Topic: **Biology, host range, ecology, survey**

INFESTATION IN GRAPES BY MEDFLY, CERATITIS CAPITATA IN THE SÃO FRANCISCO RIVER VALLEY, BRAZIL

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Abstract

Fruit crops in the São Francisco River Valley (SFV) and other irrigated districts in northeast of Brazil, has enlarged sharply in last three decades and the consequence is the increase of medfly population. In 2005 the SFV harvested 950,000 metric tons of fruit crops being circa 200,000 of table and wine grapes. Data on fruit fly infestation in grapes are sparse and grapes are not yet recorded as medfly host. The objective of this study was to assess the infestation level in grapes, Vitis vinifera, by medfly, Ceratitis capitata in the SFV. The experimental area was a large commercial farm with all cultural practices. The adult population was monitored with Jackson trap baited with TML. Samples of grapes for larval infestation assessment were collected weekly during three months in a total of 116 kilograms. The average FTD (flies/trap/day) for males medfly was 0.26. The number of pupa obtained from the fruit samples was 471 with 287 adults emerged (60.4%), all medfly. The infestation level was 4.0 pupae per kilogram of fresh fruit. The data support the hypothesis that grapes are a medfly host under SFV conditions and eventually cause high damage to the production. The medfly suppression program using SIT in the SFV has to take in account this new status of grapes for prevents production losses.

Random Sample Consensus (RANSAC) Algorithm

The **RAN**dom **SA**mple **C**onsensus algorithm is a method that relies on resampling a data set as many times as necessary to find a subset comprised of only inliers - e.g. observations belonging to a desired model. The RANSAC algorithm provides a way of estimating the necessary number of iterations necessary to fit a model using inliers only, at least once, as shown in the equation:

$$k = log(1 - p)/log(1 - w^n)$$

where:

- k: number of iterations
- p: confidence level, i.e. desired probability of success
- w: proportion of inliers expected in the *full* dataset
- n: number of observations sampled on every iteration

The models reiterated in *TreeLS* usually relate to circle or cylinder fitting over a set of 3D coordinates, selecting the best possible model through the RANSAC algorithm

For more information, checkout this wikipedia page.

Iterative Reweighted Least Squares (IRLS) Algorithm

irls `circle` or `cylinder` estimation methods perform automatic outlier assigning through iterative reweighting with M-estimators, followed by a Nelder-Mead optimization of squared distance sums to determine the best circle/cylinder parameters for a given point cloud. The reweighting strategy used in *TreeLS* is based on Liang et al. (2012). The Nelder-Mead algorithm implemented in Rcpp was provided by kthohr/optim.

Brute Force Cylinder Fit

The brute force cylinder fit approach estimates the axis rotation angles by brute force combined with 2D ransac circle fit. The coordinates of a point cloud representing a single cylinder are iteratively rotated up to a pre defined threshold, and for every iteration a circle is estimated after rotation is performed. The rotation that minimizes the circle parameters the most is used to describe the axis direction of the cylinder with the circle's radius.

The parameters returned by the brute force cylinder fit method are:

- `X,Y`: 2D circle center coordinates after rotation
- `Radius`: 3D circle radius, in point cloud units
- `Error`: model circle error from the RANSAC least squares fit, after rotation
- `DX,DY`: absolute rotation angles (in degrees) applied to the X and Y axes, respectively
- `AvgHeight`: average height of the stem segment's points
- `N`: number of points belonging to the stem segment