



Ethological control of *Conotrachelus dubiae* in camu-camu fruits [*Myrciaria dubia* (Kunth) H.B.K.]

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ABSTRACT

The objective was to evaluate methods for the control of the weevil (*Conotrachelus dubiae*) of camu-camu (*Myrciaria dubia*) in a floodplain plot of a farmer near Iquitos, Loreto, Peru. Twenty-eight 6-year-old plants with similar architecture and branching were selected for the study. The treatments were: adhesive tape (T1), bottle with attractive food (T2), pegant yellow sheet (T3) and control (T4) with randomized complete block design (DBCA), 7 replicates and 1 plant per experimental unit. The total number of fruits (NTF), fruits attacked by weevil (FAG), fallen fruits (FC), fruits weight (PF) and fruit yield (RF) were evaluated. Significant differences were found between treatments for NTF, FAG and FC, and no differences were found for PF. The NTF for T1, T2, T3 and T4 were: 353, 280, 143 and 125 respectively. The highest RF values corresponded to T1 (3.03 kg / pl) and T2 (2.78 kg / pl). T1 caused the lowest values of FC(16%) and FAG (22.73%). Negative correlations were found between RF versus FAG ($r = -0.57$) and FC (-0.73). We conclude that the most effective control against *C. dubiae* is the application of the trap with adhesive tapes.

KEY WORDS

Weevil fruit, Pest, Insect trap, Amazon fruit

1. INTRODUCTION

The camu-camu, *Myrciaria dubia* (Kunth) McVaugh, is a shrub belonging to the family Myrtaceae, originating in the Amazon region of Peru, Colombia, Brazil, Venezuela and Ecuador [10,17,23]. Its fruits of high consumption in the Peruvian Amazon possess a high content of vitamin C between 2700-4000 mg / 100 g of pulp [20, 22]. This content and other bioelements explain the agroindustrial potential of the specie [25]. In recent years, camu-camu cultivation has increased in Peru, reaching 5291 ha in Loreto [26]. This increase in production areas would be causing the proliferation of important pests that are affecting up to 80% crop yield [11].

Several phytosanitary problems of camu-camu have been studied in their basic aspects, for example the cochineal *Homoptera-Coccidae* (*Ceroplastes flosculoides*) [8]. Ecology of pest *Mimallo amilia-Lepidoptera*, was studied by Delgado (2001) [6]. Regarding diseases, the fungi *Marssonina sp.*, *Pestalotia, sp.*, *Lasiodiplodia sp.*, *Colletotricum sp.* and some parasitic plants were indentify by Villacrez (2009) [24]. As for the pest *Tuthillia cognata*, Delgado and Vásquez (2001) [6] and Pérez et al. (2008) [14], developed research on its artificial reproduction and its control by toxicity of *Paullinia clavigera* Schldl and *Chondrodendron tomentosum* Ruiz et Pav. In addition, Pinedo and Bardales (2009) [19] presented an alternative to control this persistent homopterus with rotenone (rote-biol 0.1%) and reduce its attack by 83%.

One of the main pests of camu-camu, in the regions of Loreto and Ucayali-Peru is the fruit weevil (*Conotrachelus dubiae*) [4]. Pérez et al., (2001) [12], carried out studies of the biological cycle, dispersion in field and his control. The adult is a dark brown coleopteran, up to 6 mm long [7, 13]. This insect in larval state causes perforations in the fruits, feeds on the seed and production can be affected up to 80% [7,13]. The biological cycle of weevil lasts from 88 to 177 days, remarkably longer than the 50-55 days found by Bessin (1997) [1] for common weevil (*Conotrachelus nenuphar* Herbst). The larvae remain within the fruit between 20 and 25 days, the pre-pupa lives in the soil from 46 to 67 days, while the pupa does it from 9 to 13 days. Pérez et al. (2001) [12] found that the fungus *Beauveria basiana* sporulates in the adult body of the insect and eliminate it over a period of five days.

The adult insect showed a longevity between 9 and 75 days. In floodable soils the larva was between 1 and 5 cm deep, during January and March; while in non-flood areas it was found between 1.5 and 3 cm deep, during October to December coinciding with the flowering and fruiting phase. Adults are nocturnal (6:30 pm to 10:00 pm) and are hidden between the barks of the stem called rhitidomas; They feed on fruits of different diameters (> 9 mm according to Delgado and Couturier, 2014 [7]), tender shoots and flowers. The ovulation begins with the perforation of the fruit causing a hole of up to 5 mm in diameter which usually takes place after 19:00, coinciding with the hour of greater activity of this insect [13]. The attacked fruit turns light brown, well differentiated, whose pulp is liquefied, is consumed by the insect and ascorbic acid is denatured. Productivity can be affected by up to 80% [7]. As for the genetic factor, clones were collected according to resistance / tolerance to pests, which were evaluated under flood conditions [18].

As control measures, Sánchez (2010) [21] mentions eliminating the larvae present in the fruits by fire or burial and raking the soil. However in Loreto, no integrated pest management are being taken. There are no control measures at the level of production units and less within the framework of local and regional organizations. As a result, the incidence of this pest has increased in recent years. Considering the agro-industrial importance of camu-camu, its expansion in productive systems, the problems caused by weevil in the fruits and the possibility of finding effective control alternatives, is that the objective was to evaluate three types of traps on the incidence of the pest and increase the quality and productivity of camu-camu.

2. MATERIALS Y METHODS

The research was carried out in the Mohena Caño town, a plot of the producer Jorge Escobar, in Belen district, Maynas province and Loreto department, 15 minutes by land route from the city of Iquitos. It is a zone of flooding (restinga) with average temperature of 26 ° C and annual rainfall of 2911.7 mm / year [16]. The plot is located in a low physiographic floor, with plants 6 years aged and with history of damage caused by the pest in study. The plot coordinates are: 3 ° 46'55.3"S and 73 ° 12'50.5"W (Figure 1) with a total area of 4370 m². Twenty-eight plants (seven for each treatment), were selected because their similar architecture and branching. Regarding the phenological state, were selected those that were in the period from stage 2 of the fruit development process (immature fruit 1, 29 days after flowering), to state 8 (mature fruit), covering an approximate period of 60 days [15].



Figure 1. Location of the plot of Jorge Escobar, where the study was carried out

The test was installed under Design of Complete Blocks Random (DBCA), with 7 repetitions and one plant per experimental unit.

Each observation of the experiment is described through the following effect model:

$Y_{ij} = \mu + \alpha_i + \beta_j + \epsilon_{ij}$ where;

Y_{ij} = Observation in unit for treatment i in block j

M = Overall mean effect

A_i = Effect due to treatment i

B_j = Effect due to block j

E_{ij} = Random error associated with observation Y_{ij}

Four treatments were applied: adhesive tape (T1), bottle with attractive food (T2), pegant yellow sheet (T3) and control (T4).

T1: Adhesive tape: Self-tapping aluminum tapes were attached to the stem, which were placed at both the base and the main branches of each plant under study (Figure 2).



Figure 2. Placement of adhesive tape (T1)

T2: Bottle with attractive food:

Disposable plastic bottles of 2 liters were used, to which openings were made at the sides for the entrance of the insect; In the interior was placed another plastic bottle of smaller size cut in the half fastened by wire in which camu-camu fruits were placed in several states of maturation like alimentary attractant. At the bottom of the larger bottle, water was placed with detergent to break the surface tension of the water allowing the insects to deepen preventing their exit and die by drowning. A trap was placed in the middle third of each plant under study (Figure 3).



Figure 3. Placement of traps with attractive food (T2)

T3: Pegant yellow sheet:

A yellow waterproof plastic of 1.5 m x 0.80 m was used for this treatment. The leaf was secured with wire in the plant as a hammock in the bottom third of each plant (a trap was placed for each plant, Figure 4). Studies of yellow sticky traps describe the irresistible attraction that this color exerts on insects. These traps can be built with yellow plastic pieces of different sizes according to the use given to them, smeared with a special durable glue or with vegetable or mineral oils, motor oil (grade 50), lasts approximately 10 to 15 days [2].



Figure 4. Placement of pegant yellow sheet (T3)

T4: Control: Plants without any treatment

Variables evaluated

To evaluate the incidence of weevils, the plants were harvested and the fruits attacked, which was evidenced by their brown color, perforation in the epicarp and presence of larvae in their interior. The effectiveness of the traps was determined by counting the captured insects and measuring fruit yields in kilos/plant. The frequency of evaluations and / or change of attractive was performed every 7 days. The field data obtained from each treatment were incorporated into a matrix and processed to obtain descriptive statistics, variance analysis, correlations and tests of averages (Duncan and Tukey), using the statistical software SPSS version 20.



3. RESULTS AND DISCUSSION

Results respect to the tested gorgojo control methods and their effect on pest incidence, fruit damage and productivity fruit are presented. Table 1 presents the analysis of variance for 5 response variables of the present study.

Table 1. Analysis of variance of 5 variables, with F values for four types of trap against the camu-camu fruit weevil.

Source of Variation	Degrees	NTF	PF (g)	RF (kg/pl)	FC(%)	FAG(%)
	of Freedom					
Block	6	50.69 *	0.82 NS	0.32 *	146.49 *	487.5 *
Treatment	3	94.69 **	1.90 NS	0.54 *	194.49 *	1729 **
Error	18	15.85	1.23	0.12	50.91	175
Total	27	-	-	-	-	-
CV (%)		28.54	11.21	21.82	33.73	30.29

Alfa=0.05; * Nivel significativo; ** Nivel altamente significativo; NS No significativo (Valores de F, Prueba de Fisher [32]).
NTF:Total Number of fruits **PF:** Fruit weight **RF:** Yield of fruit **FC:**Fruit drop **FAG:** Fruit attacked by weevil

2.1. Fruits Produced

It is observed in Table 1, that for TOTAL NUMBER OF FRUITS (NTF), there is a highly significant difference between treatments or types of traps (F = 94.69); (Adhesive tape) with an average of 352.71 fruits / plant is superior (Table 2, Duncan and Tukey's tests, $\alpha = 0.05$). The coefficient of variation for this variable was CV = 28.54%. As for Fruit Weight (PF), no significant difference was found between treatments for this variable (F = 1.90), so it is assumed that the phenotypic expression was notoriously influenced by the genetic factor. The trend in both camu-camu and other fruits to greater genetic control of fruit weight, Pinedo et al. (2017) [33], was found to have a repeatability index of $r = 0.690 \pm 0.294$. The coefficient of variation obtained (11.21%), evidences an adequate control of the experimental error (Table 1). Using the Duncan and Tukey tests (Table 2), it was determined that the PF ranged from 9.19 g (T1 = adhesive tapes) to 10.35 g (T4 = control)

For the variable Yield of Fruit (RF), a statistically significant difference was observed between treatments (F = 0.54). There were also differences in the block factor (F = 0.32). The coefficient of variation for this case was 21.84%. According to Table 2, Duncan's mean analysis shows that the highest fruit yields were traps with adhesive tapes (T1) and bottles with food attractants (T2). Delgado and Couturier (2014) [7] point out that it is fundamental to recognize the first symptoms of attack on fruits and control the larvae by harvesting all fruits, picking fallen fruits, destroying fruits with larvae and using traps as adhesive tapes.

Table 2. Test of means (Duncan and Tukey) of 5 variables for four types of trap against the camu-camu weevil

Treatment	NTF	PF (g)	RF(kg/pl)	FC(%)	FAG(%)
1 Tape	352.71 a	9.19 a	3.03 a	16.00 a	22.73 a
2 Bottle	280.43 a	9.81 a	2.78 a	17.21 a	40.57 b
3 Sheet	143.00 b	10.21 a	1.41 b	25.87 b	57.11 bc
4 Control	125.43 b	10.35 a	1.29 b	25.51 b	54.26 c
DMS/Error	15.8539	1.67431	0.1155	50.907	174.9956

Means with a common letter are not significantly different. Duncan and Tuckey test ($\alpha = 0.05$)

NTF:Total Number of fruits **PF:** Fruit weight **RF:** Yield of fruit **FC:**Fruit drop **FAG:** Fruit attacked by weevil

2.1. Affected Fruits

In Table 1, for the variable Fruit Drop (FC), there are statistically significant differences between treatments with a value of $F = 194.49$ and a coefficient of variation of 33.73%. In the corresponding test of means (Table 2), it was observed that the treatment of the traps of the adhesive tapes (T1) reached the lowest percentage of fruit drop, whereas in the treatments with lamina (T3) and the control (T4) The drop was over 25%. Cisneros (2010) suggested that weevils can be captured by preventing them from advancing with containment barriers such as adhesive tapes, preventing insects from climbing up the tree trunk and damaging the fruit.

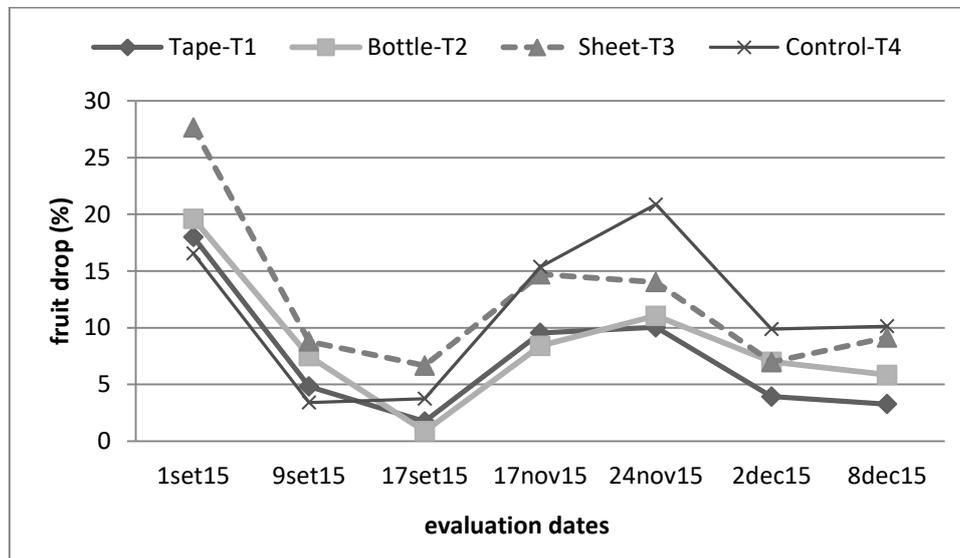


Figure 5. Camu-camu drop fruits (FC) according to the types of traps (September to December 2015.

The fruit fall occurred in two stages, the first began on 01/09/15, when the fruits were in state 4 of fruiting, with 1 cm in diameter and it is at this stage where the greatest fall of fruits . In agreement with Farro et al. (2011) [27], in the first three weeks they noticed the highest level of flower drop and in the next four weeks, the highest fruit drop in the small green state. Then in the final stage of fruiting the level of fall (24nov15) was increased, possibly in this case mainly caused by the weevil, since a high correlation between fallen fruits (FC) and fruits attacked by the weevil (FAG) was found ($R = 0.79$ ** Table 3).

In the last few weeks, the fall of the fruit decreased to reach the accumulated percentages of T1 = 51.29%, T2 = 60.26%, T3 = 87.94% and T4 = 79.97% (Figure 5), where the fruits reached State 5 (large green fruit) and 6 (fruit at the beginning of ripening or "pinton") of fruiting [9]. The level of fall found by Farro et al. (2011) [27] was an average of 74.35%, attributed to the following causes: 9.27% by pests (only 0.12% by *C. dubiae*). The 69.06% of the fall would be the result of natural abscission and 21.67% due to physiological, nutritional, wind and rainfall factors. In this sense, Abanto et al., (2015) [30] reported that boron applications to camu-camu plants induced significantly higher yields (12-year plants, up to 19.8 kg / plant versus 10.2 Kg / pl in the control). As demonstrated by Quaggio and Piza (2001) [31], boron is essential for the absorption and use of calcium by the plant and associated with manganese, iron and copper, increases the lignin content, support, increasing the flower binding and fruits. When testing the effect of the enzymatic activator "Kalifrut" Farro (2012) [29], in fruit drop, found a significant difference with the control.

It is noted that the attack of the weevil as a cause of fruit drop was much higher in this trial compared to the experience of Farro et al. (2011) [27]. The explanation was due to the longer development of the pest in the study area, which allowed its multiplication and greater impact on the fruits.

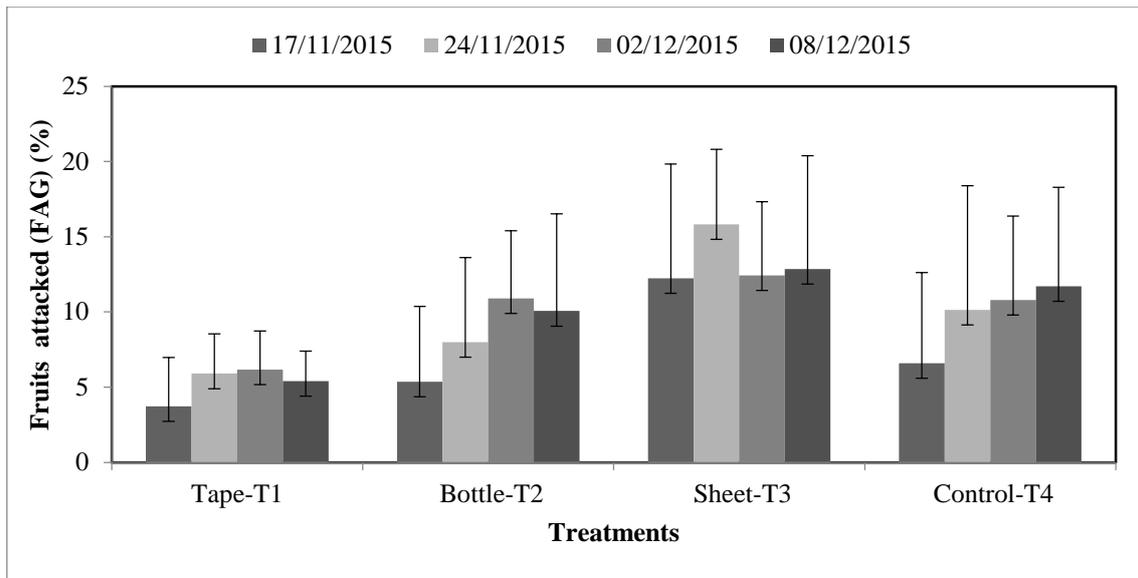


Figure 6. *Conotrachelus dubiae* attack on camu-camu fruits (FAG) according to trap types between November and December 2015.

The percentage of fruits attacked by weevil (FAG) was strongly influenced by the treatments or types of traps applied ($F = 1729$, $p < 0.01$, Table 1). The superiority of T1 (adhesive tapes) was again evident by the tests of Duncan and Tukey ($\alpha < 0.05$) where T1 ranks the first place to register the lowest fruit drop (22.73%), while for the control Fall was 54.26% (Table 2). The coefficient of variation was 30.29% for this variable. It should be noted that the percentage of fruits attacked was determined in relation to the total number of fruits produced.

As for the attack period of the weevil, shown in Figure 6, the results show that it happened during the last four weeks of the evaluations (November 17 to December 8, 2015), including the phenological periods of fructification from green to mature. The T1 trap with adhesive tapes apparently acted as a barrier against the weevil and the attack level remained below 6%.

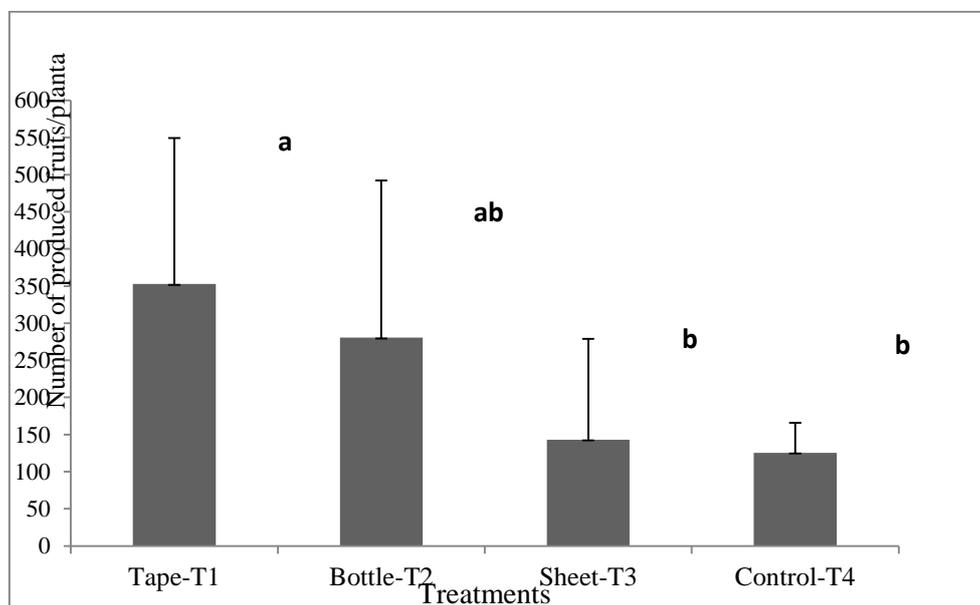


Figure 7. Productivity according to types of trap against camu-camu fruit weevil

(Treatment with the same letter are statistically equal Duncan $\alpha=0.05$)

Consistently, the T1 treatment corresponding to the adhesive tape trap shows a significantly higher productivity than the other treatments. This productivity, considering that they are plants of 6 years of age, converted into weight would be 3,177 kg / plant, which are among the ranges found by Pinedo et al. (2017) average of 2 and maximum of 8 kg / plant at 7 years of age.



2.1. Correlation analysis

Table 3 shows the correlation coefficients between the number of fallen fruits (FC), fruit yield (RF) and fruits attacked by weevil (FAG). There was a high positive correlation between FC and FAG ($r = 0.79$), which shows an increasing tendency of fallen fruits to increase the attack of the pest. This confirms that the plague really causes the fall of the fruit in addition to other climatic and nutritional factors. Contrary to the low level of weevil influence on fruit drop (0.12%) found by Farro et al. (2011) [27]. It should be considered that between the two evaluations there is a difference of 10 years, when the pest has been consolidated in the area near the city of Iquitos. Between the two tests there is an approximate distance of about 3 km. The fruit yield (RF) shows a negative correlation with both the percentage of fallen fruit ($r = -0.57$) and the percentage of fruits attacked by the weevil ($r = -0.73$). These negative correlations confirm the direct relationship between the attack of the pest and the productive capacity of the plant.

Table 3. Correlation (Pearson's index r) for the variables of fruits attacked by weevil (FAG), fruit drop (FC) and yield of fruit (RF)

	FC(%)	RF(kg/pl)	FAG(%)
FC	1		
RF	-0.57**	1	
FAG	0.79**	-0.73**	1

** Highly significant level ($\alpha=0.01$)

3. CONCLUSION

It was found that the most effective control method of the fruit weevil (*Conotrachelus dubiae*), principal pest of the camu-camu, is the application of traps with adhesive tapes (impregnated with entomological glue). This ethological method, achieved the lower levels of the fruits attacked and, in turn, the highest yield in fruit / plant production as well as the possibility of catching the insect and minimizing its population.

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4. REFERENCES

1. Bessin R. Plum curculio. University of Kentucky-College of Agriculture. ENTACT.-1997; 202. 2 p.
2. Cañedo V, Alfaro A, Kroschel J. Manejo Integrado de Plagas en Hortalizas, Principios y referencias técnicas para la Sierra Central del Perú. 2011; 24 p.
3. Cisneros HF. Control de Plagas Agrícolas - Fascículo 13 "El manejo integrado de plagas". 2010; 27 p.
4. Couturier G, Inga H, Tanchiva E. Insectos fitófagos que viven en *Myrciaria dubia* (*Myrtaceae*) frutal amazónico de la región Amazónica. Folia Amazónica 1992; 4:19-35.
5. Delgado VC. Mimallo amilia plaga de *Myrciaria dubia* en la Amazonia Peruana: Ecología y descripción de la plaga. Informe técnico. Programa de uso sostenible de la Biodiversidad. IIAP. 2001; 4 p.
6. Delgado VC, Vasquez BJ. Informe entomológico final; Estudios preliminares de la crianza artificial de *Tuthillia cognata*. Programa de biodiversidad. Proyecto Mejoramiento genético y manejo integrado de plagas del camu-camu. 2001.
7. Delgado VC, Couturier G. Manejo de insectos plagas en la Amazonía: su aplicación en camu-camu. IIAP- Iquitos. IRD- Francia. Lima, Perú. 2004; 147 p.
8. Ferrero DM, Couturier G. Les cochenilles des Myrtaceae en Amazonie peruvienne. 1. Description de deux nouveaux ravageurs de *Myrciaria dubia* (Homoptera. Coccidae et Kerriidae). Bulletin de la Societe entomologique de France 98 (5) 1993;441-448.



9. Inga H, Pinedo M, Delgado C, Linares C, Mejía K. Fenología Reproductiva de *Myrciaria dubia* McVaugh (H.B.K.) Camu-camu. *Folia Amazonica*, 2001; 12 (1-2):99-106. <http://www.iiap.org.pe/upload/Publicacion/PUBL697.pdf>
10. Imán CS. Capítulo 3. Camu-camu (*Myrciaria dubia*). In: Velarde F. D. Acciones Promisorias – Banco de Germoplasma de la SUDIRGEB – INI, volumen 1. Lima. 2009; 98 pp.
11. Sánchez J, Abanto C, Casas R. Evaluación del manejo integrado de plagas de *Myrciaria dubia* en suelos no inundables de la cuenca del Ucayali, Perú. *Folia Amazonica* 2015; 24 (1):39-44. <http://www.iiap.org.pe/upload/Publicacion/PUBL1435.pdf>
12. Perez DD, Delgado CV, Raygada RA. Bioecología del picudo del camu-camu *Conotrachelus dubiae* O'Brien, Coleoptera-Curculionidae en la Region Ucayali. Estacion Experimental Anexo Pacacocha INIA-Pucallpa. 2001; 25 p.
13. Pérez D, Iannacone J. Ciclo biológico, comportamiento y censo del picudo del Camu-camu, *Conotrachelus dubiae* O'Brien 1995 (*Coleoptera: Curculionidae*) en Pucallpa, Perú. *Acta Amazônica* 2008; 38(1): 145 – 152. <http://dx.doi.org/10.1590/S0044-59672008000100016>
14. Pérez D, Iannacone J, Tueros T. Toxicidad de *Paullinia clavigera* Schlttdl. (*Sapindaceae*) y del *Chondrodendron tomentosum* Ruiz et Pav. (*Menispermaceae*) sobre el piojo saltador del Camu-camu *Tuthillia cognata* Hodkinson (*Hemiptera: Psyllidae*). *Gayana Botánica*. 2008; 65(2):145-152. <http://dx.doi.org/10.4067/S0717-66432008000200004>
15. Pinedo PM, Riva RR, Rengifo SE, Delgado VC, Villacres V J, Gonzáles CA, Inga SH, López UA, Farroñay PR, Vega VR, Linares BS. Sistema de producción de camu-camu en restinga. Instituto de Investigaciones de la Amazonía Peruana. Iquitos. 2001; 141 p.
16. Pinedo M. Sistemas de plantacion y mejora genetica de camu-camu arbustivo – *Myrciaria dubia* – Loreto, Peru. Instituto de Investigaciones de la Amazonía Peruana. PROBOSQUES. Loreto-Perú. 2002; 9 p.
17. Pinedo PM, Linares BC, Mendoza H, Anguiz R. Plan de Mejoramiento Genetico de Camu-camu. Instituto de Investigaciones de la Amazonia Peruana-IIAP. Iquitos. Peru. 2004; 52 p.
18. Pinedo PM, Gonzales RW. Identificación, colección y evaluación de factores genéticos y ecológicos de resistencia y/o tolerancia a plagas. Proyecto INCAGRO. Manejo integrado de plagas del camu-camu. Programa de Biodiversidad Biológica. IIAP. 2004; 5 p.
19. Pinedo PM, Bardales LR. Efecto de la aplicación de rotenona (Rote-Biol) para el control del piojo saltador (*Tuthillia cognata* H.) en plantas juveniles de camu-camu. Programa de Investigación en Manejo Integral del Bosque y Servicios Ambientales-IIAP. Memoria Anual. 2009; 39-40 p.
20. Pinedo PM, Delgado VC, Farroñay P.R., Del Castillo TD, Iman CS, Villacrés J, Faching L, Oliva CC, Abanto RC, Bardales LR, Vega R. Camu-camu (*Myrciaria dubia*, *Myrtaceae*) Aportes para su aprovechamiento sostenible en la Amazonía peruana. Instituto de Investigaciones de la Amazonia Peruana. PROBOSQUES. 2010; 48 p.
21. Sanchez ChJ. Plagas del camu-camu y sacha inchi. Folleto tecnico. Programa de Investigacion de la Biodiversidad Amazonica. IIAP. 2010; 2 p.
22. Vasques MR. Florula De Las Reservas Biológicas de Iquitos, Perú. Allpahuayo-Mishana. Missouri Botanical Garden. 1997; 1046 p. <https://catalog.hathitrust.org/Record/003345572>
23. Villachica H. Cultivo del camu-camu (*Myrciaria dubia* H.B.K. McVaugh) en la Amazonía peruana. Tratado de Cooperación Amazónica. Secretaría Pro Tempore. Lima, Perú. 1996.



24. Villacrez VJ. Diagnóstico de principales enfermedades del camu-camu (*Myrciaria dubia* H.B.K. McVaugh) en selva baja. Congreso Nacional del Camu-camu. Resúmenes. 2009; 1 p.
25. Chang CA. El camu-camu: Aspectos Químicos, Farmacológicos y Tecnológicos. ICA. Perú. 2013; 125 p.
26. DPA. Dirección de Promoción Agraria de la Dirección Regional de Agricultura de Loreto. Informe de Agencias Agrarias. 2015; 7 p.
27. Farro S, Pinedo M, Huaranca R. Evaluation of the fruit-drop of [*Myrciaria dubia* (Kunth) McVaugh], camu-camu, in the "five River Basins" collection of the San Miguel experimental research station - IIAP, Loreto, Peru. African Journal of Plant Science. 2011; 5(2):102-107.
<http://www.academicjournals.org/ajps>
28. Bardales LR. Control Integrado de caída de fruta en camu-camu (*Myrciaria dubia* McVAugh H.B.K. Instituto de Investigaciones de la Amazonia Peruana. 2010; 8 p.
29. Farro S. Influencia del uso de activador enzimático "Kalifrut" en el amarre de frutos de *Myrciaria dubia* (H.B.K) Mc Vaugh "camu-camu" del Centro Experimental San Miguel – Instituto de Investigaciones de la Amazonía Peruana, Loreto, Perú. Instituto de Investigaciones de la Amazonia Peruana. Informe Técnico. 2012; 4 p.
30. Abanto RC, Pinedo PM, Albuquerque CT, Remuzgo FR, Paredes DE, Tamani R E, Fuentes de boro en producción del fruto de camu-camu en suelos aluviales de Ucayali. Folia Amazonica 2015; 24 (1): 33 – 38.
<http://www.iiap.org.pe/Upload/Publicacion/PUBL1434.pdf>
31. Quaggio JA, Piza CT. Micronutrientes para frutíferas tropicais. In: Ferreira, M. E.; Cruz, M. C. P.; Raij, B. Van; Abreu, C. A. (Ed.). Micronutrientes tóxicos e metais pesados na agricultura. Jaboticabal: CNPq/Fapesp/Potafos. 2001; 459-491.
32. Fisher RA. Statistical methods for research workers. 10^a ed. New York. Hafner, 1948; 345 p.
33. Pinedo P M, Chagas A E, Paredes D E, Abanto R C, Bardales L.R, Chagas C P, Ferreira M V. Selection of Superior Genotypes in 37 Clones of Camu-Camu by Repetitvity Analysis. Journal of Agricultural Science. 2017; 9 (6):176-187.
doi:10.5539/jas.v9n6p175



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