Integration of the traits of life history “fitness” of the black bupreste in his environment

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Abstract: Each organism is characterized by a set of traits closely related to its reproduction and survival, called life history traits (size and age at sexual maturity, growth rate, mortality rate, longevity) (STEARNS, 1992). Thus to understand the adaptive strategy (distribution and abundance) of *C. tenebrionis*, it is necessary to know its history. The present study is conducted at the heart of the Tellian Atlas in the region of Médéa, a potential area for the production of rosaceae on prunus orchards heavily infested by *Capnodis tenebrionis*. Our investigations took place from the end of spring to the beginning of autumn of 2014, with the aim of understanding the possible relationship between the nutritive support and the biological performance of *C. tenebrionis*. This trophic relationship is estimated via the fitness of the *C. tenebrionis* individuals evolving in favor of the nutritive potential. The results were significant in terms of variability in the phytochemical quality of the two hosts studied, in particular for sugars and water-soluble proteins. The relationship between variation in metabolite composition and fitness of *C. tenebrionis* individuals has been examined and shows a trophic orientation strongly oriented towards the plum. These changes affect the development of weight and size of the xylophagus.

Keywords: Capnodis tenebrionis, fitness, phytochemistry, Prunus, history traits

Introduction

In theory, evolution tends to select the organisms that present the best fitness, in order to optimize the selective value of its representatives, in order to optimize survival and optimize the fitness (ROFF, 2002). All organisms are confronted with the biotic and abiotic fluctuations of the environment (VUARIN et al., 2012). PHILLOGENE et al.(1984) report that the secondary compounds of the plant have various actions on the insect, so we took as fitness measure the body weight and body size of the black Bupreste *Capnodis tenebrionis* in reference to the nutrients allocated by its host rosaceous host plants that suffer severe damage following attack

Materials and methods

Our study took place at the heart of the Tellian Atlas. Benchicao is located at 2 ° 51 ‘east longitude and 36 ° 12’ north latitude, it has altitudes sometimes reaching 1200m, The EMBERGER index classifies the region in the subhumid bioclimatic stage with fresh winters, with rainfall Average of 600 to 700mm. In a place called HAOUCH CHANAS, samples of capnodis and transplant cortex were collected from *Prunus domestica* (Stanley variety, Amandier myrobolan) and *Prunus cerasus* (Bigarreaux burlat variety, Saint Lucie transplant) The experimental period from July 2014 to February 2014. On two randomly selected plots (EAS) among 6 nights of well-defined plots (Frontier, 1983). In order to ascertain whether the growth averages of the different fitness parameters, ie weight, body size and cephalic capsule, vary significantly according to plant metabolite concentrations, we have recommended an analysis of the variance of the global linear model (GLM). Followed by multiple regression analyzes that were performed using the SYSTAT 12 version (Hammer, 2001) to indicate the metabolites involved in the growth of the pest.

Results

Effect of the nutritional quality of the larvae of history traits of C. tenebrionis in time

The general linear model (G.L.M.) shows a highly significant evolutionary disparity between the various parameters (Figure 1A) and that the season and species parameter has a significant effect on the fitness evolution (Figures 1B and 1C).

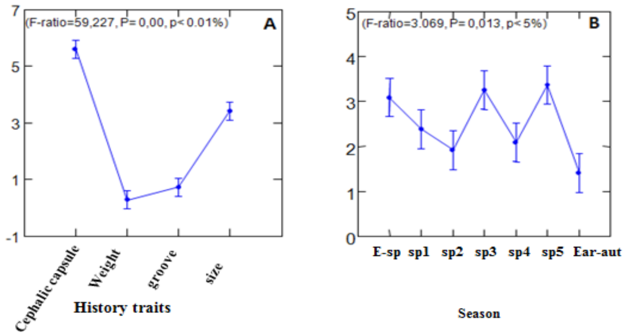

Figure 1: Graphical representation by G.L.M. Of the evolution of the packaging of C. tenebrionis. E-sp=Early spring, Sp= Spring, Ear-aut= Early autumn.

The chemical compounds produced by plants are probably the most important factor controlling the behavior of insects in nature. Similarly, the results of larval weight evolution (Figure 1) show a sucking profile of the larvae on Plum tree with the exception of mid August, which shows low weights by intake of their previous ones, assumed to be linked to completion Of the life cycle of the pest at that time on the host plant, and that the proclaimed weight is that of the first larval stages of the new generation. Unlike the Plum tree, the Cherry tree contains small measurements of weight supposed to be related to the poor phytochemical quality contained. Nonacs (2000) shows that when the internal state of the individual is not constant, the optimal behavior will not be the same at all times. For anybody, the increase in fitness associated with a change in a trait is often counterbalanced by a decrease in fitness associated with a change in another trait, at least one of which will be superior to others in an environment particular. This should be selected (Moiroux et al., 2012). In the same idea, it is interesting to note that the results obtained in the study of the analysis G.L.M. Carried out on the various fitness measures (fig. 1) and supplemented by multiple regression (fig. 3 and fig. 4) show a balanced growth between the different life history traits of *Capnodis tenebrionis* evolving on Plum tree with a significance for each conditioning parameter weight, body size and size of the cephalic capsule as opposed to the larvae on Cherry which evolve in a non-harmonious manner where no significance was noted between the different parameters of the conditioning

Key parameters influencing evolution of life history traits of C. tenebrionis larvae

The different fitness measures obtained from larvae *C. tenebrionis*, there is a multiple regression of the metabolite concentrations of the two *Prunus* host species.

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Table 1: Multiple regressions applied to changes in weight and size as a function of secondary metabolites on plum tree by contribution to carbohydrates and water-soluble proteins.

size	Coeff.	Std.err.	t	p	R^2
Constant	5,5539	2,1458	2,5883	0,060796	0
carbohydrate	0,79532	0,31103	2,557	0,062835	0,012267
Water-soluble Protein	-86,955	18,747	-4,6383	0,0097468	0,59201

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The evaluation of weight and size development in relation to secondary metabolites (Figure 2) reveals very marked differences between the observed values and the predicted maximum values.

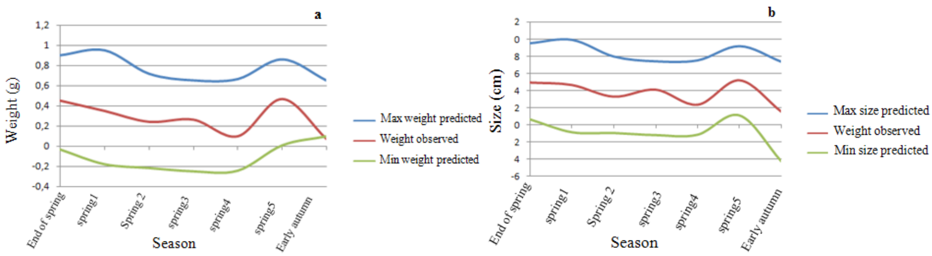

Figure 2: Amplitude of weight growth (a) and size (b) of larvae of C. tenebrionis on plum tree by intake of sugars and water-soluble proteins

Table 2: Multiple regressions applied to changes in weight and size as a function of secondary metabolites on Cherry tree by contribution to proline and proteins

weight	Coeff.	Std.err.	t	p	R^2
Constant	0,92549	0,21306	4,3437	0,012217	0
Proline	-3,1027	1,2161	-2,5514	0,063213	5,6206E-05
Water-soluble protein	-2,3396	0,69452	-3,3686	0,02808	0,31526

size	Coeff.	Std.err.	t	p	R^2
Constant	16,168	2,9403	5,4987	0,011837	0
Proline	-33,136	9,3634	-3,5389	0,038393	0,13886
Soluble protein	-33,54	10,429	-3,2159	0,048735	0,23575
Water-soluble protein	-43,712	8,272	-5,2844	0,013218	0,59182

The multiple regressions applied for the phytochemical constituents of the two *Prunus* (Plum tree, Cherry tree) and the curves obtained revealed that in Plum tree, the weight evolution and the growth of its size related to the accumulation of sugars and proteins Water soluble. These results are in agreement with Rhoades (1976), who consider that the favorable conditions for the development of certain phytophages are created during sugar initiation, which is followed by depression of protein levels and accumulation of protein, amino acids. Similar observations of Bidon (1993), confirm that the low sugar level increases susceptibility to some parasites. Sugar is the main source of energy for insects. On the other hand, some species are capable of completely replacing carbohydrates with lipids or proteins (Guessous, 1948); hence the positive correlation with the water-soluble proteins. The work carried out by Bezzala (2005) indicates that protein synthesis is closely linked to the metabolism of sugars during the respiration process from the Krebs cycle, which gives the carbon skeleton for the synthesis of proline. However, in Cherry tree, weight evolution and size growth are related to the accumulation of proline and soluble and water-soluble protein, according to Ramanjulu and Sudhakar (1997) in Bezzala (2005). At the cellular level, increase in the concentration of amino acids, especially proline, has been observed in several species of plants subjected to a water stress, these words confirm the remarks of Martinez (2008), who considers that the capnode is a pest of weakness, and develops only on trees weakened by diseases or by a bad physiological state of the attacked subject.

It is essential to relate these life history traits to each other to highlight the evolutionary trade-offs that may link them (VUARIN et al., 2012). According to ROFF (2002) compromise appears when the increase in the value of one trait occurs to the detriment of another trait. This is also confirmed by VUARIN et al. (2012) who finds the traits of life history not being independent of each other.

The prediction of deviations over time over plum tree shows maximum growth in late July and early September in relation to size and cephalic capsule growth (Figure 14), due to a maximum accumulation of reserves at the last larval stage, enabling a better transition to the pupal stage. Similarly, predictions of size differences over time in relation to the cephalic capsule and weight show homogenization and near growth intervals (Figure 16). The larval growth on cherry tree does not present a large difference between the maximum and minimum values of the size, but they know very small measurements at the beginning to be connected to the dormant early entry of the Cherry tree comparing to the Plum tree, which can be reflected. On the course of the life cycle of Capnodis tenebrionis.

Conclusions

As a sum of all results, it can be argued that developmental variability is strongly related to the phytochemical quality of host plants, whose metabolites are the main tools of plant-living co evolution that applies to all levels of organism pest, and which is expressed at all stages of the development of the plant

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