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Spatial and temporal patterns of *Aedes aegypti* (Diptera: Culicidae) container breeding in Camagüey, Cuba

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Abstract
In 2019, an entomological survey was conducted in three populations of *Aedes* mosquitoes from Camagüey, Cuba. The total number of deposit types was quantified based on their location within households. The percentage of representativeness was determined, along with differences between climatic seasons (rainy and dry). A Student's t-test and Chi-squared test were employed on 2 x 2 contingency tables ($p \leq 0.05$).The Julio Antonio Mella Health Area (JAM-HA) reported 62 positive deposit types, of which 21 were permanent and useful (33.87%), accounting for 78.86% of the total positive deposits. The Carlos Juan Finlay Health Area (CJF-HA) had 86 deposit types, with 21 being permanent and useful (24.41%) and a positivity rate of 76.74% for this type of deposit. Meanwhile, the Ignacio Agramonte Area (IA-HA) recorded 40 positive deposit types, with 19 being highly important for families (47.5%) out of a total of 355 positive deposits (83.72%). Significant differences in positivity for permanent and useful deposits were observed in both JAM-HA and CJF-HA during the rainy season; however, differences in outdoor collections were noted only in CJF-HA. This indicates the spatial heterogeneity of vector behavior, reflecting the ecological differences present in the studied Health Areas. This aspect should be considered when designing surveillance and vector control strategies.

Keywords: *Aedes aegypti*, biotopes, Camagüey, Cuba, dengue, vector control

1. Introduction

Vector-borne diseases remain highly relevant in both medical and veterinary contexts across various parts of the world. This is largely due to the adaptations developed by several mosquitoes, particularly *Aedes* (Stegomyia) *aegypti* (Diptera: Culicidae), which is a significant transmitter of arboviral diseases such as yellow fever [1], Zika [2], Chikungunya [3, 4], and dengue [5, 6]. These arboviral diseases have been favored, among other reasons, by their high epidemic potential, leading to significant impacts on health, social structures, and economies [7, 8]. This situation contributes to increasingly intense and recurrent outbreaks of arboviral diseases in various tropical countries [9, 10]. In the Americas, the situation has worsened with the emergence of chikungunya and Zika viruses, as well as the recent identification of *Ae.* (Fredwardsius*) vittatus* in our continent [11-13]. This unfavorable scenario necessitates intensified "*in situ*" ecological studies to design and implement integrative vector control strategies, emphasizing community-based surveillance and control actions [14-16].

This study aims to update bioecological knowledge regarding *Aedes* populations from three health areas with varying infestation levels, focusing on the breeding sites they prioritize for colonization. This aspect has significant practical implications for the strategic design of vector surveillance and control efforts.

2. Materials and Methods

Study area: The province of Camagüey is located between 20°31'01"-22°29'00" N and 78°39'22" O-76°57'00", approximately.

Study period: The database (models 91-11) from the Municipal Laboratory of Medical Entomology of the Municipal Hygiene and Epidemiology Unit of Camagüey (MLME-MHEU-C) was utilized, containing entomological results from the Vector Control Department across the three studied health areas: CJF-HA, JAM-HA and IA-HA (Figure 1). During the study, the two reported climatic periods for Cuba were considered: rainy (may -october) and dry (november - april) [17].

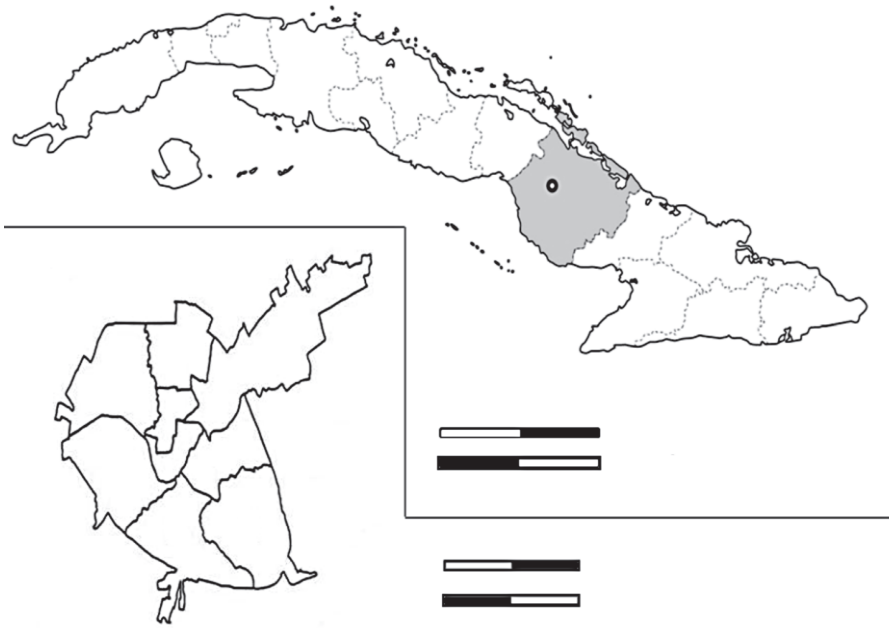

Fig 1: Health Areas studied in Camagüey province, which includes the homonymous municipality capital, Camagüey. (●). Include three main ones: CJF-HA (Carlos Juan Finlay Health Area), IA-HA (Ignacio Agramonte Health Area), and JAM-HA (Julio Antonio Mella Health Area).

- **Survey technique:** A complete inspection of 100% of the urban universe in the three areas was conducted both inside and around households, with each residence receiving a monthly visit according to Cuba's vector control network plan.
- **Sample collection:** In each positive deposit, the maximum number of larvae and/or pupae was collected using a dropper and small containers, into which water from each deposit was previously emptied. The samples were preserved in small vials with 70% alcohol. The accompanying label for shipment to MLME-MHEU-C included primary data such as address (highlighting the block), date, collection site, and type of deposit along with its location.
- **Classification and characterization of deposits:** Classification was based on the criteria set by Armada & Trigo [18], emphasizing permanent (P) and useful (U) deposits. This classification was established based on the importance and priority that families assign to accumulating water in their homes.
- **Biological material classification:** This was performed following of Gonzalez´s criteria [19].
- **Data processing:** The type and total number of each positive deposit were quantified based on their location within each dwelling (exterior and interior) across climatic seasons, calculating the percentage representation for each total. To compare positive PU deposits between climatic seasons based on capture location, a non-parametric Chi-squared test was used in 2 x 2 contingency tables. For analyzing totals of each type of positive deposit, a student's t-test was employed, maintaining a significance level of $p \leq 0.05$. Furthermore, the behavior of repeatability for each type of deposit throughout the study year and according to climatic seasons was determined using a Venn inclusion diagram to identify which elements (types of deposits) were shared or not among the three health areas, serving as a decision-making tool.

3. Results

In Figure 2, the behavior of focality by health area, month, and outdoor captures is presented, showing that during the rainy season, higher abundance values were reported, particularly between july and september.

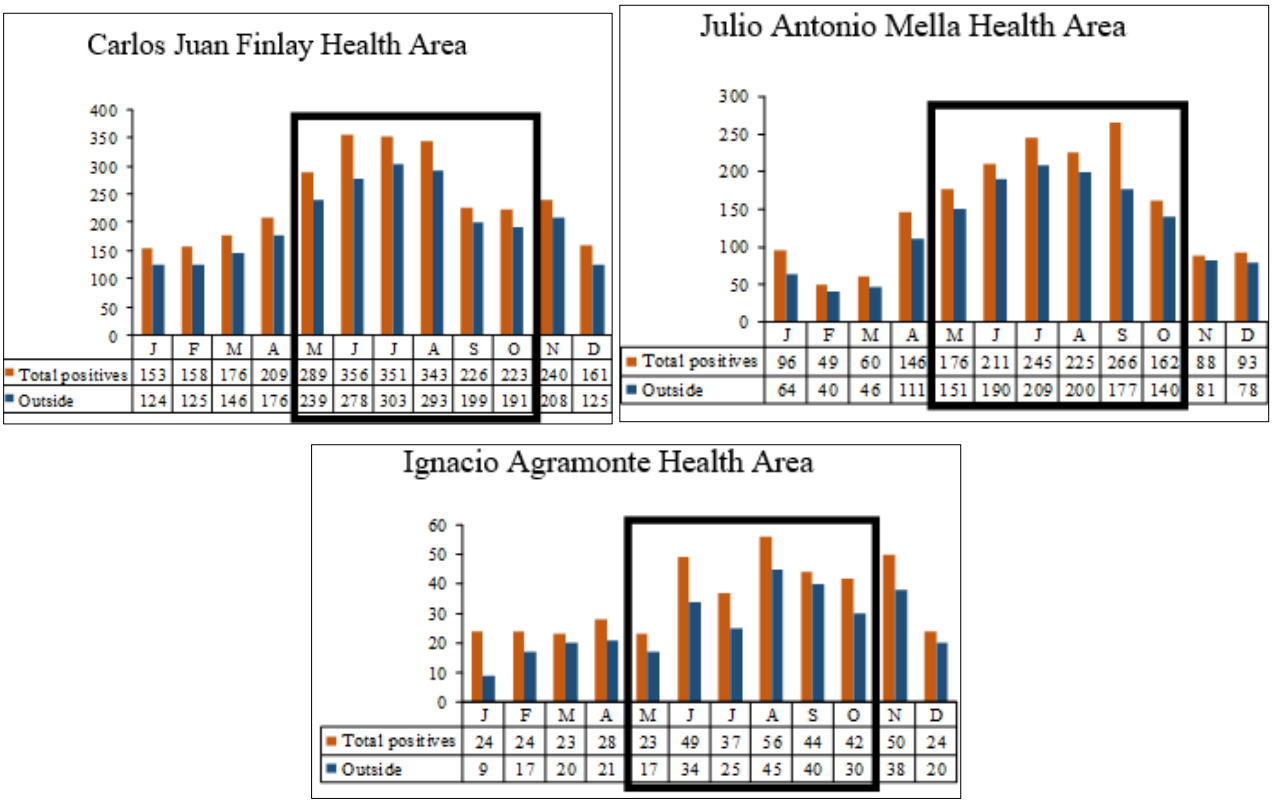

Fig 2: Monthly positivity according to capture location (outside) for *Aedes aegypti* in the three Health Areas during 2019. The months included in the rainy season (May - October) are enclosed in the quadrant. The highest abundance values are highlighted in red.

Tables 1 - 3 detail the types of deposits colonized by *Ae. aegypti* in the three study areas. CJF-HA, 87 types of deposits were identified, with 22 classified as PU (25.28%), JAM-HA, 62 types of deposits were reported, with 20 classified as PU (32.25%). In this area, larvae were captured in 1817 deposits, where PU also represented a minority type but contributed 86.29% to positivity. While, IA-HA reported a total of 40 types of deposits, of which 19 (47.5%) were classified as permanent and useful (PU), contributing 75.23% to the total positive deposits showing similar behavior to previous areas. In total, there were 98 positives deposits types recorded, with 21 classified as PU (21.64%), contributing the highest positivity percentage (78.04%). Among these various receptacles, the ground-level tank deposit stood out with 28.07% larval samples.

Table 1: Behavior of positivity among climatic seasons in different deposits to *Aedes aegypti* in the Carlos Juan Finlay Health Area during 2019. Permanent and useful deposits (PU) are highlighted. See Figure 5.

Deposits	Rainy season	%	Outside	%	Dry season	%		%	Overall total	Outside	%
Ground-level tank	816	57.79	694	57.64	596	42.21	510	42.36	1412	1204	85.27
Barrel	109	58.60	73	57.94	77	41.40	53	42.06	186	126	67.74
Cooking pot	70	64.22	61	64.21	39	35.78	34	35.79	109	95	87.16
Water basin	65	64.36	49	61.25	36	35.64	31	38.75	101	80	79.21
Can	73	83.91	71	83.53	14	16.09	14	16.47	87	85	97.70
Bucket	50	62.50	33	62.26	30	37.50	20	37.74	80	53	66.25
Animal drinker	48	67.61	48	67.61	23	32.39	23	32.39	71	71	100.00
Used car tired	48	73.85	46	73.02	17	26.15	17	26.98	65	63	96.92
Cistern	35	55.56	32	56.14	28	44.44	25	43.86	63	57	90.48
Ditch	28	50.00	27	49.09	28	50.00	28	50.91	56	55	98.21
Toilet seat	30	55.56	18	75.00	24	44.44	6	25.00	54	24	44.44
Sewagwe pit	31	63.27	30	62.50	18	36.73	18	37.50	49	48	97.96
Pot	14	41.18	10	34.48	20	58.82	19	65.52	34	29	85.29
Spiritual vase	9	27.27	3	60.00	24	72.73	2	40.00	33	5	15.15
Plastic small tank	21	65.63	15	62.50	11	34.38	9	37.50	32	24	75.00
Register	12	44.44	12	48.00	15	55.56	13	52.00	27	25	92.59
Small bowl	21	77.78	18	78.26	6	22.22	5	21.74	27	23	85.19
Puddle	21	80.77	17	77.27	5	19.23	5	22.73	26	22	84.62
Flower pot	24	96.00	22	95.65	1	4.00	1	4.35	25	23	92.00
Water box	14	66.67	13	65.00	7	33.33	7	35.00	21	20	95.24
Bowl	10	55.56	10	66.67	8	44.44	5	33.33	18	15	83.33
Jar	13	81.25	13	86.67	3	18.75	2	13.33	16	15	93.75
Tank lid	13	86.67	11	84.62	2	13.33	2	15.38	15	13	86.67

Refrigerator tray	6	40.00	3	60.00	9	60.00	2	40.00	15	5	33.33
Elevated tank	7	50.00	7	50.00	7	50.00	7	50.00	14	14	100.00
Latrine	9	75.00	9	75.00	3	25.00	3	25.00	12	12	100.00
Laundry sink	8	66.67	7	63.64	4	33.33	4	36.36	12	11	91.67
Nylon	8	66.67	7	63.64	4	33.33	4	36.36	12	11	91.67
Well	10	90.91	10	90.91	1	9.09	1	9.09	11	11	100.00
Hole	6	60.00	6	60.00	4	40.00	4	40.00	10	10	100.00
Flower vase	4	40.00	2	28.57	6	60.00	5	71.43	10	7	70.00
Knob	5	55.56	5	55.56	4	44.44	4	44.44	9	9	100.00
Animal feeder	8	88.89	8	88.89	1	11.11	1	11.11	9	9	100.00
Wine pitcher	8	88.88	6	75.00	1	11.12	1	25.00	9	7	77.77
Tinaja*	6	75.00	3	75.00	2	25.00	1	25.00	8	4	50.00
Tree hole	7	87.50	6	85.71	1	12.50	1	14.29	8	7	87.50
Puddle	5	83.33	4	80.00	1	16.67	1	20.00	6	5	83.33
Cattle watering trough	4	66.67	4	66.67	2	33.33	2	33.33	6	6	100.00
Milk can	4	80.00	3	75.00	1	20.00	1	25.00	5	4	80.00
Bathtub	4	80.00	2	66.67	1	20.00	1	33.33	5	3	60.00
Tile	5	100.00	5	100.00	0	0.00	0	0.00	5	5	100.00
Casserole	5	100.00	4	100.00	0	0.00	0	0.00	5	4	80.00
Gallon	5	100.00	4	100.00	0	0.00	0	0.00	5	4	80.00
Water boot	5	100.00	4	100.00	0	0.00	0	0.00	5	4	80.00
Air conditioner	5	100.00	4	100.00	0	0.00	0	0.00	5	4	80.00
Bottle	4	100.00	4	100.00	0	0.00	0	0.00	4	4	100.00
Jar	4	100.00	2	100.00	0	0.00	0	0.00	4	2	50.00
Banana plant	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Basin	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Soap dish	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Iron wheel	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Kitchen	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Urinal	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Pipe	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Curtain	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Washing machine	4	100.00	3	100.00	0	0.00	0	0.00	4	3	75.00
Water fountain	3	100.00	1	100.00	0	0.00	0	0.00	3	1	33.33
Scarp metal	3	100.00	2	100.00	0	0.00	0	0.00	3	2	66.67
Battery	3	100.00	2	100.00	0	0.00	0	0.00	3	2	66.67
Down pipe	1	33.33	1	50.00	2	66.67	1	50.00	3	2	66.67
Fish bowl	1	50.00	1	50.00	1	50.00	1	50.00	2	2	100.00
Duck pond	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Milk can	0	0.00	0	0.00	2	100.00	2	100.00	2	2	100.00
Polyfoam	0	0.00	0	0.00	2	100.00	2	100.00	2	2	100.00
Tray	1	50.00	1	50.00	1	50.00	1	50.00	2	2	100.00
Hand wash basin	1	50.00	1	50.00	1	50.00	1	50.00	2	2	100.00
Plate	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Tube	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Coconut	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Kitchen sink	1	50.00	1	50.00	1	50.00	1	50.00	2	2	100.00
Drainage	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Swimming pool	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Tarpaulin	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Carburetor	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Bullion	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Clay figure	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Transformer	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Palm stalk	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Frying pan	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Crib	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Watering can	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Block	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Candy jar	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Plastic box	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Toy	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Cask	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
TOTALS	1788	61.98	1503	62.44	1097	38.02	904	37.56	2885	2407	83.43

Table 2: Behavior of positivity among climatic seasons in different deposits to *Aedes aegypti* in the Julio Antonio Mella Health Area during 2019. Permanent and useful deposits (PU) are highlighted. See Figure 5.

Depósits	Rainy season	%	Outside	%	Dry season	%	Outside	%	Overall total	Outside	%
Ground-level tank	508	67.11	420	68.29	249	32.89	195	31.71	757	615	81.24
Barrel	132	72.53	100	73.53	50	27.47	36	26.47	182	136	74.73
Bucket	65	76.47	48	78.69	20	23.53	13	21.31	85	61	71.76
Water basin	53	67.09	43	72.88	26	32.91	16	27.12	79	59	74.68
Can	55	83.33	50	83.33	11	16.67	10	16.67	66	60	90.91
Cooking pot	44	70.97	39	70.91	18	29.03	16	29.09	62	55	88.71
Cistern	44	77.19	39	76.47	13	22.81	12	23.53	57	51	89.47
Animal drinker	33	57.89	33	58.93	24	42.11	23	41.07	57	56	98.25
Sewage pit	28	75.68	28	77.78	9	24.32	8	22.22	37	36	97.30
Used car tire	21	70.00	21	70.00	9	30.00	9	30.00	30	30	100.00
Tinajón*	25	86.21	25	92.59	4	13.79	2	7.41	29	27	93.10
Register	13	59.09	13	59.09	9	40.91	9	40.91	22	22	100.00
Ditch	14	63.64	10	55.56	8	36.36	8	44.44	22	18	81.82
Small bowl	18	85.71	16	88.89	3	14.29	2	11.11	21	18	85.71
Pot	11	57.89	10	62.50	8	42.11	6	37.50	19	16	84.21
Laundry sink	14	73.68	12	80.00	5	26.32	3	20.00	19	15	78.95
Toliet seat	15	83.33	2	50.00	3	16.67	2	50.00	18	4	22.22
Plastic small tank	16	94.12	13	92.86	1	5.88	1	7.14	17	14	82.35
Spiritual vase	13	86.67	0	0.00	2	13.33	0	0.00	15	0	0.00
Bowl	12	80.00	10	76.92	3	20.00	3	23.08	15	13	86.67
Bathtub	9	60.00	9	60.00	6	40.00	6	40.00	15	15	100.00
Elevated tank	13	92.86	9	90.00	1	7.14	1	10.00	14	10	71.43
Nylon	11	84.62	11	91.67	2	15.38	1	8.33	13	12	92.31
Jar	8	61.54	6	54.55	5	38.46	5	45.45	13	11	84.62
Water box	7	58.33	7	58.33	5	41.67	5	41.67	12	12	100.00
Flower vase	4	40.00	2	33.33	6	60.00	4	66.67	10	6	60.00
Tinaja*	7	70.00	6	75.00	3	30.00	2	25.00	10	8	80.00
Puddle	6	60.00	4	57.14	4	40.00	3	42.86	10	7	70.00
Latrine	8	88.89	8	88.89	1	11.11	1	11.11	9	9	100.00
Well	8	88.89	8	88.89	1	11.11	1	11.11	9	9	100.00
Tank lid	8	100.00	7	100.00	0	0.00	0	0.00	8	7	87.50
Flower pot	7	87.50	7	87.50	1	12.50	1	12.50	8	8	100.00
Animal feeder	6	75.00	6	75.00	2	25.00	2	25.00	8	8	100.00
Wine pitcher	5	71.43	5	71.43	2	28.57	2	28.57	7	7	100.00
Hole	3	50.00	3	60.00	3	50.00	2	40.00	6	5	83.33
Refrigerator tray	3	50.00	2	100.00	3	50.00	0	0.00	6	2	33.33
Milk can	2	40.00	2	50.00	3	60.00	2	50.00	5	4	80.00
Swimming pool	2	50.00	2	50.00	2	50.00	2	50.00	4	4	100.00
Knob	3	75.00	3	75.00	1	25.00	1	25.00	4	4	100.00
Cattle watering trough	1	33.33	1	33.33	2	66.67	2	66.67	3	3	100.00
Tube	3	100.00	3	100.00	0	0.00	0	0.00	3	3	100.00
Downpipe	3	100.00	3	100.00	0	0.00	0	0.00	3	3	100.00
Plate	3	100.00	3	100.00	0	0.00	0	0.00	3	3	100.00
Canteen	2	50.00	1	0.00	1	50.00	1	100.00	3	2	50.00
Pigsty floor	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Urinal	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Small plate	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Seat coffee	2	100.00	1	100.00	0	0.00	0	0.00	2	1	50.00
Bottle	2	100.00	2	100.00	0	0.00	0	0.00	2	2	100.00
Drainage	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Metal box	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Cup	0	0.00	0	0.00	1	100.00	0	0.00	1	0	0.00
Curtain	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Jar	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Skipper	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Hand wash basin	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Tray	1	100.00	0	0.00	0	0.00	0	0.00	1	0	0.00
Scrap metal	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Tile	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Basin	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Cask	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
TOTALS	1285	70.72	1067	71.76	532	29.28	420	28.24	1817	1487	81.84

Table 3: Behavior of positivity among climatic seasons in different deposits to *Aedes aegypti* in the Ignacio Agramonte Health Area during 2019. Permanent and useful deposits (PU) are highlighted. See Figure 5.

Depósitos	Rainy season	%	Outside	%	Dry season	%	Outside	%	Overall total	Outside	%
Ground-level tank	115	60.85	91	63.64	74	39.15	52	36.36	189	143	75.66
Barrel	24	60.00	21	72.41	16	40.00	8	27.59	40	29	72.50
Cistern	8	38.10	7	35.00	13	61.90	13	65.00	21	20	95.24
Ditch	11	57.89	11	57.89	8	42.11	8	42.11	19	19	100.00
Bucket	14	82.35	6	85.71	3	17.65	1	14.29	17	7	41.18
Water basin	10	76.92	6	66.67	3	23.08	3	33.33	13	9	69.23
Puddle	10	76.92	4	57.14	3	23.08	3	42.86	13	7	53.85
Animal drinker	6	50.00	4	50.00	6	50.00	4	50.00	12	8	66.67
Cooking pot	7	58.33	7	70.00	5	41.67	3	30.00	12	10	83.33
Tinajón*	3	30.00	3	37.50	7	70.00	5	62.50	10	8	80.00
Bowl	3	37.50	2	28.57	5	62.50	5	71.43	8	7	87.50
Register	3	42.86	3	50.00	4	57.14	3	50.00	7	6	85.71
Elevated tank	1	16.67	1	16.67	5	83.33	5	83.33	6	6	100.00
Plastic small tank	5	83.33	2	66.67	1	16.67	1	33.33	6	3	50.00
Flower pot	2	50.00	2	50.00	2	50.00	2	50.00	4	4	100.00
Milk can	3	75.00	2	66.67	1	25.00	1	33.33	4	3	75.00
Pot	2	50.00	2	100.00	2	50.00	0	0.00	4	2	50.00
Tinaja*	1	33.33	0	0.00	2	66.67	0	0.00	3	0	0.00
Well	1	33.33	1	33.33	2	66.67	2	66.67	3	3	100.00
Sewage pit	3	100.00	3	100.00	0	0.00	0	0.00	3	3	100.00
Toilet seat	1	33.33	1	100.00	2	66.67	0	0.00	3	1	33.33
Small bowl	2	66.67	2	66.67	1	33.33	1	33.33	3	3	100.00
Toilet bowl hole	1	33.33	0	0.00	2	66.67	0	0.00	3	0	0.00
Flower vase	2	100.00	1	100.00	0	0.00	0	0.00	2	1	50.00
Glass	1	50.00	0	0.00	1	50.00	0	0.00	2	0	0.00
Wine pitcher	1	50.00	1	50.00	1	50.00	1	50.00	2	2	100.00
Can	0	0.00	0	0.00	2	100.00	2	100.00	2	2	100.00
Swimming pool	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Spiritual vase	1	100.00	0	0.00	0	0.00	0	0.00	1	0	0.00
Water box	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Sewage system	0	0.00	0	0.00	1	100.00	1	100.00	1	1	100.00
Bathtub	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Nylon	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Used car tire	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Hole	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Bucket cover	1	100.00	0	0.00	0	0.00	0	0.00	1	0	0.00
Animal feeder	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Tube	1	100.00	0	0.00	0	0.00	0	0.00	1	0	0.00
Jar	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
Bottle	1	100.00	1	100.00	0	0.00	0	0.00	1	1	100.00
TOTALS	251	59.20	191	60.44	173	40.80	125	39.56	424	316	74.53

However, positivity in natural deposits was very low at only 0.27% (14 positive deposits), all reported in CJF-HA. Larvae of *Ae. aegypti* were also collected from nine types of deposits with high levels of eutrophication (9.27%), including registers, ditches, latrines, sewage pits, drainage, sewage system, pigsty floor, dow pipe, and animal feeders, contributing 4.99% to overall focality. Regarding abundance levels, significant differences were observed towards the rainy season in CJF-HA and JAM-HA; however, differences in capture locations were only noted in CJF-HA outdoors (Table 4), indicating heterogeneity in species behavior. Interestingly, among the ten most repetitive types of deposits, 90% had high utility for families (Table 5), showing the total months each type had representatives. Nine types exceeded 70% repeatability, with PU accounting for 88%, which extended across both climatic seasons. In Figure 3A, it can be seen that while PU deposit types were minority in all three health areas, they reported the highest number of positive deposits (3B) as well as greater presence in outdoor captures (Figure 3). Figure 4 illustrates the number of shared deposit types where *Ae. aegypti* was reported colonizing 32 similar types across all three areas (32.98%) out of the 97 reported during the study year. Among these types of deposits, PU accounted for a total of 17 types representing 53.12%, reaffirming their significant contribution to focality. The combination between CJF-HA and JAM-HA reached a total of 20 similar breeding sites while similarities between IA-HA and CJF-HA as well as between IA-HA and JAM-HA were low. It is noteworthy that in CJF-HA there were reported 28 types of deposits that did not have representatives in the other two health areas.

Table 4: Behavior of positivity to *Aedes aegypti* according to climatic seasons during 2019 (Yates correction with a significance of $p \leq 0.05$)

According to the abundance of positive deposits				
Julio Antonio Mella Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU	1004	435	1439	p=0.0001
Negative PU	281	97	378	
Total	1285	532	1817	
Carlos Juan Finlay Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU	1300	915	2215	***p=0.0001***
Negative PU	488	183	671	
Total	1788	1098	2886	
Ignacio Agramonte Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU	180	139	319	*p=0.0562*
Negative PU	71	34	105	
Total	251	173	424	
According to the location of positive deposits				
Julio Antonio Mella Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU outside	825	340	1165	*p=0.1440*
Negative PU outside	242	80	322	
Total	1067	420	1487	
Carlos Juan Finlay Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU outside	1084	759	1843	*p=0.0001*
Negative PU outside	419	146	565	
Total	1503	905	2408	
Ignacio Agramonte Health Area				
Condition	**Rainy season**	**Dry season**	**Total**	**Significance**
Positive PU outside	147	102	249	*p=0.3980*
Negative PU outside	44	23	67	
Total	191	125	316	

Table 5: Repeatability of positive deposits to *Aedes aegypti* among the Ignacio Agramonte Health Area (IA-HA), Carlos Juan Finlay Health Area (CJF-HA), and Julio Antonio Mella Health Area (JAM-HA) during 2019. The 10 most abundant types of deposits are highlighted. See Figure 5.

Deposits type	**Times it repeats in the year**			**Overall total**	**Times it repeats in the rainy season**			**Overall total for rainy season**	**Times it repeats in the dry season**			**Overall total for dry season**
	IA	**CJF**	**JAM**		**IA**	**CJF**	**JAM**		**IA**	**CJF**	**JAM**	
Ground-level tank	12	12	12	36	6	6	6	18	6	6	6	18
Barrel	12	12	12	36	6	6	6	18	6	6	6	18
Animal drinker	9	12	11	32	4	6	6	16	5	6	5	16
Cistern	9	12	10	31	4	6	6	16	5	6	4	15
Water basin	7	12	12	31	5	6	6	17	2	6	6	14
Bucket	7	12	12	31	5	6	6	17	2	6	6	14
Cooking pot	8	12	11	31	4	6	6	16	4	6	5	15
Ditch	9	12	9	30	5	6	5	16	4	6	4	14
Sewage pit	2	12	12	26	2	6	6	14	0	6	6	12
Register	7	10	8	25	3	5	3	11	4	5	5	14
Puddle	8	10	7	25	5	7	4	16	3	3	3	9
Can	2	12	10	24	0	6	6	12	2	6	4	12
Pot	3	10	9	22	2	6	5	13	1	4	4	9
Bowl	4	10	8	22	2	4	5	11	2	6	3	11
Used car tire	1	12	8	21	1	6	4	11	0	6	4	10
Small bowl	3	9	9	21	2	6	6	14	1	3	3	7
Plastic small tank	4	10	5	19	3	5	4	12	1	5	1	7
Toilet seat	0	12	7	19	0	6	5	11	0	6	2	8
Water box	1	9	7	17	1	5	4	10	0	4	3	7
Spiritual base	2	10	5	17	1	4	3	8	1	6	2	9
Jar	1	7	8	16	1	4	4	9	0	3	4	7
Laundry sink	0	6	10	16	0	4	6	10	0	2	4	6
Flower vase	1	8	6	15	1	4	3	8	0	4	3	7
Tinaja*	3	6	6	15	1	4	4	9	2	2	2	6
Maceta	3	7	5	15	1	6	4	11	2	1	1	4
Elevated tank	3	7	4	14	1	3	3	7	2	4	1	7

Nylon	1	7	6	14	1	4	4	9	0	3	2	5
Milk can	4	5	5	14	3	2	2	7	1	3	3	7
Latrine	0	7	6	13	0	5	5	10	0	2	1	3
Well	3	5	5	13	1	4	4	9	2	1	1	4
Tinajón*	7	0	5	12	3	0	3	6	4	0	2	6
Animal feeder	1	5	6	12	1	4	4	9	0	1	2	3
Wine pitcher	2	5	5	12	1	4	3	8	1	1	2	4
Tank lik	0	8	4	12	0	6	4	10	0	2	0	2
Hole	1	7	3	11	1	4	1	6	0	3	2	5
Refrigerator tray	0	5	5	10	0	2	3	5	0	3	2	5
Knob	0	7	2	9	0	4	1	5	0	3	1	4
Bathtub	0	0	9	9	0	0	5	5	0	0	4	4
Cattle watering trough	0	5	3	8	0	4	1	5	0	1	2	3
Swimming pool	1	1	4	6	0	1	2	3	1	0	2	3
Bottle	1	3	2	6	1	3	2	6	0	0	0	0
Down pipe	0	2	3	5	0	1	3	4	0	1	0	1
Tree hole	0	5	0	5	0	4	0	4	0	1	0	1
Plato	2	0	3	5	2	0	3	5	0	0	0	0
Air conditioner	0	4	0	4	0	4	0	4	0	0	0	0
Bathtub	1	3	0	4	1	2	0	3	0	1	0	1
Basin	0	3	1	4	0	3	1	4	0	0	0	0
Water boot	0	4	0	4	0	4	0	4	0	0	0	0
Casserole	0	4	0	4	0	4	0	4	0	0	0	0
Curtain	0	3	1	4	0	3	1	4	0	0	0	0
Gallon	0	4	0	4	0	4	0	4	0	0	0	0
Urinal	0	3	1	4	0	3	1	4	0	0	0	0
Tube	0	2	2	4	0	2	2	4	0	0	0	0
Battery	0	3	0	3	0	3	0	3	0	0	0	0
Scrap metal	0	2	1	3	0	2	1	3	0	0	0	0
Canteen	0	0	3	3	0	0	2	2	0	0	1	1
Kitchen	0	3	0	3	0	3	0	3	0	0	0	0
Soap dish	3	0	0	3	3	0	0	3	0	0	0	0
Jar	0	2	1	3	0	2	1	3	0	0	0	0
Washing machine	0	3	0	3	0	3	0	3	0	0	0	0
Hand wash basin	0	2	1	3	0	1	1	2	0	1	0	1
Banana plant	0	3	0	3	0	3	0	3	0	0	0	0
Duck pond	0	2	1	3	0	2	1	3	0	0	0	0
Iron wheel	0	3	0	3	0	3	0	3	0	0	0	0
Toilet seat	3	0	0	3	1	0	0	1	2	0	0	2
Tile	0	2	1	3	0	2	1	3	0	0	0	0
Pipe	0	3	0	3	0	3	0	3	0	0	0	0
Tray	0	1	1	2	0	0	1	1	0	1	0	1
Cask	0	1	1	2	0	1	1	2	0	0	0	0
Coconut	0	2	0	2	0	2	0	2	0	0	0	0
Pigsty floor	0	0	2	2	0	0	2	2	0	0	0	0
Kitchen sik	0	2	0	2	0	1	0	1	0	1	0	1
Water fountain	0	2	0	2	0	2	0	2	0	0	0	0
Drainage	0	1	1	2	0	0	1	1	0	1	0	1
Toilet bowl hole	2	0	0	2	1	0	0	1	1	0	0	1
Polyfoam	0	2	0	2	0	0	0	0	0	2	0	2
Seat coffe	0	0	2	2	0	0	2	2	0	0	0	0
Fish bowl	0	1	0	1	0	1	0	1	0	0	0	0
Sewage system	1	0	0	1	0	0	0	0	1	0	0	1
Block	0	1	0	1	0	1	0	1	0	0	0	0
Bullion	0	1	0	1	0	1	0	1	0	0	0	0
Metal box	0	0	1	1	0	0	0	0	0	0	1	1
Plastic box	0	1	0	1	0	1	0	1	0	0	0	0
Carburetor	0	1	0	1	0	0	0	0	0	1	0	1
Cup	0	0	1	1	0	0	0	0	0	0	1	1
Candy jar	0	1	0	1	0	1	0	1	0	0	0	0
Clay figure	0	1	0	1	0	1	0	1	0	0	0	0
Toy	1	0	0	1	1	0	0	1	0	0	0	0
Tarpaulin	0	1	0	1	0	0	0	0	0	1	0	1
Palm stalk	0	1	0	1	0	1	0	1	0	0	0	0
Crib	0	1	0	1	0	1	0	1	0	0	0	0
Watering can	0	1	0	1	0	1	0	1	0	0	0	0

Frying pan	0	1	0	1	0	1	0	1	0	0	0	0
Tank lid	1	0	0	1	1	0	0	1	0	0	0	0
Transformer	0	1	0	1	0	1	0	1	0	0	0	0
Tube	1	0	0	1	1	0	0	1	0	0	0	0
Glass	1	0	0	1	1	0	0	1	0	0	0	0

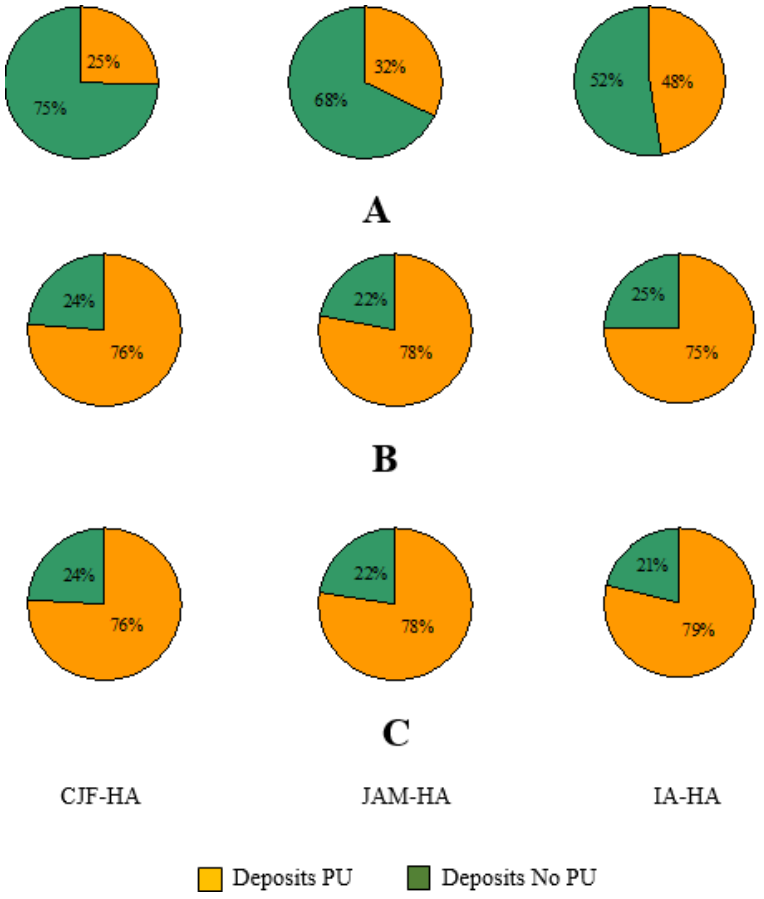

Fig 3: Entomological situation on the types of deposits colonized by *Aedes aegypti* during 2019. A) Percentage of representativeness of abundance by type of deposit. B) Percentage of representativeness of the total positive deposits. C) Percentage of representativeness of the total positive deposits outside the homes. Where: IA-HA: Ignacio Agramonte Health Area. CJF-HA: Carlos Juan Finlay Health Area. JAM-HA: Julio Antonio Mella Health Area.

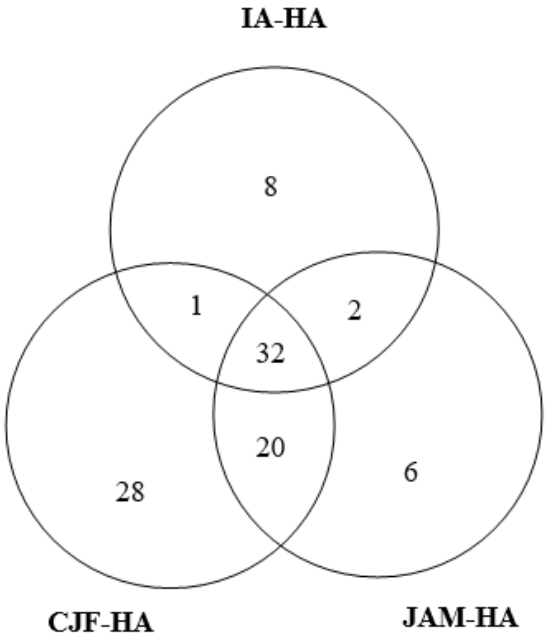

Fig 4: Inclusion Venn Diagram showing the total deposits shared among Health Areas in 2019. Where IA-HA: Ignacio Agramonte Health Area; CJF-HA: Carlos Juan Finlay Health Area and JAM-HA: Julio Antonio Mella Health Area

Fig 5: (see Table 1-3 and Table 5). Typical artificial clay deposits of the province of Camagüey, which are generally used to accumulate drinking water. A) Tinaja (also has extensive religious utility) and B) Tinajón.

4. Discussion

In light of the (re)emergence of vector-borne diseases, we face new challenges in the design and implementation of anti-vector programs. The current integrated fight within the "One Health" framework demands greater community and intersectoral involvement to ensure adequate surveillance and protection of "*priority deposits*," considering their utility and importance in meeting the urgent needs of the community in specific localities. Estimating the presence and abundance of immature states in anthropogenic containers is one of the priority tasks in the integrated management of aedes mosquitoes and the diseases they transmit [20]. In this regard, Fajardo *et al*. [21] highlighted the significance of such attention to reduce adverse effects associated with diseases transmitted by various arthropods. Additionally, there is a need to strengthen entomological surveillance to obtain updated data on the behavior of species under medical monitoring, which will facilitate an appropriate strategic design to act on the most productive breeding sites, ultimately defining control measures during outbreaks and epidemics.

The presence of *Ae. aegypti* was observed in a wide variety of containers, indicating that community actions have proven insufficient, allowing the mosquito to adapt successfully in urban environments subjected to significant disturbances. The epidemiological relevance of a deposit is related to its abundance and distribution within local households [22]. In our study, the most positive deposits were low tanks and barrels, with the former recognized as the "*key container*" in Cuba [22-25], which maintains the best productivity of *Ae. aegypti* pupae under cuban environmental conditions. However, other less useful deposits could become a serious problem if their presence increases significantly compared to low tanks, reporting higher pupal indices per unit space. This warrants deeper investigation to clarify each type of deposit's true contribution to mosquito population renewal and identify which deposit(s) can harbor a higher concentration of pupae as an indicator of "well-being" for the species. Larval sampling is useful for characterizing breeding site typology, while pupal sampling aids in developing productivity indices — both essential tasks for guiding control actions [26]. However, the relationship between larval indices and dengue prevalence is not linear due to viral transmission heterogeneity [27].

The presence of *Ae. aegypti* in eutrophic water deposits reaffirms concerning strategic changes that the species is adopting in Camagüey, a situation previously alerted in other studies on the island [15, 23]. This shift indicates adaptive skills typical of a species with a clear tendency towards "*r*" strategists [28], for which various control actions have been implemented, such as applying abate (granular Temefos) and brushing among other measures. Adulticide chemical applications have primarily targeted indoor environments, presumably encouraging females to move outside for oviposition. This could explain why most larval collections occur around residences, coinciding with our observations that this area sees less action from families in their weekly self-inspection known as "*family autofocal*" in Cuba. If this activity had been conducted, it would have prevented most positive deposits since they were accessible to families living in homes with this vector. Domestic sanitation of containers involves both governmental responsibilities (solid waste collection) and individual citizen duties.

Therefore, achieving adequate levels of community participation should be a primary objective for the *Ae. aegypti* control program [29]. This can be accomplished through physical measures with minimal economic expenditure for families if awareness increases regarding combating dengue/vector transmission requires both residential and state-level involvement. This necessitates developing an effective yet complex social communication strategy. In our context, other synanthropic mosquito species can develop in the same biotopes as *Ae. aegypti*, such as *Ae. albopictus*, *Ae. vittatus*, and *Culex* (Culex) *quinquefasciatus* — an important aspect to consider regarding their control management due to the pathogens they transmit [30, 31].

5. Conclusion

There is a wide variety of deposits colonized by *Ae. aegypti* outdoors, with PU predominating, particularly ground-level tank and barrels. The "*family autofocal*" approach can significantly contribute to reducing breeding sites in the studied areas.

6. Compliance with ethical standards

Transparency

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study, and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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8. Authors' Contributions
All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

9. Disclosure of conflict of interest
No concflict of interest exists among the Authors.

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