# Temperature effect on the duration of the development of *Bactrocera dorsalis* (Diptera: Tephritidae)

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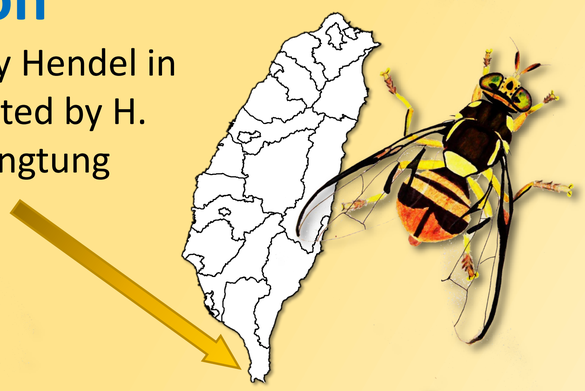
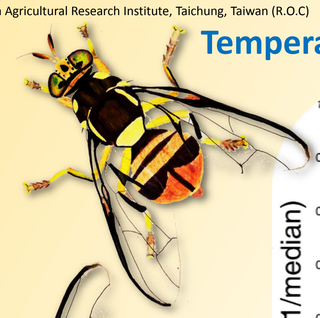
## Introduction

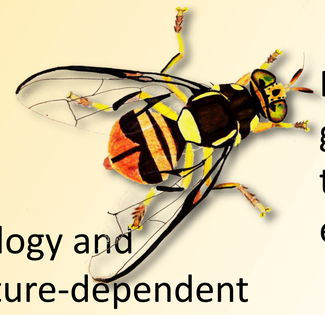
Was reported in Taiwan by Hendel in 1912 specimen was collected by H. Sauter from Hengchun, Pingtung





Among dipterans is one of the most invasive and polyphagous (about 300 species including crop and wild plants)

The oriental fruit fly, *Bactrocera dorsalis* (Hendel) (Diptera: Tephritidae: Dacinae)



## Objective

To determine the effects of temperature on the biology and development of *B. dorsalis*, and construct temperature-dependent development models

## Materials and methods

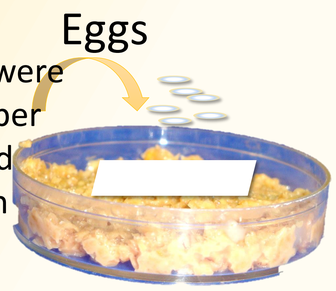
### Temperature-dependent development experiments

Eggs → Larva → 13 °C, 14.4 °C, 16.2 °C, 19.5 °C, 23.8 °C, 27.7 °C, 31.8 °C, 34.8 °C

Newly emerged *B. dorsalis* larva (200) were placed individually in 5 cm by 1 cm in diameter vial filled with artificial diet (≈ 1.5 $cm^3$), then, exposed in growth chambers at eight temperatures

### Development of B. dorsalis eggs at constant temperatures

Newly laid *B. dorsalis* eggs (> 500) were placed in Petri dishes with filter paper above of a thin layer of artificial and eclosion was daily observed at each temperature.

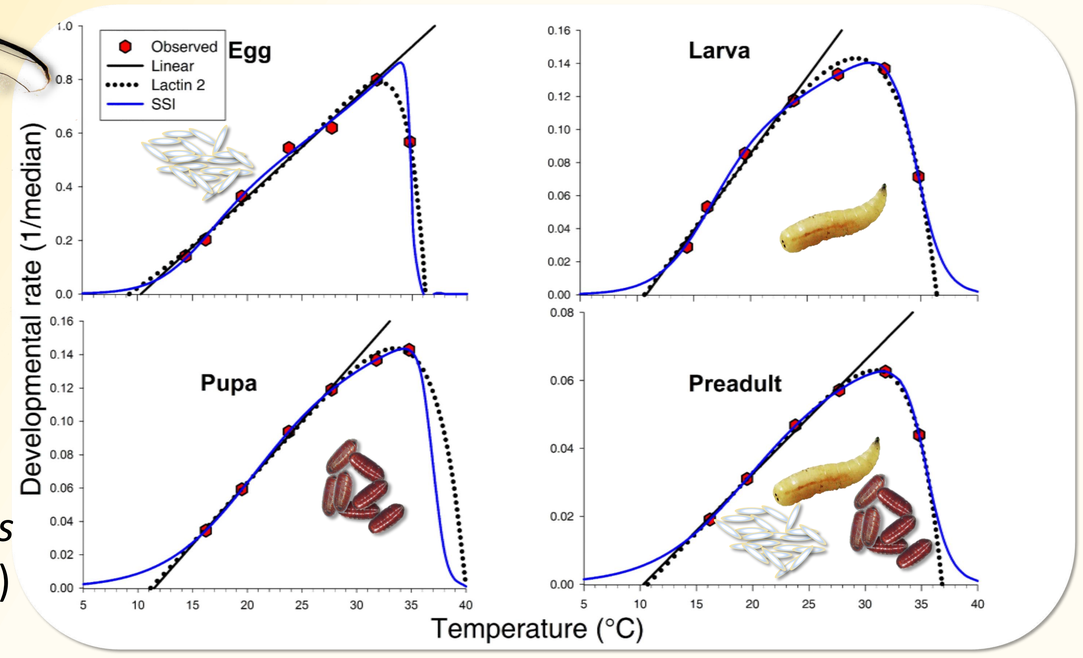


Eggs → 13 °C, 14.4 °C, 16.2 °C, 19.5 °C, 23.8 °C, 27.7 °C, 31.8 °C, 34.8 °C

The development rate of eggs, larva, pupa, and preadult stage were fitted to two nonlinear development rate models, Lactin 2 and Sharpe-Schoolfield model (SS), since, are the most widely adopted models and because their biological significance

## Results

### Temperature-dependent development experiments




Both non linear models, appear to be well fitted to our observations, however, graphically the SS model at egg stage show an optimal temperature higher than the observed value. The highest development rate was at 31.8 °C for all stages, excluding pupa stage (34.8 °C )

**Table 1 The lower developmental thresholds (LDT) and thermal constant**

| Stage | Regression | | | Lower threshold | Thermal |
|---|---|---|---|---|---|
| | Equation | df | $r^2$ | temp. (°C) | constant (DD) |
| Egg | 0.0374·X - 0.3854 | 4 | 0.990 | 10.3 | 26.8 |
| Larva | 0.0093·X - 0.1003 | 2 | 0.987 | 10.8 | 107.7 |
| Pupa | 0.0074·X - 0.0852 | 2 | 0.998 | 11.5 | 134.7 |
| Preadult | 0.0033·X - 0.0344 | 2 | 0.995 | 10.3 | 299.2 |

Preadult stage were 10.3°C and 299.2 degree-days (DD)

**Table 2 Development time of Bactrocera dorsalis eggs at constant temperatures**

| Temperature (°C) | Development time (days) | |
|---|---|---|
| | Mean ± SE | Median |
| 13 | - | - |
| 14.4 | 7.6 ± 0.00 f | 7.1 |
| 16.2 | 5.2 ± 0.01 e | 4.9 |
| 19.5 | 3.0 ± 0.01 d | 2.7 |
| 23.8 | 2.2 ± 1.30 c | 1.8 |
| 27.7 | 1.9 ± 0.06 b | 1.6 |
| 31.8 | 1.5 ± 0.00 a | 1.3 |
| 34.8 | 2.0 ± 0.01 b | 1.8 |

Eggs didn't survive at 13 °C, development period ranged from 7.6 days (14 °C) to 1.5 days (31.8 °C); from 23.8 to 34.8 °C, eggs eclosion was about two days

## Conclusions

-Our models, posses good realism and accuracy with our observations. However *B. dorsalis* development varies, within, hosts (Huang, Y-B., Chi, H., 2014. ) and strains.

- Dipterans have a wide plasticity resulting in differences in their development time and temperatures thresholds

## References

Hendel, F. 1912 H. Sauter's Formosa-Ausbeute. Genus Dacus (Dipt.). Supplementa Entomologica. 1: 13-24.

Huang, Y-B., Chi, H., 2014. Fitness of Bactrocear dorsalis (Hendel) on seven host plants and an artificial diet. Turk, entomol. Derg. 38, 401-414.

## Acknowledgements

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