

Topic: SIT principle & application

INDUCED STERILITY IN THE MEDFLY, CERATITIS CAPITATA: COMPARISON OF EGG STERILITY FROM FRUIT WITH SPERM IDENTIFICATION IN MATED WILD FEMALES

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Abstract

The measurement of induced sterility is the final "acid-test" in monitoring the sterile insect technique after field releases of sterile insects against wild populations of specific insect pests. A research program involving the release of sterile tsl genetic sexing males of the medfly, *Ceratitis capitata*, commenced in June, 2006 in the fruit growing area of Pernambuco province, Brazil. Males released in one area were pre-treated with ginger root oil as an aromatherapeutic stimulant known to improve sterile male medfly mating ability. In order to help monitor these open field fly releases in mango orchards, a series of large field cage experiments began with the following protocol. Two field cages, 5 M wide X 15 M long, were each set up over 4 large guava plants that covered the length of the cages end to end. Sexually mature (5 da. old) tsl males (ca. 1,000) were released together with ca. 200 per sex of wild, sexually mature (10–20 da old) in the morning of the first day in the center of each cage. The sterile males in one of the cages were pre-treated with ginger root oil aroma the day prior and overnight (ca. 20 hrs) in a closed, but ventilated room at the Embrapa Semi-Arid laboratory located nearby the Embrapa experimental research station. The flies were allowed to mate for 2 days, then 12 apples (pre-punctured with oviposition holes) were hung in each cage to collect eggs over the next 24 hrs. Apples were replaced and a second eggging was performed for 24-48 hrs to collect more eggs. Eggs were dissected from the apples and placed on moist blotter paper and scored for egg hatch 3 days later. Fried competitiveness, C-values, were calculated for the sterile males of each cage. On the day of the final eggging in the cages, both male traps and liquid protein traps were hung in the cages to collect surviving flies. Trapped females were dissected and spermathecae examined for sperm. If mated, the sperm was identified according to type of mating involved—sterile, wild, or both sterile and wild (multiple mating) according to the sperm identification protocol established for medflies by McInnis. Confirmation of the sperm ID technique was made at the Embrapa research facility in June, prior to fly releases in order to allow the comparison of induced sterility from mated females with the egg sterility obtained from fruit. The first results of sperm identification from mated females, in both treatments, have shown multiple mating, and it was also observed that males treated with ginger root oil prior to release into the field cages mate better with wild females and increase induced sterility based on egg hatch from fruit.

References

- Liang, X. et al., 2012. Automatic stem mapping using single-scan terrestrial laser scanning. *IEEE Transactions on Geoscience and Remote Sensing*, 50(2), pp.661–670.
- Olofsson, K., Holmgren, J. & Olsson, H., 2014. Tree stem and height measurements using terrestrial laser scanning and the RANSAC algorithm. *Remote Sensing*, 6(5), pp.4323–4344.
- Conto, T. et al., 2017. Performance of stem denoising and stem modelling algorithms on single tree point clouds from terrestrial laser scanning. *Computers and Electronics in Agriculture*, v. 143, p. 165-176.

Examples

```
file = system.file("extdata", "pine.laz", package="TreeLS")
tls = readTLS(file)
segment = filter_poi(tls, Z > 1 & Z < 2)
pars = shapeFit(segment, shape='circle', algorithm='irls')

segment@data %$% plot(Y ~ X, pch=20, asp=1)
pars %$% points(X,Y,col='red', pch=3, cex=2)
pars %$% lines(c(X,X+Radius),c(Y,Y), col='red',lwd=2,lty=2)
```

 shapeFit.forks

EXPERIMENTAL: Point cloud multiple circle fit

Description

Search and fit multiple 2D circles on a point cloud layer from a single tree, i.e. a forked stem segment.

Usage

```
shapeFit.forks(
  dlas,
  pixel_size = 0.02,
  max_d = 0.4,
  votes_percentile = 0.7,
  min_density = 0.25,
  plot = FALSE
)
```

Arguments

dlas	LAS object.
pixel_size	numeric - pixel side length to discretize the point cloud layers while performing the Hough Transform circle search.
max_d	numeric - largest tree diameter expected in the point cloud.