

Food or water deprivation induces distinct changes in the Locomotor Activity of *Bactrocera oleae*

ID: 12ISFFEI-a01f

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Background: The olive fruit fly, *Bactrocera oleae* (Rossi) (Diptera: Tephritidae), is a key global pest requiring refined management strategies. Understanding how essential resources, specifically food and water, modulate physiological parameters such as locomotor activity is crucial for optimizing the efficacy of control methods, including baiting and mass-trapping. This study investigated the impact of food and water deprivation on the movement patterns of adult *B. oleae*.

Methods: Locomotor activity was quantified in *B. oleae* adults under controlled laboratory conditions. Experiments were designed to isolate the effects of two distinct stress conditions: food deprivation and water deprivation. A control group with access to both food and water was also maintained. Activity was continuously recorded using an automated monitoring system (Trikinetics) over a defined period of 72 hours, and data recorded were analysed to assess the activity patterns across the treatment groups.

Results: Locomotory patterns exhibited strong temporal dependencies, with significant differences observed between daytime and nighttime periods. Activity was highest in food-deprived adults, followed by water-deprived, and then control groups. Daytime activity showed a temporally restricted peak, with substantially higher locomotion recorded during the late period (15:00 to 20:59) compared to the early period (07:00 to 14:59). Activity was also age-dependent: 5-day-old males and females were significantly more active than 45-day-old counterparts. Finally, 30-day-old females exhibited significantly higher locomotory activity than age-matched males during the daytime.

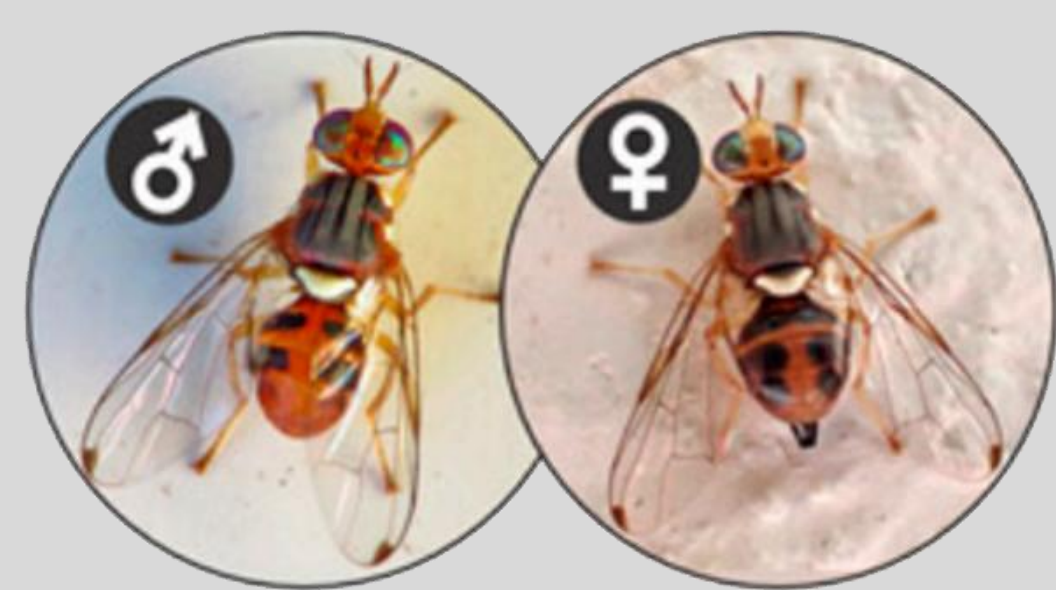
Conclusions: The locomotor behavior of *B. oleae* is significantly influenced by the temporal phase and stress physiology. The findings provide precise behavioral metrics: a strong stress hierarchy, distinct late-day activity peaks, and notable age- and sex-specific differences. These findings offer actionable insights for enhancing pest control strategies that target stress physiology, senescence, and the aging process. Furthermore, this comprehensive dataset is directly applicable to quality control assessments within Sterile Insect Technique (SIT) programs and forms a vital foundation for future research on *B. oleae* under varied stress conditions.

Keywords: pest control, olive groves, Tephritidae, activity patterns

Session 1. Biology, Ecology, Physiology and Behavior

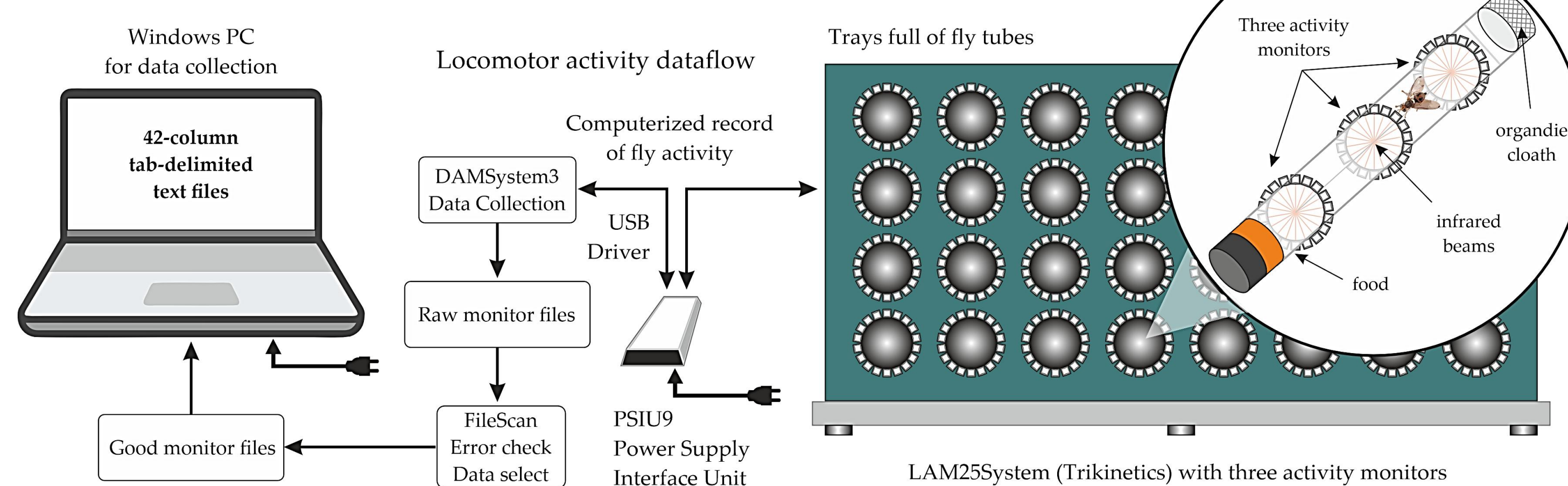
Methodology

Activity was continuously recorded using an automated monitoring system (Trikinetics) over a defined period of 72 hours, and data recorded were analysed to assess the activity patterns across the treatment groups.

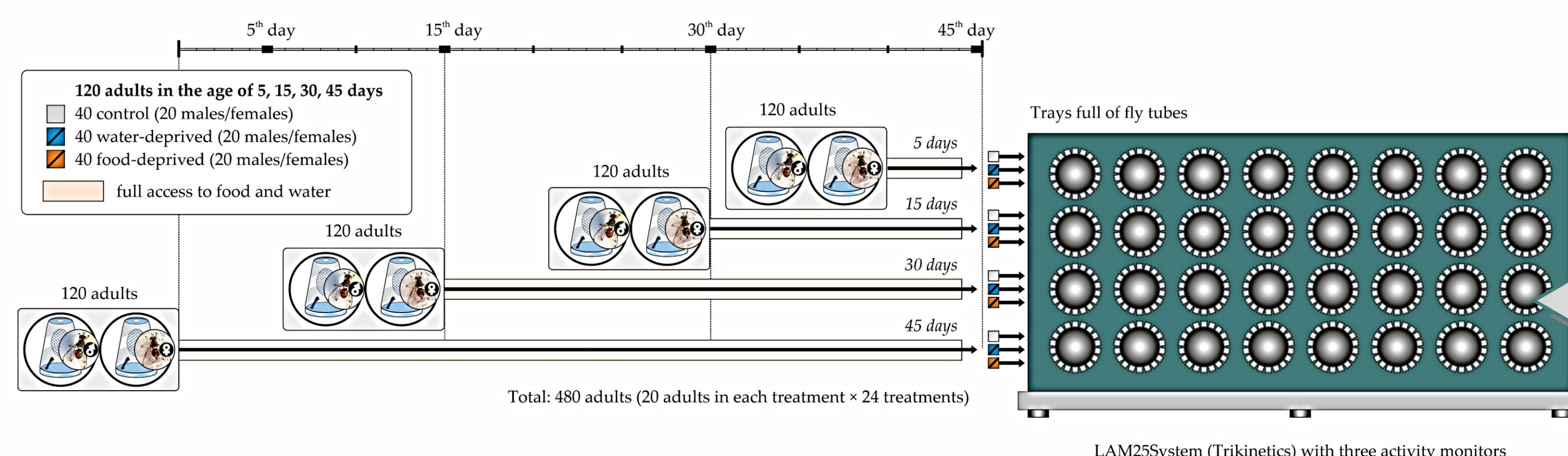


Bactrocera oleae (Rossi) (Diptera: Tephritidae)

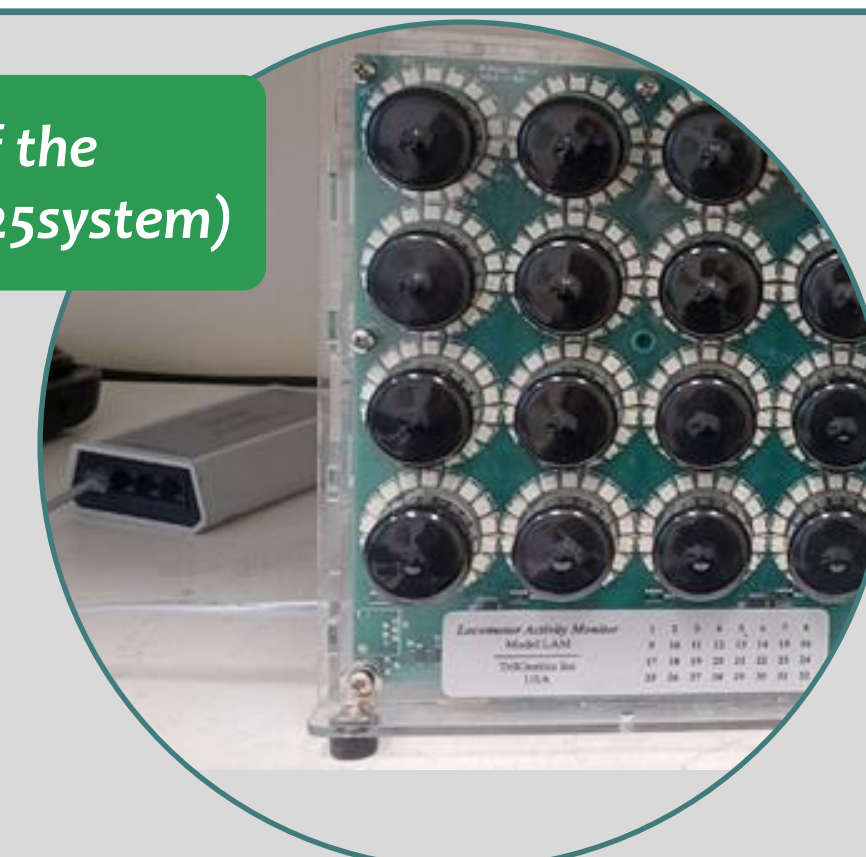
Locomotor (Trikinetics)



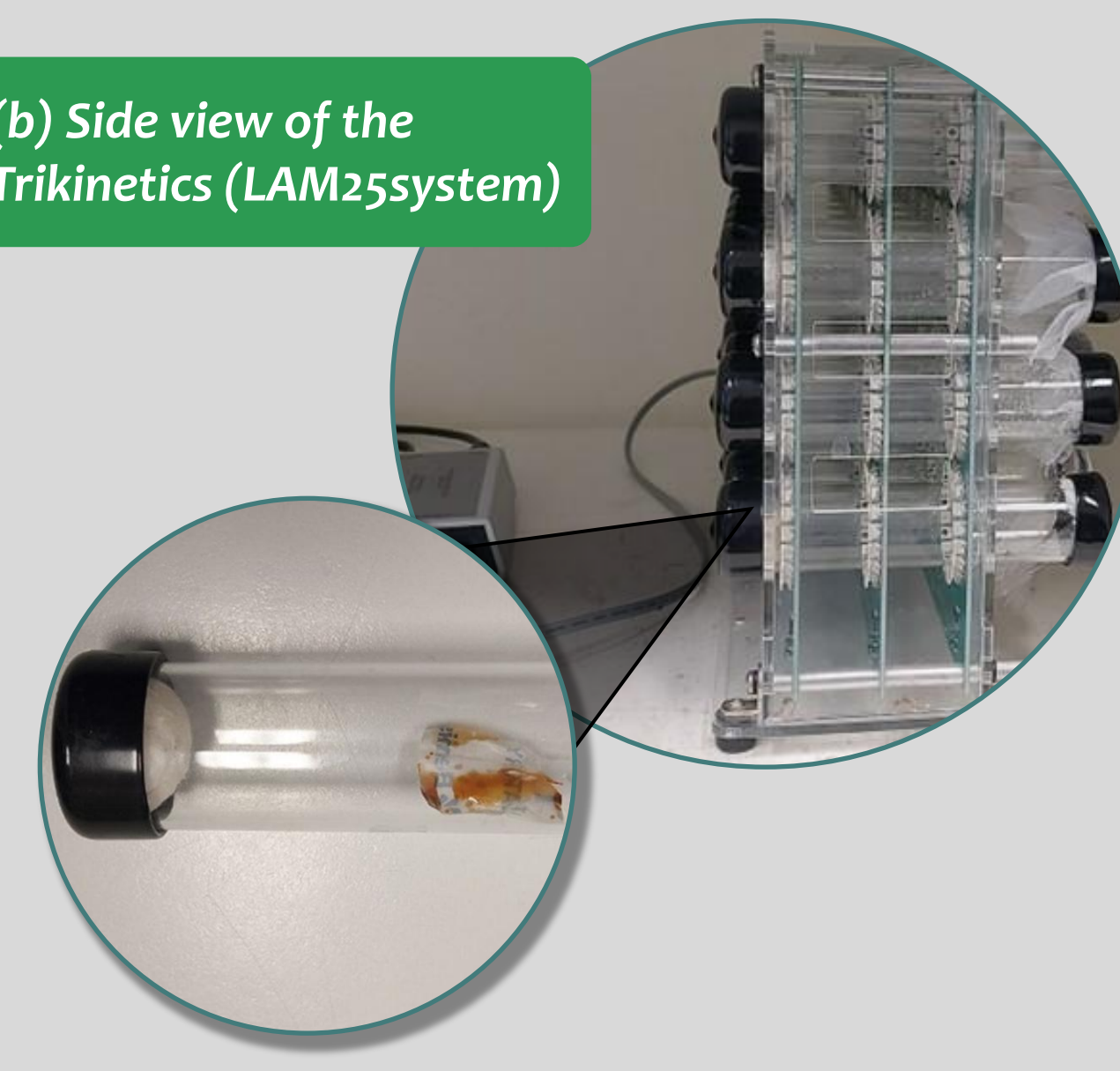
Experimental process



(a) Front view of the Trikinetics (LAM25system)



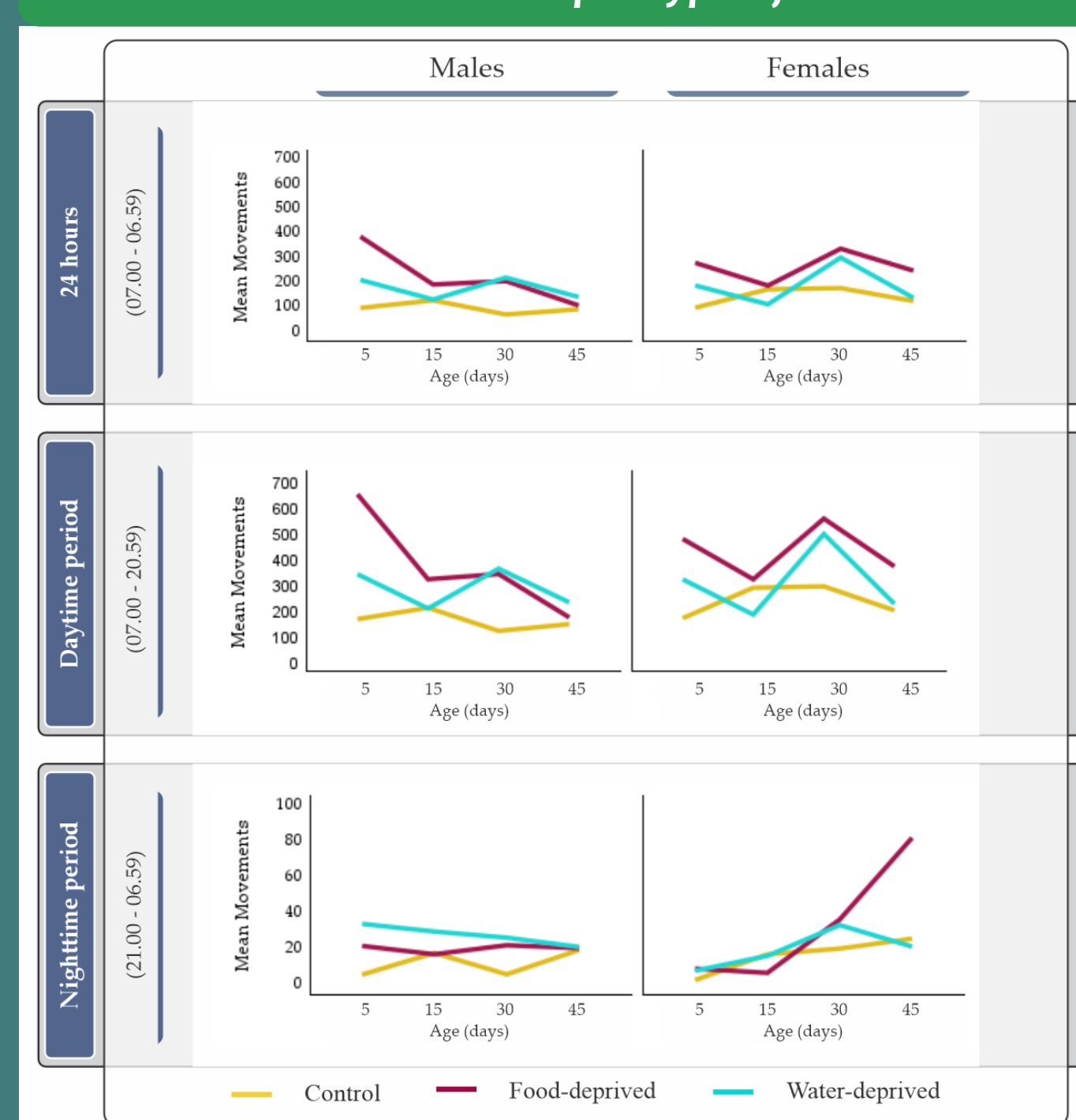
(b) Side view of the Trikinetics (LAM25system)



Results

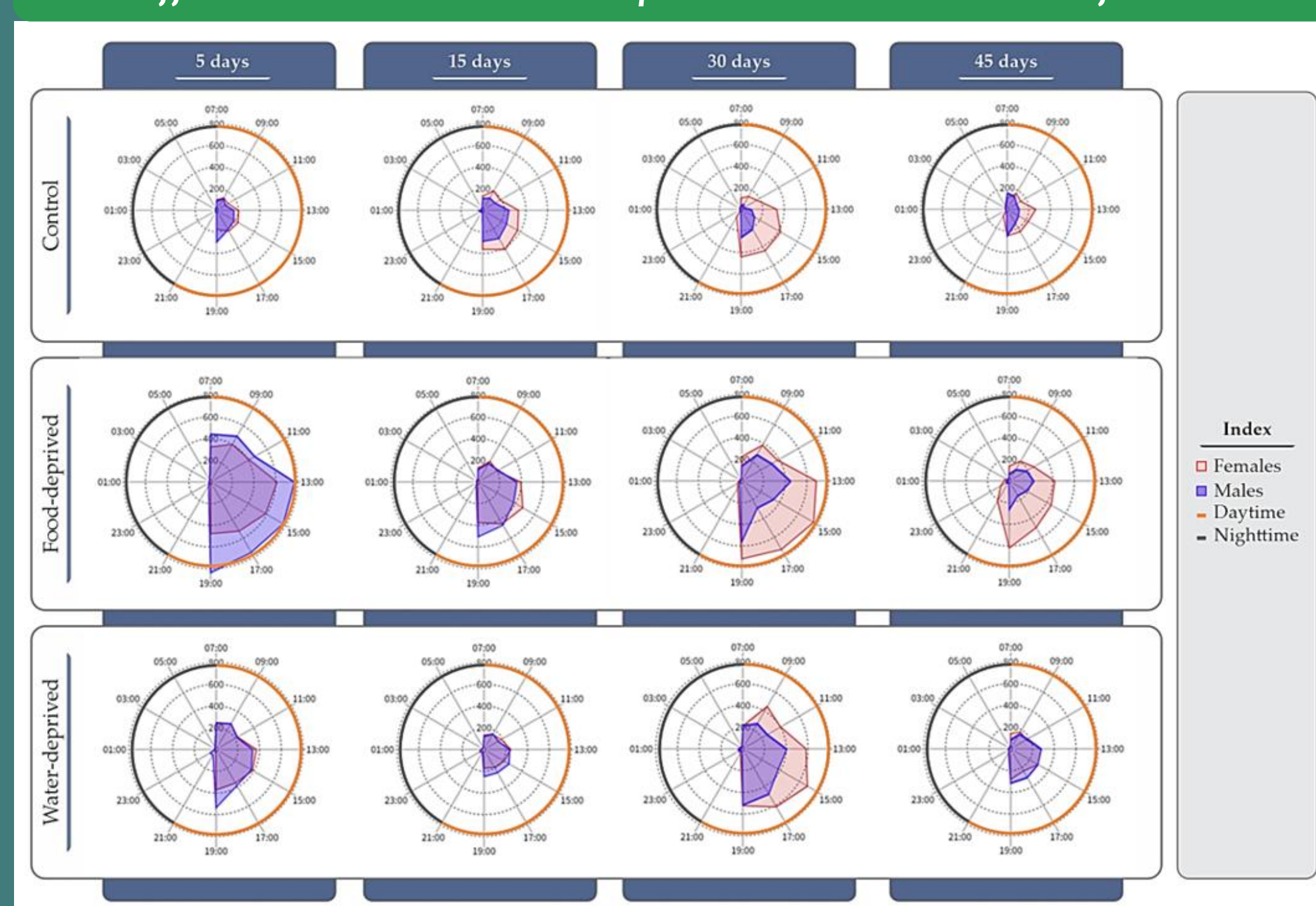
Locomotory activity was highest in food-deprived adults, followed by water-deprived and control groups, with younger individuals (5-day-old) being significantly more active than older ones (45-day-old). Significant sex-specific differences were observed during the daytime, specifically with 30-day-old females exhibiting much higher activity levels than age-matched males. Movement patterns showed strong temporal dependencies, peaking sharply during the late daytime period (15:00–20:59) before shifting significantly during the night.

Mean movements per type of stress



A. Mean movements (untransformed data) of males and females for each type of stress during different periods of the day (daytime and nighttime periods) and total mean movements during the day (24 hours).

Differences on mean movement patterns between males and females



B. Radar diagrams are employed to visualize the differences in mean movement patterns (untransformed data) between males and females across various types of stress and age groups. Movement recording starts at 07:00 in the morning, with averaged movement values plotted for every two-hour interval throughout the three-day experiment.

Heatmap of mean movements during daytime and night



C. Heatmap with mean value of movements – IR sensor interruptions (untransformed data) for males and females in three types of stress (control, food-deprived, and water-deprived), and for four age groups (5, 15, 30, and 45 days).

Conclusions

The locomotor behavior of *B. oleae* is driven by temporal phases and stress levels, providing key metrics on stress hierarchy, activity peaks, and age- or sex-specific differences. These insights support the development of more effective pest management programs by enabling more precise targeting based on the pest's physiology and activity patterns.



12th International Symposium on Fruit Flies of Economic Importance

AGADIR, MOROCCO
10 / 15 MAY 2026