

## Abstract

*Rhynchophorus ferrugineus* Oliv. (Coleoptera: Dryophthoridae) is still the worst threat for palm trees worldwide. This weevil, native to Southeast Asia and Melanesia, has spread throughout the Middle East and the Mediterranean basin over the last 25 years, being detected as well in America and Australia. *R. ferrugineus* can affect a large number of species, most belonging to the Arecaceae family. In their native areas the pest mainly affects the Coconut palm, *Cocos nucifera* L. However, in its spread to other continents, it has increased its host range, showing a strong preference for species of the *Phoenix* genera, such as *P. canariensis* Hort. ex Chabaud and *P. dactylifera* L. The management of this pest consists in several preventive and curative techniques: early detection, application of chemical or biological insecticides, destruction of infested plant material, mechanical sanitation, and a trapping system based on olfactory attractants. Because of the low efficacy of the aforementioned control measures, *R. ferrugineus* still causes major economic and landscape losses. In order to define aspects that have facilitated its rapid dispersal and contribute to improving its management, in the present thesis the effects of key aspects, such as vision and flight, which influence the mobility of *R. ferrugineus*, have been analysed.

In the present research, the chromatic preference of *R. ferrugineus* adults has been studied by analysing their captures in coloured bucket traps. Black traps capture the highest number of insects compared with the other colours studied. The results were similar in tests carried out using traps baited with olfactory attractants, and in those performed with traps without this kind of compounds. This demonstrates that colour by itself is a crucial attraction factor. Moreover, the spectral reflectance of studied colours and of some *P. canariensis* tissues has been analysed. The wavelength spectrum of black shows great similarity to that of fibres of *P. canariensis*, so this may be the reason why *R. ferrugineus* prefers this colour. Regarding sex ratio of the insect in traps, female captures are significantly greater in those baited with olfactory attractants. However, a higher number of female captures does not always occur when these compounds are not used. On the other hand, the study of sex ratio in natural populations of the insect demonstrates that the proportion is one female per male. Therefore, the greater number of captures of females in commercial traps is due exclusively to their greater attraction towards the olfactory attractants used.

Another of the analysed aspects has been the flight potential of *R. ferrugineus* adults under laboratory conditions. In order to know more about the mobility of this insect, different parameters have been studied using a computer-monitored flight mill. The selected parameters used to define the *R. ferrugineus* flight potential have been the number of flights, total distance flown, longest single flight, flight duration, and average and maximum speed. Moreover, the influence of sex, body size, and age of the adults on the aforementioned parameters has been examined. *R. ferrugineus* sex does not have a significant effect on the compared flight parameters. The body size in females is significantly greater, but this does not influence their flight potential. A higher percentage of flight is observed for adults with an age range of 8-23 days old, compared to the 1-7 day old adults. However, age does not significantly influence their flight potential. By analysing the longest single flight undertaken by each adult, up to 63 % of the insects can be classified as short-distance flyers (under 500 m), 27.3 % as medium-distance flyers (between 500 and 5000 m), and up to 9 % as long-distance flyers (above 5000 m).

Finally, in order to complement the data obtained in the flight potential study under laboratory conditions, a test has been performed in field under natural conditions. The flight behaviour and dispersal of *R. ferrugineus* has been analysed using the mark-release-recapture method. This test focused on detecting the influence of different biotic and abiotic factors, such

as sex, temperature, relative humidity, and solar radiation, in the take-off and dispersal of the adult insects. Take-off probability of *R. ferrugineus* adults is significantly greater in males. Moreover, this probability increases when temperatures and solar radiation rise. Concerning the insect dispersal by flying, the number of recaptures is influenced by temperature, increasing significantly when this factor increases. Likewise, dispersal distances of *R. ferrugineus* also increase significantly as temperatures rise. The insect tends to fly distances below 500 m (77.1 % of recaptured adults), following the same tendency observed in studies performed using the flight mill. However, *R. ferrugineus* is able to travel up to 7 km, being recorded under laboratory conditions a potential flight up to 20 km. To conclude, dispersal time of the adults is very short (more than 90 % of the adults were recaptured during the first seven days), being significantly lower when relative humidity increases.

As a general conclusion of the analysis of factors influencing the mobility of *R. ferrugineus* adults, flight is influenced by different biotic and abiotic factors, such as sex, temperature, relative humidity, and solar radiation. Moreover, even though adults tend to fly short distances, they are able to travel several kilometres, which allows them to carry out an efficient dispersal. For this reason we can conclude that this weevil presents a high dispersal potential, demonstrated both in laboratory and field studies. On the other hand, the analysis of the insect vision, through the study of chromatic preference, indicates that *R. ferrugineus* adults are able to distinguish different colours, preferring colours very similar to those of their host plants. This ability, together with the high dispersal potential, and the orientation and communication capacity through pheromonal and kairomonal compounds, increase the likelihood of success of the insect during the colonization process. The factors analysed in the present doctoral thesis may contribute to the improvement of management techniques of *R. ferrugineus*, but it is still necessary to continue research into the behaviour of this pest to minimize their damaging effects.