Eco. Env. & Cons. 30 (February Suppl. Issue) : 2024; pp. (S239-S242)

ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2024.v30i02s.050

Stimulated chemoreception with assisted chromoreception using Barrix-Hunter Red Palm Weevil (RPW) trap and lure to effectively attract and trap RPW pest in coconut fields

S. Kannan*, Lokesh Makam[1] and S.P. Venkatesh Prasad[2]

Department of Biostudies, Barrix Agro Sciences Pvt. Ltd., Bengaluru 560 058, India
[1],[2]Barrix Agro Sciences Pvt. Ltd., Bengaluru 560 058, India

(Received 22 July, 2023; Accepted 14 September, 2023)

ABSTRACT

In the present open field trial study, using Barrix Hunter-RPW Trap and Lure (patent applied:202241012003) the pest RPW was successfully influenced with chemoreception by the use of pheromone lure containing a blend of 4-methyl-5-nonanol and 4-methyl-5-nonanone, in specific blend ratio of 7:1. The attraction efficiency of Barrix Hunter-RPW trap and lure was also affected by the colour of the trap, with specific maroon colour, matching to PANTONE 7421 C colour code influencing the chromoreception and colour cue of the pest RPW. The trap's colour and pheromone lure both efficiently producing linear influence in attracting and trapping of RPWs in coconut fields. Pest catch data was statistically analysed by one-way analysis of variance (ANOVA), the results demonstrated that combined pheromone blend lure and trap's colour have a significant effect on attracting adult red palm weevils. Mean sum of weevils caught / trap at the end of 4 weeks was significantly higher in maroon coloured trap, followed by brown coloured trap and least number of weevils captured in burgundy coloured trap. Thus, field trials demonstrated maximum mean number of weevils captured was statistically significant for maroon (matching to PANTONE 7421 C colour code) coloured crescent wing trap, used along with pheromone lure; Barrix Hunter RPW Trap and Lure.

Key words: *Aggregation pheromone, Chemoreception, Chromoreception, Red palm weevil.*

Introduction

Red palm weevil (RPW) (*Rhynchophorus ferrugineus* Olivier) originally from Southeast Asia has reported as a major pest of coconut palm (Faleiro, 2005). Worldwide the pest potentially infests 26 different palm species belonging to 16 families.

The cultivation of coconut palms holds paramount significance, serving as a vital livelihood for countless individuals worldwide. Its far-reaching influence resonates in the economic fabric of societies, shaping the fortunes of millions. This cherished practice spans over twelve million hectares, this cultivation practice extends its influence across a diverse spectrum of over 90 countries globally. In Indian subcontinent, 6.9% palms were infested and affected as recorded in Kerala indicating a moderate pest incidence (Abraham *et al.,* 1989) and in Tamil Nadu, high incidence of 11.65% infestation was recorded, affecting early palm trees of coconut planta-

(*Head R&D, [1]MD&CEO, [2]Chief Technical Officer)

tions (aged less than 10 years) resulting a cumulative loss for 10 years of Rs. 66,000 (Sekhar, 2000).

Early detection of the pest infestation is difficult as the entire developmental process, from egg-larvae-pupal-adult stage of pest takes place within the tender shoot of palm stem. Huge infestation of the pest, results in rapid multiplication of the pests within the soft tissues of palm trees and will easily knock down the trees due to intense damage resulting from completely damaged and hollowing of trunk of palm trees (Abraham *et al.*, 1998). Even during the early 1980, farmers depend on poisonous insecticides to control the weevil, but failed to contain the pest. Baffled farmers started using unscientific and irrational use of chemical pesticides which are applied via trunk injection or root feeding (Faleiro, 2006). These insecticides have an adverse effect on the beneficial and most importantly their toxic residues found in coconut water (Ranasinghe *et al*., 2003). Adult weevils hide in the leaf axils during daytime so axil filling with 5% BHC plus sand mixture recommended as control measure (Mathen and Kurian, 1966). Farmers were baffled in identifying the initial stages of infestations and suffer losses due to economically affecting red palm weevil pest. Farmer community is worried as the pest does not have effective pesticides to control the infestation.

Intense scientific studies and experiments finally established the chemo signal for *R. ferrugineus,* and the pheromones were identified and chemically recognized as 4-methyl-5-nonanol and 4-methyl-5-nonanone. These identified pheromones are high potential chemical candidates in the management of RPWs as it effectively invites both male and female RPWs (Hallet *et al*., 1993). In general, male emitted sex pheromones attract both male and female insects, increasing the intensity pheromone source due to thickly populated insects (Karlson and Luscher, 1959). Adults of red palm weevil are strong flies, flying more than a kilometre daily (Wattanapangsiri, 1966). The adult female RPWs under the influence of palm's kairomone selects the young palm plants and lay eggs in the crown of the palm plant (Faleiro and Satarkar, 2002). Various methods were employed using pheromones to contain the RPW pest, includes a bucket type of traps along with pheromone lure and sometimes insecticide treated food baits were used to attract and trap red palm weevil. Diverse designs of the traps were assessed to effectively trap the RPW pest. One of which is trap with four windows, having 5 L capacity bucket trap with outer rough surface was fabricated and evaluated in Kingdom Saudi Arabia (KSA)(Faleiro *et al*., 1998) but none of them were effective either in monitoring or trapping the RPWs.

The major objective of the current research was to assess and establish the olfactory response of adult red palm weevil using 7:1 blend ratio of aggregation pheromone and simultaneous effect of trap colour on efficiency in attracting and catching RPWs. The field trial demonstrating the combined influence of chemoreception and chromoreception of RPWs, using uniquely designed and maroon coloured (matching to PANTONE 7421 C colour code) crescent wing trap along with the pheromone lure containing a mixture of pheromones 4-methyl-5-nonanol and 4-methyl-5-nonanone in an experimentally proven specific ratio. The field trials conducted using Barrix Hunter – pheromone lure, having a claim of 7:1 blend ratio of 4-methyl-5-nonanol and 4-methyl-5-nonanone, impregnated into the activated wood matrix, supplied along with Barrix Hunter - RPW Trap.

Materials and Methods

Field trials conducted to study the effect of trap colour influencing the colour perception/cue (chromoreception ability) in RPW pest to effectively attract and trap RPWs by the Barrix Hunter RPW Trap and Lure (patent applied: 202241012003). Number of trials conducted using variable colours of the traps and in this present study we are reporting the three major colours of the traps include maroon, brown and burgundy which had a significant influence on the chromoreception of RPWs. By field trial results, it was concluded that colour of the trap also has an effective role in influencing chromoreception of the RPW pest, and trap moulded with the specific maroon colour (matching to PANTONE 7421 C colour code) exhibited the maximum influence on the chromoreception ability of the RPWs and increases trap's efficiency to attract and catch of RPW pest. The experimental field trials conducted in coconut plantations (where palms were 10-20 years old) located in N G Palya, Thalekote and Lakshmigowdana Palya of Kunigal Taluk, Karnataka, India with three different trap colours (maroon, brown and burgundy).

Experiments designed and was based on Randomized Complete Block Design (RCBD) with three treatments and five replications. Treatments were

with Barrix Hunter RPW Trap & Lure, uniquely designed Crescent wing traps (based on flying pattern of RPW under the influence of pheromone blend) with three distinct colours, Maroon, brown and burgundy, having a crescent base bowl with 2l water holding capacity. Aggregation pheromone with blend ratio 7:1 (4-methyl-5-nonanol and 4-methyl-5-nonanone) impregnated into activated cellulose matrix [wooden blocks (0.05*0.03 m)]. The pheromone lure placed in the lure holder slot of the Barrix Hunter RPW Trap's "T" shaped assembly. The completely assembled trap along with the pheromone lure installed at a height of 0.91 to 1.2 m above the ground level. Base bowl of the crescent trap filled with water up to two-third level, to immobilize trapped RPWs. Traps placed at equidistance covering the entire area @ 3traps/ha. Trap's influence to effectively attract and trap RPW pest was evaluated, and pest catches were counted and recorded at weekly intervals, up to four weeks. Trapped weevils were carefully collected, identified, and recorded. Trap catch data subjected to statistical analysis by one-way analysis of variance (ANOVA) method.

Results and Discussion

The results demonstrated that the pheromone blend ratio along with colour of the trap had a significant effect on the level of responses (Table 1). Aggregation pheromone at a blend ratio of 7:1, 4-methyl-5-nonanol and 4-methyl-5-nonanone along with maroon (matching to PANTONE 7421 C colour code) coloured Barrix Hunter RPW Trap & Lure elicited a significant capture (137.55 weevils) than Burgundy coloured trap (59.98 weevils). While that of brown coloured trap (79.96 weevils) demonstrated intermediate response. Based on turkey's test, field trial results were classified as for maroon coloured trap followed by brown and burgundy coloured trap.

These findings are in harmony with Abbas *et al.*, (2006) who reported that pheromone components of 4-methyl-5-nonanol and 4-methyl-5-nonanone in the ratio 9:1 was found to be effective in attracting both male and female adults of RPW. These findings are in accordance with Abdallah and Al- Khatri (2005) who in his findings reported the influence of colour inpheromone baited traps to attract RPW pest. Colour of the trap significantly influences the colour cue in attracting the weevils (Abuagla and Al-Deeb, 2012).

Conclusion

Present coconut field trials clearly indicate the substantial differences in functional and performance ability of the traps is influenced by the trap colours, when used along with pheromone lure, containing pheromone blend ratio of 7:1 (4-methyl-5-nonanol and 4-methyl-5-nonanone) to effectively attract and trap RPW pest. Barrix Hunter RPW Trap & Lure with maroon colour captured more adult weevils than brown and burgundy-coloured traps. Thus, Barrix Hunter RPW Trap and Lure offers an eco-

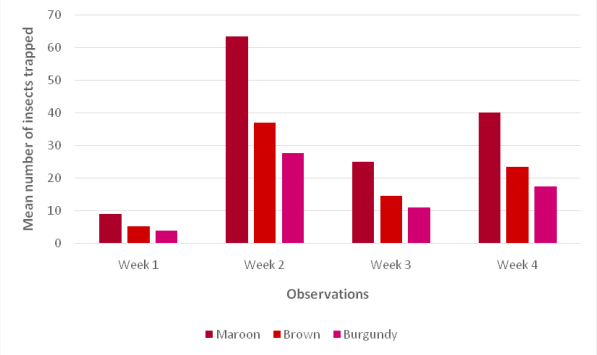

Fig. 1. Mean number of weevils captured per trap during the field trials.

Table 1. Chemoreception of RPWs along with assisted chromoreception to the diverse colours of the traps using pheromone lure.

Blend Ratios	Colour of the Barrix Hunter RPW Trap	Mean weevils trapped/Trap Week 1	Mean weevils trapped/Trap Week 2	Mean weevils trapped /Trap Week 3	Mean weevils trapped/Trap Week 4
7:1	Maroon	8.92[a*]	63.60[a]	24.89[a]	40.14[a]
7:1	Brown	5.18[b]	37.05[b]	14.42[b]	23.33[b]
7:1	Burgundy	3.90[c]	27.75[c]	10.85[c]	17.48[c]
CV		8.49	8.12	10.56	9.68
SEM±		0.23	1.55	0.79	1.17
CD		0.74	5.07	2.57	3.81

*Different letters at each data indicate significant differences according to DMRT at P<0.05

Fig. 2. Installation of Barrix Hunter RPW Trap and Lure in the farmer's field.

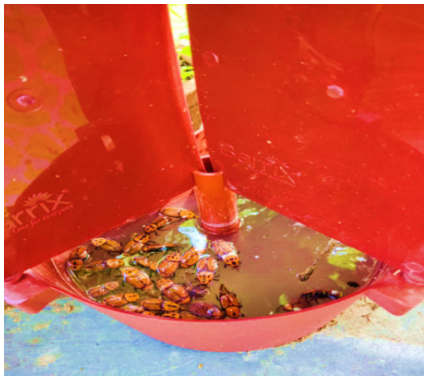

Fig. 3. Weevil trapped in maroon coloured Barrix Hunter RPW Trap and Lure.

friendly, safe, economical, and effective trap device to farmers to efficiently attract and trap RPW pest, thereby helping farmers to monitor and control the infestation of RPW pest and helping them to protect palm trees.

Acknowledgement

We thank Lokesh Makam, CEO, Barrix Agro Sciences Pvt. Ltd. for providing us the facilities to conduct the research activities.

References

Abbas, M.S.T., Hanounik, S.B., Shahdad, A.S. and Al-Bagham, S.A. 2006. Aggregation pheromone traps, a major component of IPM strategy for the red palm weevil, *Rhynchophorus ferrugineus* in date palms (Coleoptera: Curculionidae). *Journal of Pest Science. 79*(2): 69-73.

Abdallah, F.F. and Al-Khatri, S.A. 2005. The effect of pheromone, kairomone and food bait on attracting males and females of red palm weevil in date palm plantations. *Egyptian Journal of Agricultural Research*. 83: 169-177.

Abraham, V.A., Al-Shuaibi, M., Faleiro, J.R., Abozuhairah, R.A. and Vidyasagar, P.S.P.V. 1998. An integrated management approach for red palm weevil, *Rhynchophorus ferrugineus* Oliver, a key pest of date palm in the middle east. *Agril. Sciences*. 3:77-83.

Abraham, V.A., Koya, K. M.A. Kurian , C. 1989. Integrated management of red palm weevil (*Rhynchophorus ferrugineus* F.) in coconut gardens. *Journal of Plantation Crops.* 16 (Supplement): 159-162.

Abuagla, A.M. and Al-Deeb, M.A. 2012. Effect of bait quantity and trap color on the trapping efficacy of the pheromone trap for the red palm weevil, *Rhynchophorus ferrugineus*. *Journal of Insect Science.* 12: 120.

Faleiro, J.R., Abraham, V.A. and Al-Shuaibi, M. A. 1998. Role of pheromone trapping in the management of red palm weevil. *Indian Coconut Journal*. 29(5): 1-3.

Faleiro, J.R. 2005. Pheromone technology for the management of red palm weevil *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Rhynchophoridae)-A key pest of coconut. Technical Bulletin No. 4, ICAR Research Complex for Goa. 40 pp.

Faleiro, J.R. and Satarkar, V.R. 2002. Suitability of insecticides for use in red palm weevil pheromone traps. *Pestology.* 26: 34–36.

Faleiro, 2006. A review of the issues and management of the red palm weevil *Rhynchophorus ferrugineus* (Coleoptera: Rhynchophoridae) in coconut and date palm during the last one hundred years. *International Journal of Tropical Insect Science.* 26: 135-154.

Hallett, R.H., Gries, G., Gries, R., Borden, J.H., Czyzewska, E., Oehlschlager, A.C., Pierce, H.D., Angerilli, N.P.D. and Rauf, A. 1993. Aggregation pheromones of two Asian palm weevils, *Rhynchophorus ferrugineus* and *R. vulneratus. Naturwissenschaften.* 80: 328-331.

Karlson, P. and Lüscher, M., 1959. 'Pheromones': a new term for a class of biologically active substances. *Nature.* 183: 55-56.

Lefroy, H.M. 1906. The more important insects injurious to Indian Agriculture. Govt. Press, Kolkata (Calcutta), India.

Mathen, K. and Kurian, C. 1966. Prophylatic control of *Rhynchophorusferrugineus* F. *Indian Journal of Agricultural Science*. 36(6): 285-286.

Ranasinghe, C.S., Fernando W.P.K.K., Zaneer, S.M.M. and Mubarak, A.M. 2003. Analysis of residue levels in kernel and nuts water of coconut palms injected with monocrotophos. *Journal of Natural Science Foundation*, Sri Lanka 31 (3&4): 431-436.

Sekhar, S.I. 2000. Titanic loss from a tiny weevil in coconut. *Indian Coconut Journal*. 30(9): 8-10.

Wattanapongsiri, A. 1966. A revision of the genera *Rhynchophorus* and Dynamics (Coleoptera: Curculionidae). Bangkok, Thailand; Department of Agriculture Science Bulletin. 1: 328pp.