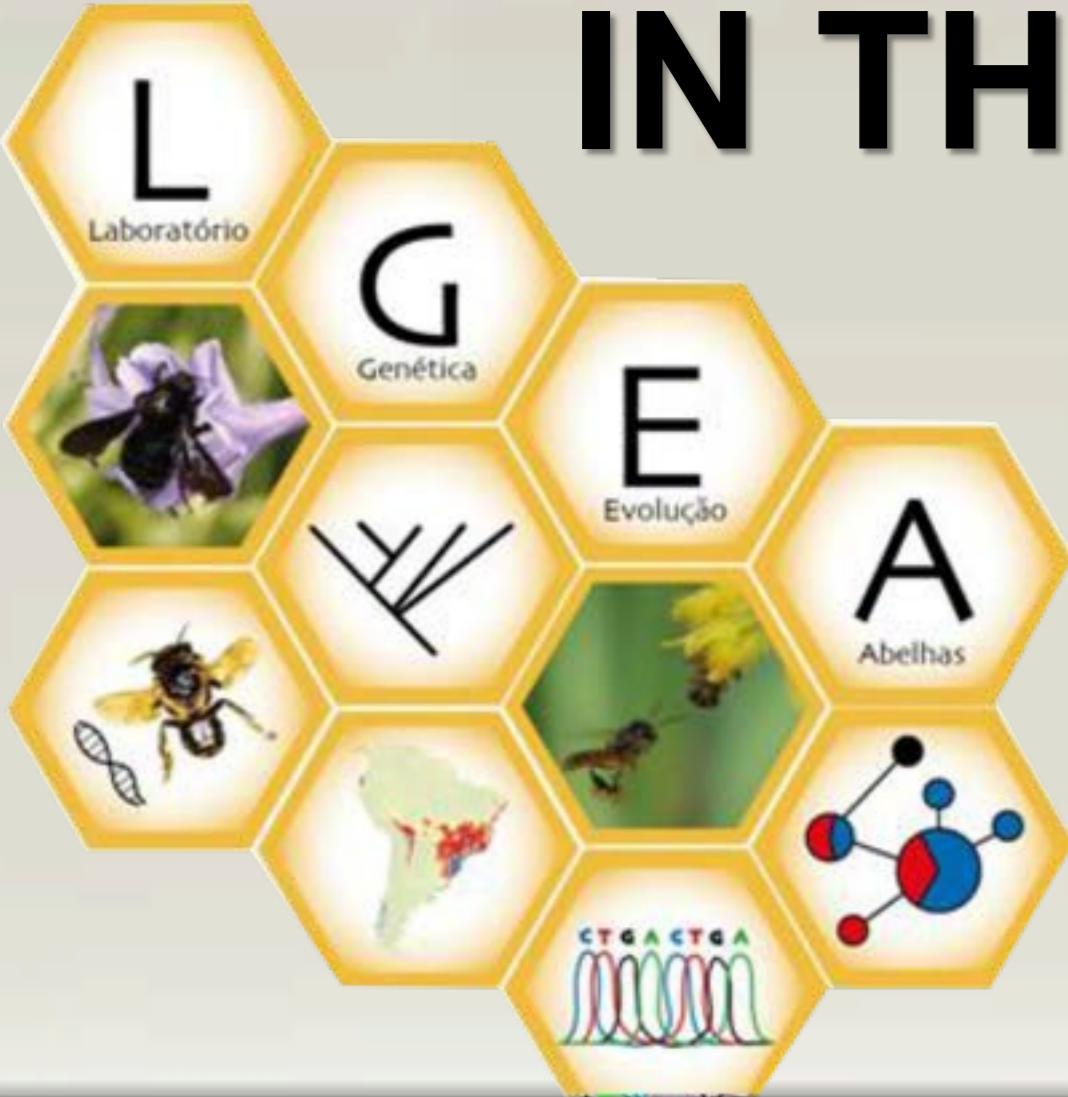


GENE EXPRESSION ANALYSES OF BIVOLTINE BEHAVIOR IN THE SOLITARY BEE *TETRAPEDIA DIVERSIPES* AND ITS IMPLICATION IN EUSOCIALITY



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Introduction

The number of generations that a species produces in one year determines its voltine pattern. In bees the voltine behavior is considered to be the result of evolutionary adaptations to environmental conditions such as temperatures, humidity, latitude and food resources. However this behavior may have profound consequences in the population structure and social organization. For example, bivoltinism with diapause in one of the generations allows the overlapping of individuals from the same female, which is a necessary characteristic for social evolution.

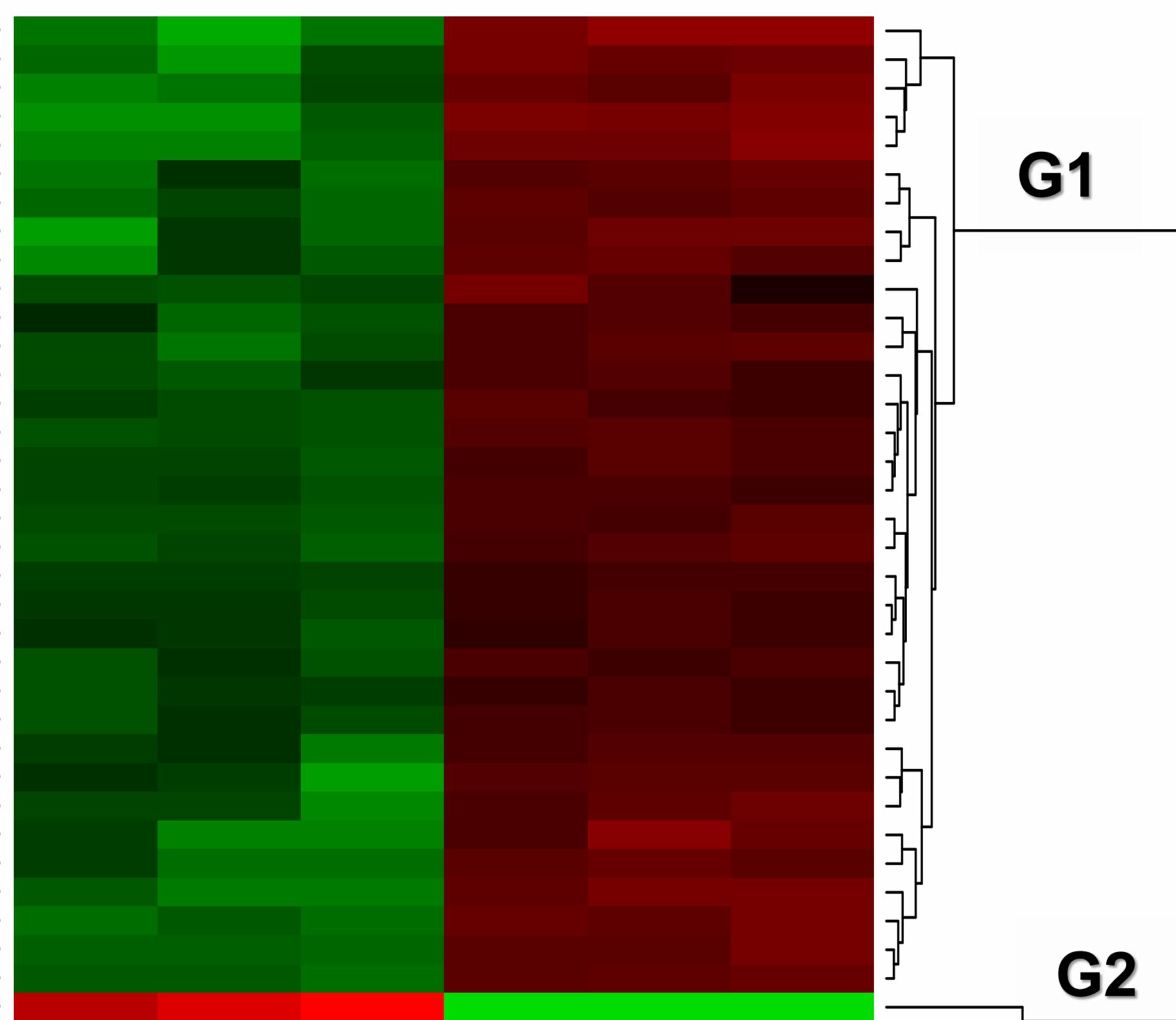
Herein we have used the RNA-Seq technique to perform a comparative transcriptome analysis of foundresses from both generations of the solitary bee *Tetrapedia diversipes*. This is a bivoltine species native from South America that enters diapause during the last larvae developmental during the winter (Figure 1).

Generation 1



Oviposition – Spring/
Summer

Development – 1 month



G1

Generation 2



Oviposition – Summer/
Autumn

Development – 5-12 months

Up expressed G1

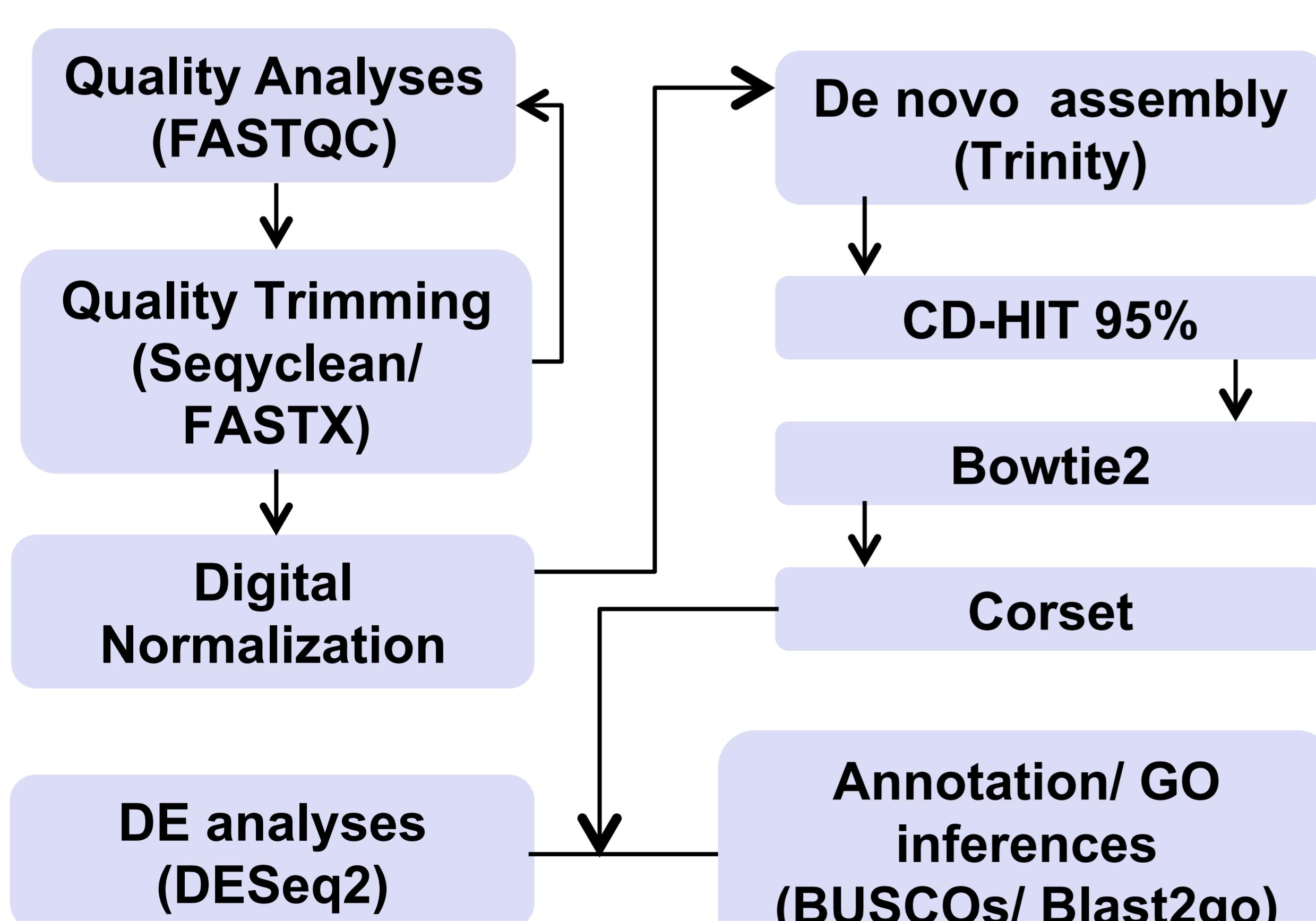
Gene name	GO process
Cytochrome Oxidase - subunit partial	C:mitochondrial inner membrane; C:integral component of membrane; C:respiratory chain; F:cytochrome-c oxidase activity; F:copper ion binding; P:electron transport chain; P:hydrogen ion transmembrane transport
NADH Dehydrogenase subunit 4I	C:mitochondrion; F:oxidoreductase activity, acting on NAD(P)H; P:ATP synthesis coupled electron transport
Succinate Dehydrogenase (CybS)	C:mitochondrion envelope; C:integral component of membrane
Cytochrome b	C:mitochondrion; C:integral component of membrane; C:respiratory chain; F:electron carrier activity; F:oxidoreductase activity; F:metal ion binding; P:respiratory electron transport chain

Up expressed G2

Gene name	GO process
Dehydrogenase Reductase - SDR family member 11 (DHRS11)	F:oxidoreductase activity; P:oxidation-reduction process

Figure 1: Figure summarizing the two different generations of the bee *T. diversipes*. The first generation (G1) has a fast larval development while the second generation (G2) enters in diapause. Heatmaps indicates the transcripts up expressed in foundresses of each generation, red- up expressed transcripts; green- down expressed transcripts. In the boxes follow the annotation and gene ontology information of the identified transcripts from each group of up expressed transcripts.

Material and Methods



Results and Discussion

Table I: Assembly quality analyses.

Transcriptome	
No of transcripts	29,189
N50	3,006
GC	37.93%
Complete BUSCOs	83.70%

Table II: Differentially expressed transcripts analyses.

DE transcripts	
Up G1	34
Up G2	2
Annotate G1	4
Annotate G2	1

All differentially expressed genes annotated in G1 are involved in the mitochondrial respiratory chain complex (Figure 1), which indicates a high-energy demand in foundresses bees from G1. Also most of the differentially expressed transcripts are new and their function and structure are unknown. These results illustrate the importance of studies in non-model species and also call attention for the role of unknown genes in the evolution of complex traits such as bivoltine and social behaviors.

Figure 2: Analyses strategy. In parenthesis follow the programs used in each step.

Acknowledgments:

