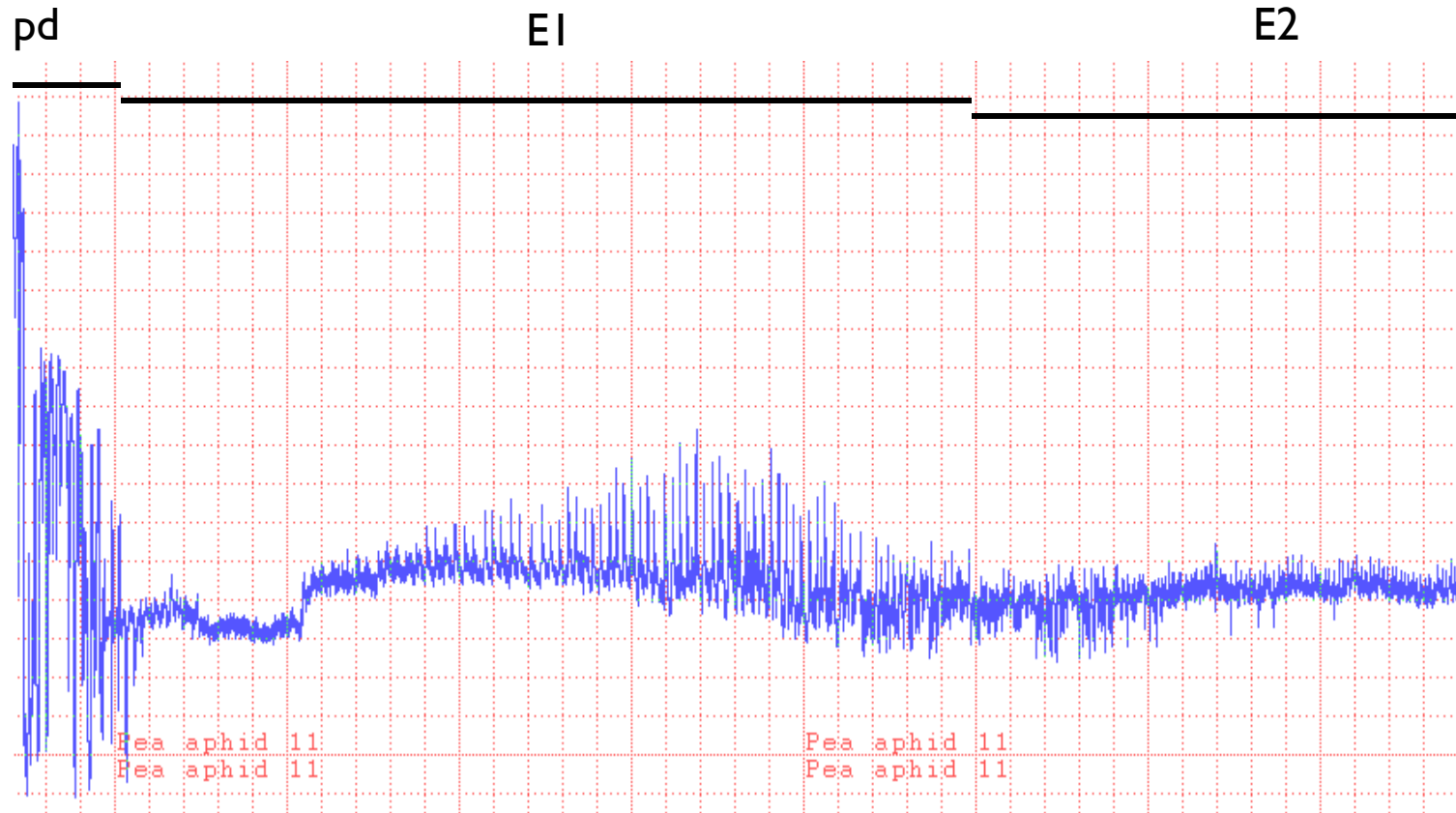


Pea Aphid #11, 2 seconds/division, 8x magnification, 18592 TBF

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Aphid Waveforms: E1 and E2



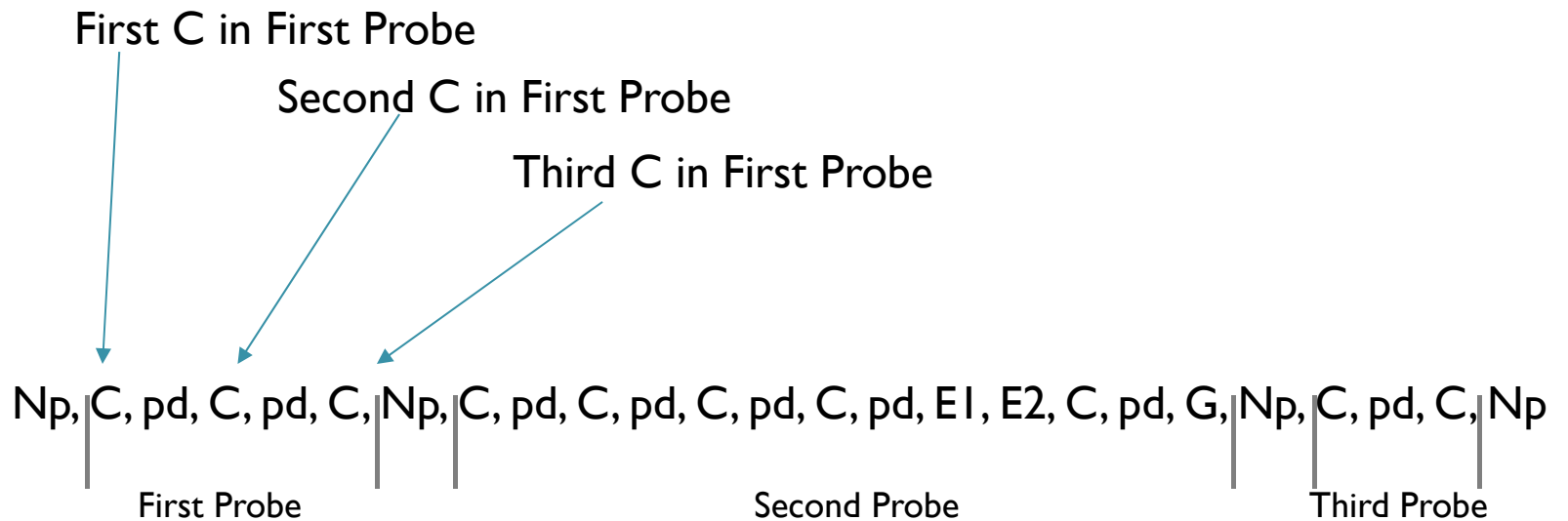
Pea Aphid #11, 1.6 seconds/division, 16x magnification, 54146 TBF

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Aphid Waveforms: A sequence

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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.**

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Psyllid 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 D
- The only behavior allowed before D is C

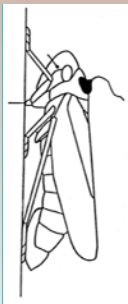
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Psyllid Data: Assumptions

- 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.

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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.

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