THE GENUS *MEPRAIA* MAZZA, GAJARDO & JÖRG (HEMIPTERA: REDUVIIDAE) IN CHILE: MORPHOLOGICAL, GENETICS AND ECOLOGICAL DIFFERENTIATION OF ITS SPECIES.

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INTRODUCTION

THE SPECIES OF GENUS *MEPRAIA* ARE BLOOD-SUCKING INSECTS, VECTORS OF THE PROTOZOAN *TRYPANOSOME CRUZ*I THAT CAUSE CHAGAS' DISEASE

THIS DISEASE WAS DESCRIBED IN 1909 BY THE BRAZILIAN MEDICAL CARLOS CHAGAS AND IS WIDELY DISTRIBUTED IN LATIN AMERICA WERE THERE ARE ABOUT 140 VECTORS AND ABOUT 12 MILLIONS PEOPLE INFECTED.

ACCORDING TO WHO THERE ARE SOME 2 MILLION WOMEN OF CHILDBEARING AGE INFECTED BY *T. CRUZI* IN LATIN AMERICA. THIS MEANS A MATERNAL-FETAL TRANSMISSION

THE PARASITE CAUSES DAMAGE OF THE HEART, ESOPHAGUS AND GASTROINTESTINAL TRACT

DR. CARLOS CHAGAS
1879 MINAS GERAIS –1934 RIO DE JANEIRO

DISCOVERER OF THE AMERICAN TRYPANOSOMIASIS,

ORIGINAL DRAWINGS ON *T.CRUZI*





GEOGRAPHICAL DISTRIBUTION OF CHAGAS ' DISEASE IN LATIN AMERICA



THE ANCESTOR OF *TRYPANOSOMA CRUZI* WAS PROBABLY INTRODUCED TO SOUTH AMERICAN VIA BATS APPROXIMATELY 7-10 MILLION YEARS AGO.

THE CHAGAS' DISEASE IN CHILE

CHAGAS DISEASE EXISTS IN CHILE ABOUT 9000 YEARS AGO. 41% OF THE REST OF HUMAN MUMMIES FROM THE COAST AND VALLEYS OF NORTHERN CHILE WERE POSITIVE BY PCR AND HYBRIDIZATION PROBES WITH KINETOPLAST DNA OF *TRYPANOSOMA CRUZI*

IN 1999 CHILE IT WAS DECLARED FREE OF VECTORIAL DISEASE OF THE CHAGAS DISEASE, BUT THERE ARE STILL WILD PLACES OF THE VECTORS

IN CHILE THERE ARE SOME 142 THOUSAND PEOPLE INFECTED AND MORE THAN 90% ARE ASYMPTOMATIC. WHICH MEANS CLOSE TO 1% OF PEOPLE ARE INFECTED

MUMMIES OF THE CHINCHORRO CULTURE THEY ARE THE OLDEST IN THE WORLD (9000 YEARS OLD).



MUSEUM OF SAN MIGUEL OF AZAPA, NORTH OF CHILE

THE VECTORS OF CHAGAS' DISEASE IN CHILE

IN CHILE THERE ARE FOUR VECTORS OF CHAGAS' DISEASE: *TRIATOMA INFESTANS, MEPRAIA SPINOLAI, M. GAJARDOI* AND *M.PARAPATRICA*

TRIATOMA INFESTANS





MEPRAIA GAJARDOI





MEPRAIA PARAPATRICA





THE GENES FOR
WING
ARE LIKAGED TO Y
CHROMOSOME



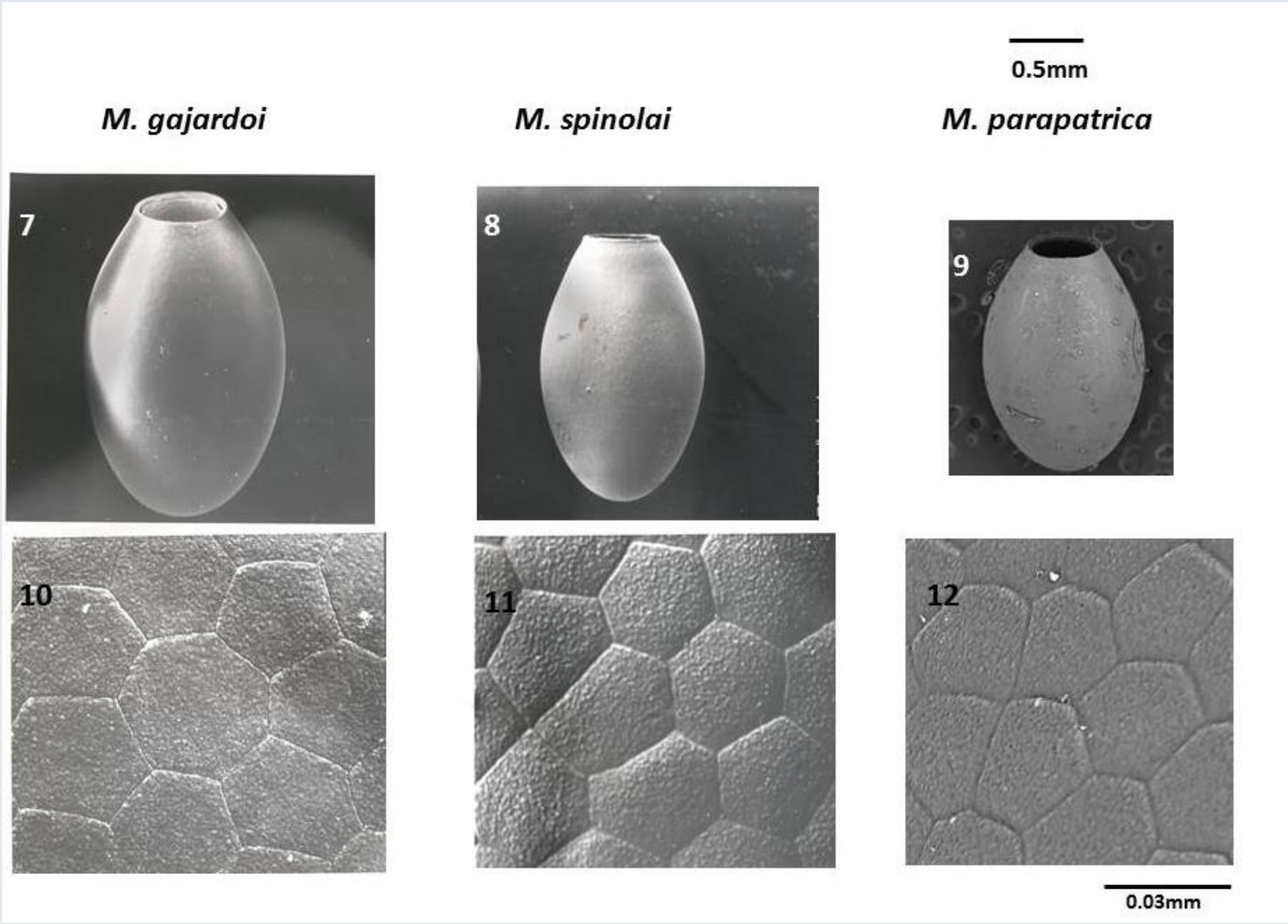




MEPRAIA SPINOLAI

THE WINGLESS CONDITION IS A NEOTENY

MORPHOLOGICAL DIFFERENCES BETWEEN EGGS OF SPECIES OF GENUS *MEPRAIA*



GEOGRAPHICAL DISTRIBUTION OF *M.GAJARDOI, M.PARAPATRICA* AND *M.SPINOLAI*





M.GAJARDOI





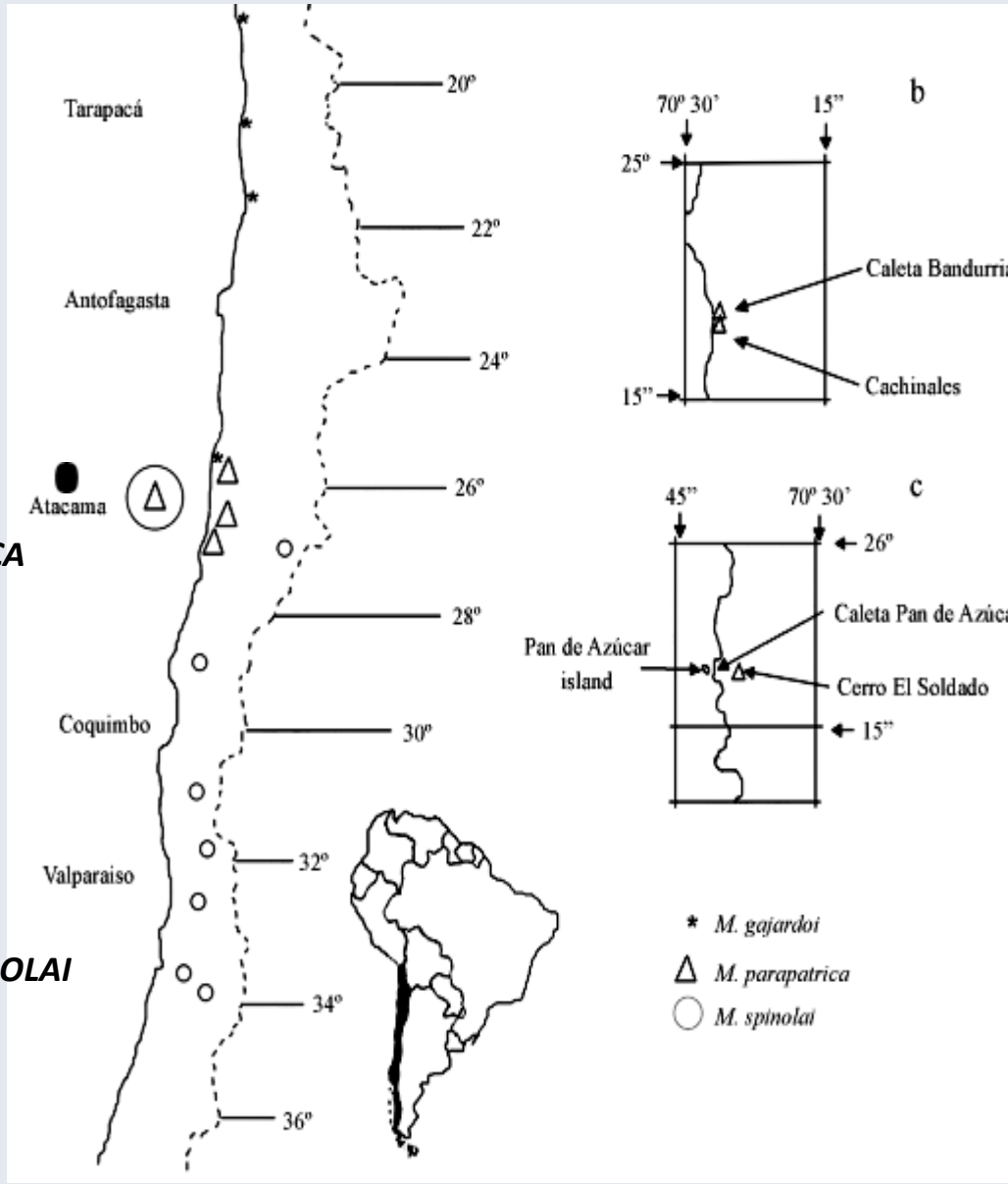
M. PARAPATRICA







M. SPINOLAI



RESULTS OF EXPERIMENTAL CROSSES IN *MEPRAIA SPINOLAI*

THE GENES FOR TORAX AND WING DEVELOPMET ARE LINKED TO Y CHROMOSOME.

FEMALES AND MALES WINGLESS ARE NEOTENICS

RECIPROCAL CROSSES GIVE DIFFERENTS RESULTS

P



F1

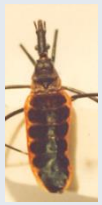


WINGED OR WINGLESS MALES

P



F1



ONLY WINGLESS MALES

THE *MEPRAIA* SPECIES SHOW A CLINAL MODEL OF GEOGRAPHICAL DISTRIBUTION. THIS SUGGESTED PARAPATRIC SPECIATION

PLEISTOCENE

OLDEST SPECIES

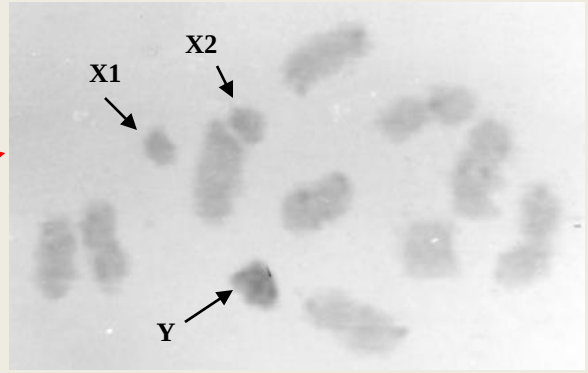
PACIFIC OCEAN

MEPRAIA GAJARDOI

WINGLESS FEMALES

AND

BRACHYPTEROUS MALES



2N = 20+ X1 X2 Y

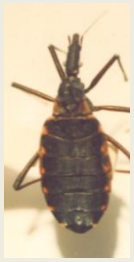
HETEROCHROMATINISATION

ASSOCIATED TO SEABIRDS AND LIZARDS

MEPRAIA PARAPATRICA

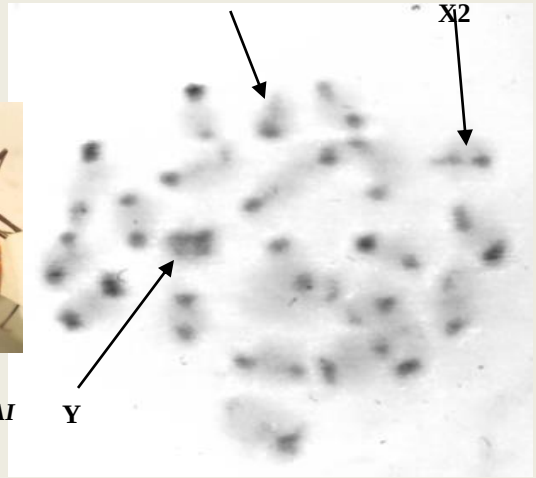
WINGLESS FEMALES

BRACHYPTEROUS AND MACROPTEROUS MALES





M.PARAPATRICA *M. SPINOLAI*



2N = 20+ X1 X2 Y

DISCUSIÓN Y CONCLUSIONES

LATE PLESITOCENE

MEPRAIA GAJARDOI



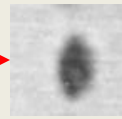
PAN DE AZUCAR ISLAND

MEPRAIA PARAPATRICA

MEPRAIA PARAPATRICA

PACIFIC OCEAN

TRANSLOCATION= BREAK OF Y CHROMOSOME

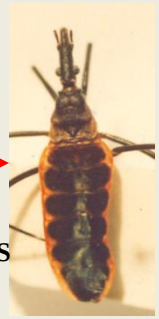


NEO Y

Y1 **Y2**

MEPRAIA SPINOLAI
INVADES OTHER TROPHIC NICHES
IN THE VALLEY OF THE REGIONS III, IV, V AND METROLITANA

APO0MORPHY



2N = 20+ X1 X2 Y1 Y2

WINGLESS MALES IS A DIAGNOSIS CHARÁCTER FOR *M. SPINOLAI*

HOW *M.SPINOLAI* DISTRIBUTED IN DOMESTIC, PERIDOMESTIC AND WILD ENVIRONMENT ??







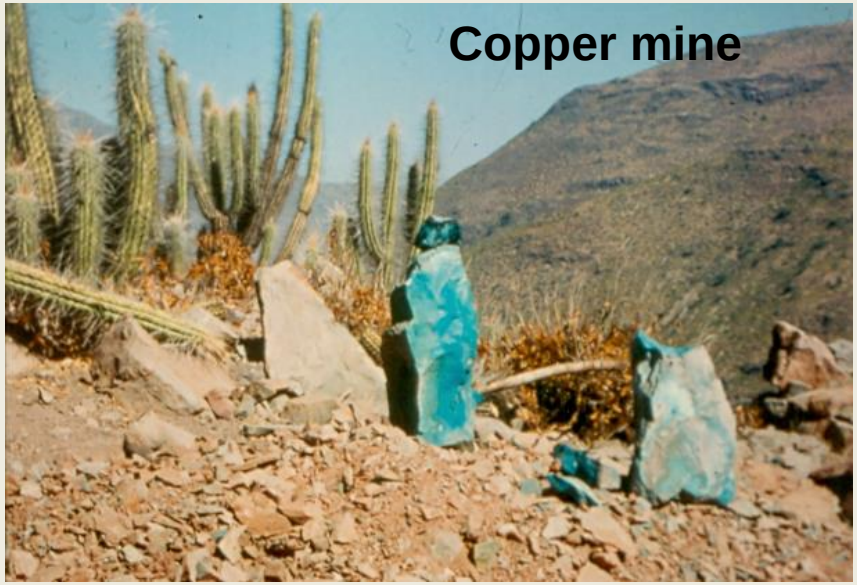


FIGURE 1. NUMBER OF WINGLED AND WINGLESS MALES AND FEMALES OF *MEPRAIA SPINOLAI* FROM , COLLECTED IN WILD AND PERIDOMESTIC ENVIRONMENT (1994 TO 2015) (N = 394)

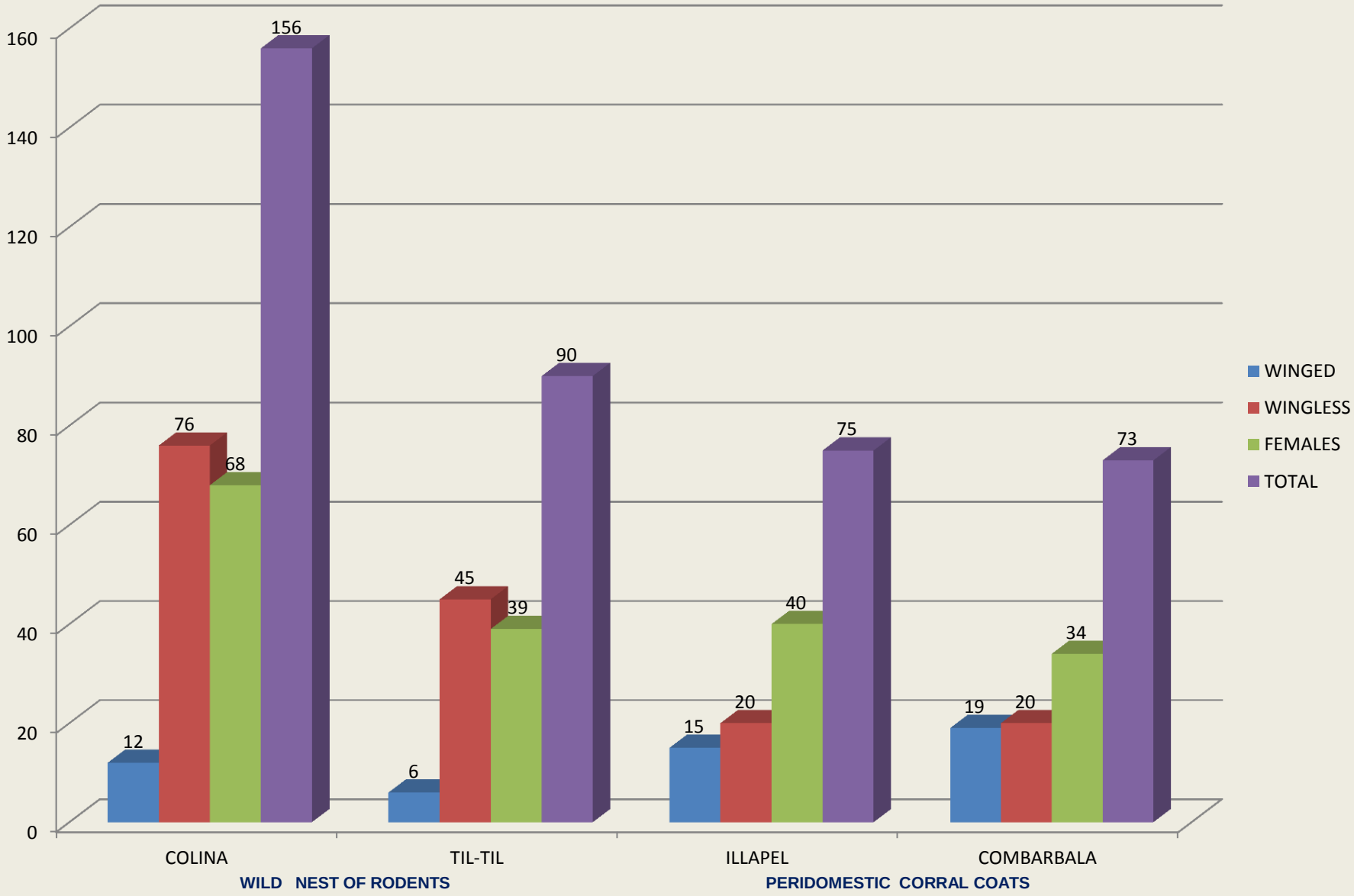


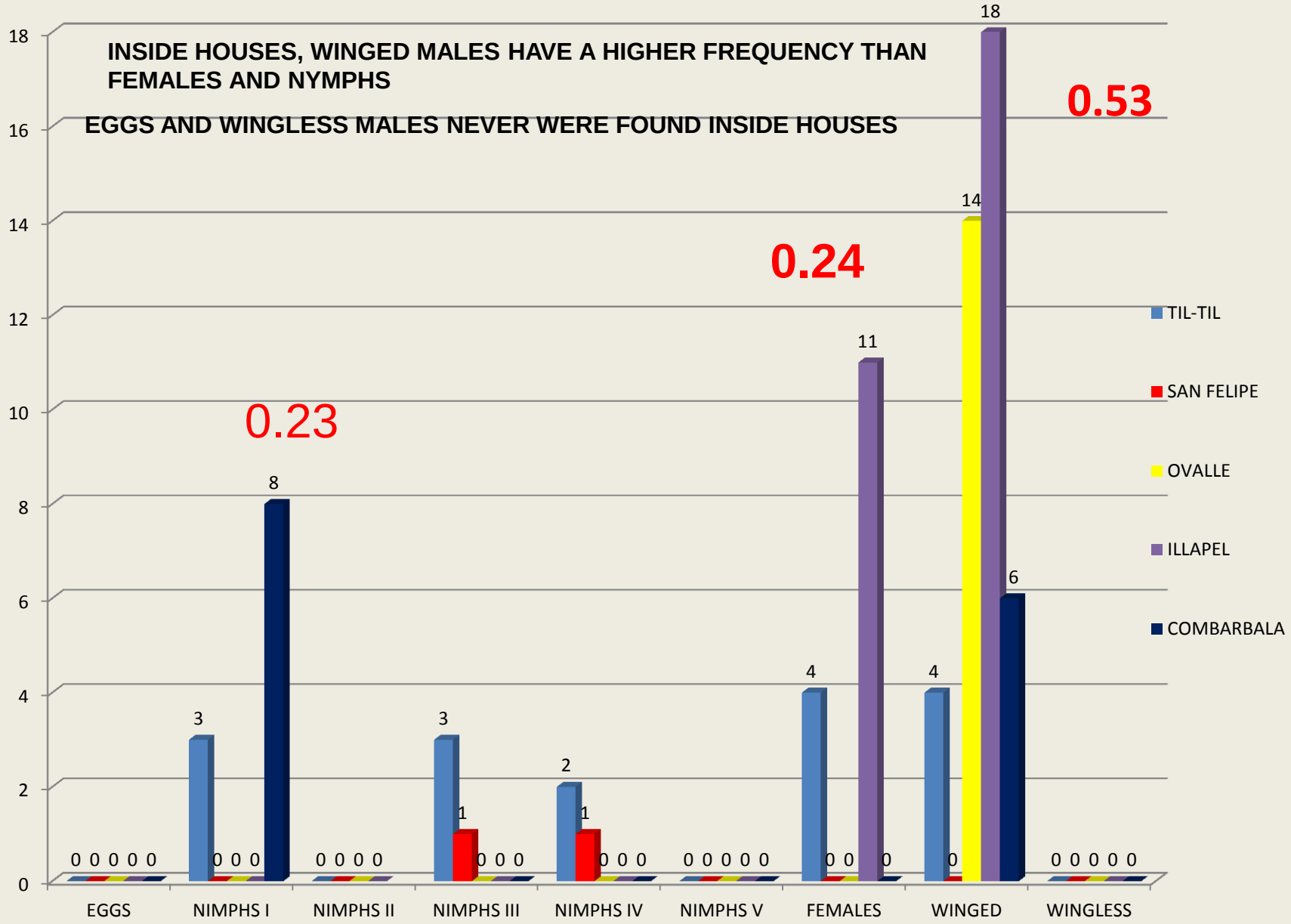
TABLE 1. COMPARISON BY X^2 TEST BETWEEN PROPORTIONS OF WINGED AND WINGLESS MALES IN *M.SPINOLAI* IN WILD AND PERIDOMESTIC POPULATIONS

LOCALITIES AND ENVIRONMENTS	PROPORTION OF WINGED MALES	PROPORTION OF WINGLESS MALES	X2 P
COLINA (WILD)	14	86	0.177 > 0.67
TIL_TIL (WILD)	12	88	
ILLAPEL (PERIDOMESTIC)	43	57	0.724 > 0.39
COMBARBALA (PERIDOMESTIC)	49	51	

TABLE 2. COMPARISON BY X^2 TEST BETWEEN THE PROPORTION OF MALES (WINGED + WINGLESS) AND FEMALES IN WILD AND PERIDOMESTIC POPULATIONS

LOCALITIES AND ENVIRONMENTS	PROPORTION OF MALES WINGED + WINGLESS	PROPORTION OF FEMALES	X2	P
COLINA (WILD)	56	44	0.020	> 0.88
TIL_TIL (WILD)	57	43		
ILLAPEL (PERIDOMESTIC)	47	53	0.720	> 0.39
COMBARBALA (PERIDOMESTIC)	53	47		

FIGURE 3. LIFE CYCLE STAGES OF *M. SPINOLAI* INSIDE DOMESTIC ENVIRONMENT (RURAL HOUSES) IN LOCALITIES OF NORTH AND METROPOLITAN REGION OF CHILE (N= 79)



EGG OF *M.SPINOLAI* COLLECTED NEAR OF THE BURROW OF THE SMALL RODENT *OCTODON DEGUS*



THE EGGS NEVER WERE COLLECTED INSIDE HOUSES

FIGURE 2. INFECTION OF *M.SPINOLA*I AND *M.GAJARDO*I BY *T. CRUZI* IN WILD AND PERIDOMESTIC ENVIRONMENT (1994 TO 1998)

IN WILD ENVIRONMENTS *M. SPINOLAI* IS MORE INFECTED BY *T. CRUZI* THAN IN PERIDOMESTIC AREAS

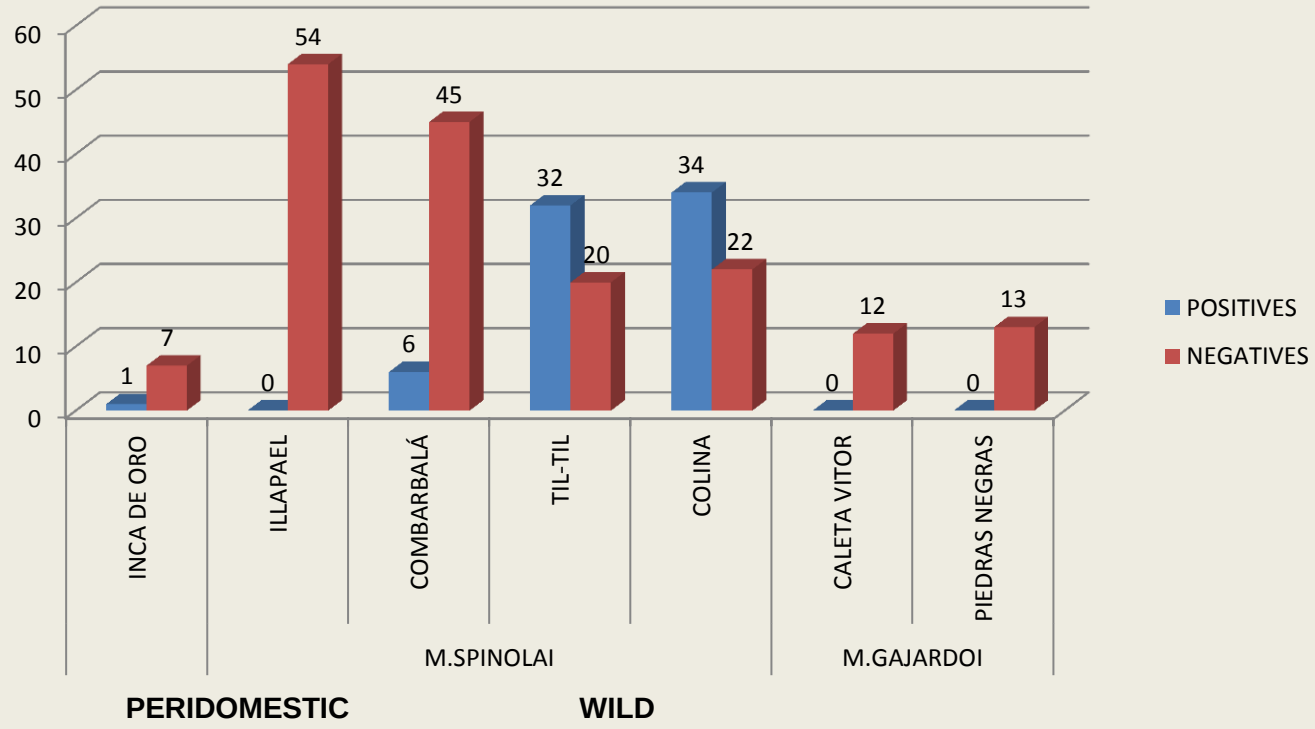


FIGURE 5. NUMBER OF INDIVIDUALS OF *M. SPINOLAI* INFECTED (POSITIVES) AND UNINFECTED (NEGATIVES) WITH *TRYPANOSOMA CRUZI* , COLLECTED IN DOMESTIC, PERIDOMESTIC AND WILD ENVIRONMENT FROM ATACAMA TO METROPOLITANA REGION BETWEEN 2012 TO 2014 YEARS IN CHILE (N = 673)

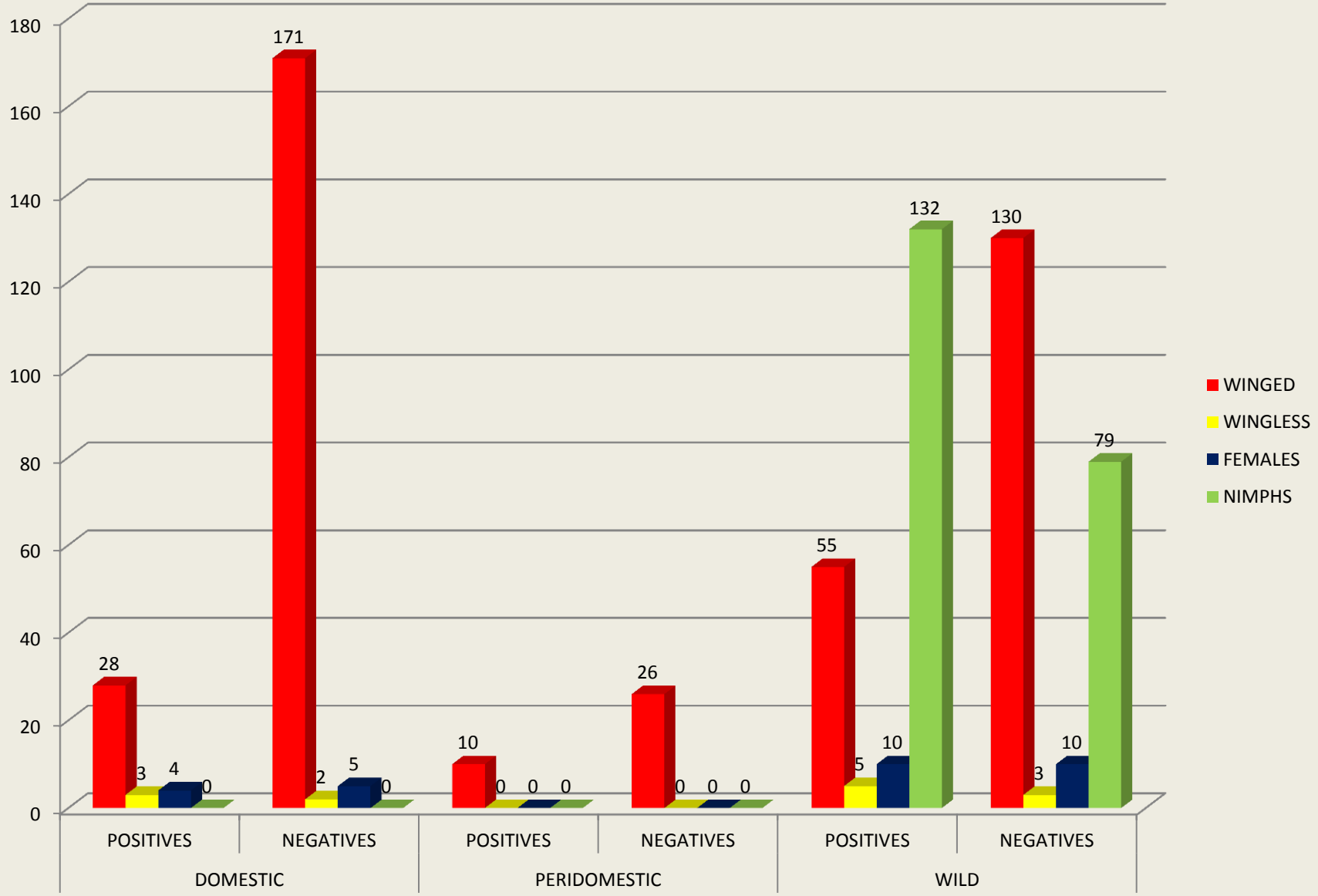


TABLE 4. COMPARISON BY X^2 TEST BETWEEN THE PROPORTION OF POSITIVES AND NEGATIVES WINGED MALES IN DOMESTIC, PERIDOMESTIC AND WILD POPULATIONS

LOCALITIES AND ENVIRONMENTS	PROPORTION OF POSITIVES WINGED MALES	PROPORTION OF NEGATIVES WINGED MALES	X2	P
DOMESTIC	14	86	5.90	<0.015
PERIDOMESTIC	28	72		
DOMESTIC	14	86	7.45	<0.006
WILD	30	70		
PERIDOMESTIC	28	72	0.09	> 0.755
WILD	30	70		

TABLE 5. COMPARISON BY X^2 TEST BETWEEN THE PROPORTION OF ABUNDANCE OF MALES (WINGED + WINGLESS) AND FEMALES IN WILD AND PERIDOMESTIC POPULATIONS

LOCALITIES AND ENVIRONMENTS	PROPORTION OF MALES WINGED + WINGLESS	PROPORTION OF FEMALES	X2	P
COLINA (WILD)	56	44	0.020	> 0.88
TIL_TIL (WILD)	57	43		
ILLAPEL (PERIDOMESTIC)	47	53	0.720	> 0.39
COMBARBALA (PERIDOMESTIC)	53	47		

CONCLUSIONS

THE WINGLESS MALES ARE MORE FREQUENT IN WILD POPULATIONS THAT IN DOMESTIC AND PERIDOMESTIC ENVIRONMENT

INSIDE HOUSES, WINGED MALES ARE SIGNIFICANTLY MORE FREQUENT THAT WINGLESS MALES, FEMALES AND NIMPHS.

EGGS WAS FOUND ONLY IN WILD POPULATIONS. THIS SUGGEST THAT THE REPRODUCTION OF *M.SPINOLA*I OCCUR PREFERABLY IN WILD CONDITIONS.

THE PRINCIPAL INVASOR TOWARDS DOMESTIC ENVIRONMENT ARE THE WINGED MALES. THIS FACT SUGGEST THAT THEY ARE THE DISPERSIVE FORM OF THIS SPECIE, SIMILAR TO THE OTHER SPECIES OF INSECTS WITH WINGED AND WINGLESS

FEEDING DEPRIBATION COULD EXPLAIN THE LOW INFESTATION OF WINGED MALES COLLECTED INSIDE HOUSES IN COMPARATION WITH THESE WINGED MALES IN WILD HABITAT

IN INSECTS IT HAS BEEN POSTULATED AN ECO-GEOGRAPHICAL THEORY OF THERMOREGULATION. ACCORDING TO THIS THEORY THE INSECTS WITH LONGER WINGS WOULD BE DISTRIBUTED IN COLDER CLIMATES. THOSE WITHOUT WINGS OR VERY SHORT WINGS, COULD BE ADAPTED BETTER IN WARMER CLIMATES

IN BASE TO THE HYPOTHESIS, THE WING OF WINGED MALES OF *M.SPINOLAI* COULD CAUSE A GREENHOUSE EFFECT AND HEAT WOULD ACCUMULATE IN THEIR BODY AND THEY WOULD SEEK REFUGE INSIDE THE HOUSES WHERE THERE ARE A MOST NICE ENVIRONMENT. CONVERSELY WINGLESS MALES DISPERSE THE HEAT BODY MORE EASILY AND THEY WOULD BE BETTER ADAPTED TO THE WILD HOT AREAS

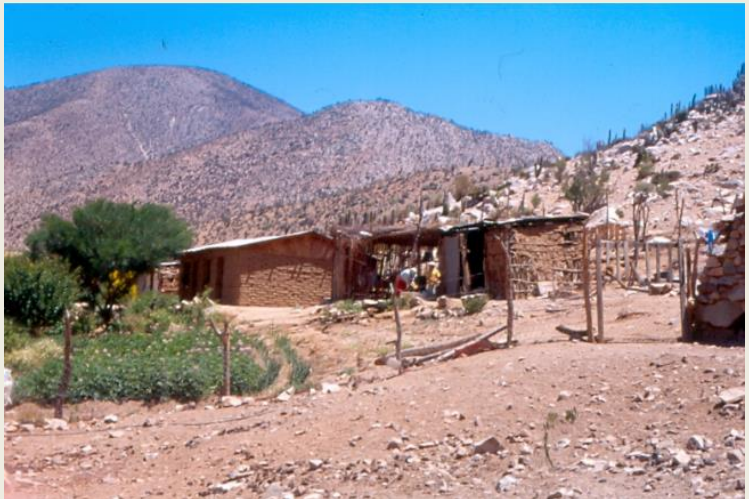
THIS IS WHAT WE CALL "REFUGE THEORY"

THEN IN *M.SPINOLAI* WOULD BE A DISRUPTIVE SELECION

DISRRUPTIVE SELECTION IN *MEPRAIA SPINOLAI ?*



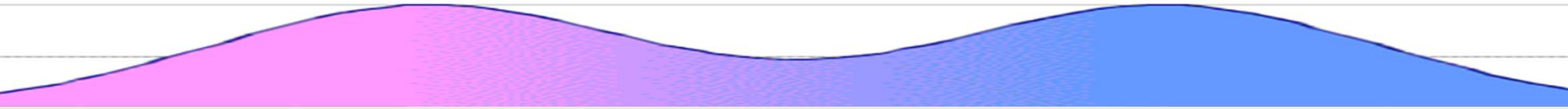

DOMESTIC AND PERIDOMESTIC ENVIRONMENT






WILD ENVIRONMENT





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THANK VERY MUCH FOR YOUR ATTENTION