

SEASONAL DISTRIBUTION AND SEX RATIO OF FIVE NOCTUID SPECIES (INSECTA, LEPIDOPTERA) CAPTURED IN BLACKLIGHT TRAPS ON SÃO MIGUEL - AZORES

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With 5 figures and 1 table

ABSTRACT. The adult flight periods of *Agrotis ipsilon* (HÜFNAGEL), *Agrotis segetum* (DENNIS & SCHIFERMÜLLER), *Noctua pronuba* LINNAEUS, *Peridroma saucia* (HÜBNER) and *Xestia c-nigrum* (LINNAEUS) (Lepidoptera, Noctuidae) were studied between July of 1988 and December of 1989, at Ribeira Grande, Arribanas and Lagoa do Congro on the island of São Miguel, using Pennsylvania blacklight traps. While there was evidence of considerable fluctuations in density, *A. ipsilon*, *A. segetum*, *P. saucia* and *X. c-nigrum* were present continuously at the three locations. In contrast *N. pronuba* was only captured between July and September. For any given species both sexes were captured simultaneously. In *X. c-nigrum* males were more frequent than females while in the other species females were more abundant. However, in no case does the *sex-ratio* deviate intirely from 1:1.

INTRODUCTION

The Archipelago of Azores, located in the Atlantic ocean between 36°55'43" and 39°43'23" of North latitude and between 24°46'15" and 31°16'24" of West longitude, presents climatic conditions prosperous to the development of many Lepidopterous (about 162, VIEIRA & PINTUREAU, 1993), including some species of Noctuidae that are considered as agricultural pests (TAVARES, 1989). The adults of this family present great mobility, and the larvae of many species are polyphagous. The migrant character of certain noxious species stresses the need of a warning system that allows to forecast their outbreaks. For what, among other techniques, light traps are used.

The adult dynamics of *A. ipsilon*, *A. segetum*, *N. pronuba*, *P. saucia* and *X. c-nigrum* was studied between July 1988 and December 1989 by placing pennsylvania light traps at

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three locations in São Miguel island (Ribeira Grande, Arribanas and Lagoa do Congro).

In order to evaluate the potential impact of these species on the regional agrosystem, a list of their host plants is also presented. The present work is a small contribution to a more global project: biological control program.

MATERIAL AND METHODS

The adult population dynamics of *A. ipsilon*, *A. segetum*, *N. pronuba*, *P. saucia* and *X. c-nigrum* was studied from July 1988 to December 1989 (i.e. 76 weeks), using pennsylvania light traps placed at three locations in São Miguel island: Ribeira Grande (altitude 100 m, coast North), Arribanas (250 m, interior South-Southwest) and Lagoa do Congro (550 m, interior South-Southeast).

Each light trap, equipped with a TLD 18W lightbulb, was installed at the edge of a permanent pasture gramineae field, lifted a meter from the ground. The captured specimens would fall into a container with formol at 5%, to preserve the material. Adults were collected from trap-containers once a week. The biological material was washed, and the species of each adult determined. Records were made of species name, sex and date of capture for each specimen.

The number of captured adults per week for each species and location was determined, the sex-ratio was computed per week, and all the female and male percentages were transformed by the arc-sin function, before applying a two factor analysis of variance.

Also, a bibliographic survey of the host plants of each studied Lepidoptera was undertaken.

RESULTS AND DISCUSSION

Agrotis ipsilon

The total number of *A. ipsilon* adults captured in the light traps (Fig. 1) was relatively low (40 adults at Ribeira Grande, 140 at Arribanas and 209 at Lagoa do Congro). Whatever the location, the species were present all over the year, but the captures reached their maximum in August 1989 at Lagoa do Congro, December 1988 at Arribanas and March 1989 at Ribeira Grande.

The low captures obtained might be related to the type of trap, since sex traps usually capture more than light traps (CAUSSE *et al.*, 1989; VIEIRA *et al.*, 1990). On the other hand, the existence of a peak on the first week of August 1989, at Lagoa do Congro, contrasts with what happened at Ribeira Grande (absence of captures, Fig. 1), suggesting migratory movements of the adults, what agrees with the migrant character of this species (WILSON *et al.*, 1981; CAUSSE *et al.*, 1989).

The sex-ratio was favourable to females for Arribanas (52.9%) and Ribeira Grande (66.7%), while for Lagoa do Congro we had a sex-ratio of 1:1.

The two factor analysis of variance (capture places and number of males and females) showed no significant differences between capture places ($F = 1.60$, $p = 0.209$) or between the sexes ($F = 2.1 \times 10^{-5}$, $p = 0.996$). Also, the interaction between both factors is not significant ($F = 0.0087$, $p = 0.991$).

The analysis of Table 1 shows that *A. ipsilon* is markedly polyphagic, being able to attack many of the implanted cultures in the region (VIEIRA et al, 1990), namely horticulture, industrial, flower and cereal crops, as well as weeds.

Agrotis segetum

The total number of *A. segetum* adults captured in light traps (Fig. 2) was low (42 adults at Ribeira Grande, 23 at Arribanas and 3 at Lagoa do Congro). This species was more abundant in May and from August to November, in areas at low altitude (Ribeira Grande); it was present throughout the year, except from March until to August, in medium altitude areas (Arribanas); and it appeared sporadically in March and November at the higher location (Lagoa do Congro). The captures reached a maximum of 10 adults at Ribeira Grande in August 1988.

The sex-ratio was favourable to the females at Ribeira Grande (57.1%) and Lagoa do Congro (100%), while at Arribanas it was so for the males (73.9%).

Since *A. segetum* is considered a sedentary species (POITOUT & BUES, 1976), this sex-ratio variation might be related to the low number of insects captured at the higher zone, which probably results from less favourable abiotic conditions for insect development.

Statistically, the two factor analysis of variance (capture places and number of males and females) shows significant differences between capture places ($F = 4.9$, $p = 0.0082$), mainly between Ribeira Grande and Lagoa do Congro ($p < 0.05$), but doesn't show significant differences between the captured sexes ($F = 0.014$, $p = 0.905$). Also, the interaction between both factors is not significant ($F = 1$, $p = 0.355$).

The analysis of Table 1 shows that *A. segetum* is a noxious species to a great number of cultures and weeds, except for flowers and garden plants.

Noctua pronuba

The total number of *N. pronuba* adults captured in the light traps (Fig. 3) was 158 at Ribeira Grande, 1895 at Arribanas and 5873 at Lagoa do Congro. This species was observed mainly in the second semester of 1988 and 1989, with a maximum of captures in the Summer months (between July and September), rising with the altitude.

The sex-ratio was favourable to females in all the studied locations (Ribeira Grande 55.1%, Arribanas 57.3% and Lagoa do Congro 57.4%).

Indeed, the two factor analysis of variance (capture places and number of males and

females) shows significant differences between capture places ($F = 9.5$, $p = 8.93 \times 10^{-5}$), specifically between Lagoa do Congro and those of Ribeira Grande and Arribanas ($p < 0.05$), but doesn't do so between both sexes ($F = 0.035$, $p = 0.852$). The interaction between both factors is not significant ($F = 0.044$, $p = 0.957$), also.

N. pronuba attacks many plants, mainly from the area of horticulture and weeds (Table 1).

Peridroma saucia

The presence of *P. saucia* was nearly constant in the three locations (Fig. 4), with a total of 191 adults captured at Ribeira Grande, 203 at Arribanas and 599 at Lagoa do Congro. The maximum of captures was 334 adults, registered in August 1989 at Lagoa do Congro, which at the other two locations is limited to some individuals.

Regarding the species as a migrant (POITOUT & BUES, 1976), this peak can be related to the capture of adults arriving from other locations, eventually of lower altitudes, and normally with higher temperature.

The sex-ratio was favourable to females in all the studied locations (Ribeira Grande 69.6%, Arribanas 71.4% and Lagoa do Congro 52.4%).

A two factor analysis of variance (capture places and number of males and females) shows no significant differences between capture places ($F = 2.2$, $p = 0.113$) or between sexes ($F = 0.45$, $p = 0.504$). Also, the interaction between both factors is not significant ($F = 0.035$, $p = 0.965$).

When compared with the other studied Lepidoptera, *P. saucia* shows less host plants, but can affect crops from different areas, except in forestry, flower crops and garden plants (Table 1).

Xestia c-nigrum

The total number of *X. c-nigrum* adults captured in the light traps (Fig. 5) was 951 at Ribeira Grande, 3079 at Arribanas and 4834 at lagoa do Congro. The species was nearly allways present at the three locations, with the maximum of 1958 captures at Lagoa do Congro, during the Summer months, more pronounced at the higher altitude location.

The sex-ratio was favourable to males in all the studied locations (Ribeira Grande 63.4%, Arribanas 64.8% and Lagoa do Congro 58.6%).

Indeed, the two factor analysis of variance (capture places and number of males and females) shows significant differences between the capture places ($F = 4.3$, $p = 0.014$), between the locations of Lagoa do Congro and Ribeira Grande ($p < 0.05$), but the same doesn't happen between both sexes ($F = 1.6$, $p = 0.107$). The interaction between both factors is not significant ($F = 0.15$, $p = 0.857$), also.

In the Azores, *X. c-nigrum* feeds on a great variety of cultivated plants, except for those in the area of forestry (Table 1).

CONCLUSION

The preliminary results obtained don't allow a connection between the voltinism of each species. While there was evidence of considerable fluctuations in density, *A. ipsilon*, *A. segetum*, *P. saucia* and *X. c-nigrum* were present continuously at the three locations. In contrast *N. pronuba* was only captured between July and September.

For any given species both sexes were captured simultaneously. In *X. c-nigrum* males were more frequent than females while in the other species females were more abundant. However, in no case does the sex-ratio deviates significantly from 1:1.

The studies related with adult population dynamics should be continued, and if possible widened to other islands of the Archipelago. In parallel, there is a need for more research on larval population dynamics and hibernation, as well as on the phenomena of migration or sedentarism, in order to have a better knowledge about the biological cycle of those species.

All the cited species are polyphagous, attacking many crops from the region, but not reaching critical economic levels.

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TABLE 1- Plants attacked by *Agrotis ipsilon*, *A. segetum*, *N. pronuba*, *P. saucia* and *X. c-nigrum* (PALHINHA, 1966; BALACHOWSKY, 1972; HEATH & EMMETT, 1979; PARELLADA, 1980; CARVALHO, 1981; CALLE, 1982; CARNEIRO, 1982; AIZPURUA, 1985; IPPOLITO & PARENZAU, 1985; HILL, 1987; CARTER & HARGREAVES, 1988; HACHLER, 1988; SILVA, 1992). (*) appeared in many species of this taxon; (+) crops practised in the region for economic interest or tradition; (#) crops not practised in the region.

Culture Area / Host Plant	<i>A. ipsilon</i>	<i>A. segetum</i>	<i>N. pronuba</i>	<i>P. saucia</i>	<i>X. c-nigrum</i>
Horticulture					
# pumpkin - <i>Cucurbita</i> sp.	X	X	X		
# artichoke - <i>Cynara scolymus</i> L.				X	
+ lettuce - <i>Lactuca sativa</i> L.	X	X	X	X	
# bamboo - <i>Bambusa</i> sp. (vars o cvs)	X	X	X		
+ potato - <i>Solanum tuberosum</i> L.	X	X	X		X
+ onion - <i>Allium cepa</i> L.	X	X	X		X
+ carrot - <i>Datura stramonium</i> L.	X	X	X		
+ kale - <i>Brassica oleracea</i> L. (vars o cvs)	X			X	X
# parsnip - <i>Pastinaca sativa</i> L.	X	X	X		
# asparagus - <i>Asparagus</i> sp. (vars o cvs)	X	X	X	X	
# spinach - <i>Spinacia oleracea</i> L.	X	X	X		
# chick pea - <i>Cicer arietinum</i> L.	X	X	X		
+ watermelon - <i>Citrullus lanatus</i> Mansf.	X	X	X		
+ melon - <i>Cucumis melo</i> L.	X	X	X		
+ strawberry - <i>Fragaria chiloensis</i> L.	X	X	X		
# mustard - <i>Sinapis alba</i> L.					X
+ turnip - <i>Brassica napus</i> L. (vars o cvs)	X	X	X		X
+ cucumber - <i>Cucumis sativus</i> L.	X	X	X		
# rape - <i>Brassica rapa</i> L.	X	X	X		
# soya bean - <i>Glycine max</i> L.	X	X	X		
+ tomatoe - <i>Lycopersicon esculentum</i> Mill.	X	X	X	X	X
# - <i>Lafat cylindrica</i> Roem.	X	X	X		
Industrial crops					
# cotton - <i>Gossypium</i> sp.	X	X			X
+ sugar beet - <i>Beta vulgaris</i> L.	X	X	X		X
+ coffee - <i>Coffea arabica</i> L.	X	X			
+ tea - <i>Thea sinensis</i> L.	X	X			
+ chicory - <i>Cichorium intybus</i> L.		X		X	
# linen - <i>Linum catharticum</i> L.					X
# hop - <i>Humulus lupulus</i> L.	X		X		
+ tobacco - <i>Nicotiana glauca</i> L.	X	X	X		X
# sesam - <i>Sesamum indicum</i> L.		X			
Fruit crops					
# vine - <i>Vitis</i> sp. (sps, vars o cvs)		X	X	X	X
# red currant - <i>Ribes spicatum</i> Robs.				X	X
# some young fruit plants		X		X	
Forestry					
# castor bean - <i>Ricinus communis</i> L.		X			
+ pine - <i>Pinus</i> sp.		X			
+ wattle - <i>Acacia</i> sp.		X			
Flower crops					
# sunflower - <i>Helianthus annuus</i> L.	X				
* <i>Betula</i> sp.; * <i>Buddleia</i> sp.; * <i>Ranunculus</i> sp.			X		
* <i>Valerian</i> sp.; * <i>Viola</i> sp.			X		
* in many ornamental and gardens					X
Cereal crops					
# rice - <i>Oryza sativa</i> L.	X				X
# oats - <i>Avena sativa</i> L.	X				
# rye - <i>Secale cereale</i> L.		X			
+ barley - <i>Hordeum vulgare</i> L.					X
+ corn - <i>Zea mays</i> L.	X	X			X
+ wheat - <i>Triticum aestivum</i> L.	X	X			X
+ sorgho - <i>Sorghum intrans</i> L.	X	X			
* in various Gramineae			X	X	
Pastures and Forrages					
# colza - <i>Brassica napus</i> L. var. <i>napus</i>		X			
+ alfalfa - <i>Medicago sativa</i> L.		X			X
+ Forrage oem - <i>Zea mays</i> L.		X			
+ clovers - <i>Trifolium</i> sp. (sps, vars o cvs)		X			X
* in a big variety of Poaceae and Fabaceae			X	X	X
Weeds					
* <i>Amaranthus</i> sp.; * <i>Achillea</i> sp.;	X	X			
* <i>Arcythum</i> sp.; * <i>Artemisa</i> sp.;		X			X
* <i>Asclepias</i> sp.; * <i>Atriplex</i> sp.;	X	X			
* <i>Barbarea</i> sp.; * <i>Betula pumilifera</i> L.;	X		X		
* <i>Carduus</i> sp.; * <i>Chenopodium</i> sp.;	X	X			
* <i>Cirsium</i> sp.; * <i>Convolvulus</i> sp.;		X			
* <i>Cynodon</i> sp.; * <i>Dactylis glomerata</i> L.;			X		
* <i>Datura</i> sp.; * <i>Digitaria</i> sp.;	X		X		
* <i>Epidium</i> sp.; * <i>Erodium</i> sp.;		X			X
* <i>Leontodon</i> sp.; * <i>Lineria</i> sp.;		X			
* <i>Malva</i> sp.; * <i>Paspalum</i> sp.;	X	X			
* <i>Passiflora</i> sp.; * <i>Plantago</i> sp.;		X	X	X	X
* <i>Polygonum</i> sp.; * <i>Potentilla reptans</i> L.;		X			
* <i>Primula</i> sp.; * <i>Rhinanthus</i> sp.;		X			
* <i>Rumex</i> sp.; * <i>Sida</i> sp.;		X		X	X
* <i>Senecio vulgaris</i> L.; * <i>Sinapis</i> sp.;		X	X		
* <i>Sonchus</i> sp.; * <i>Stellaria media</i> L.;		X	X		X
* <i>Taraxacum</i> sp.; * <i>Vaccinium myrtillus</i> L.;	X		X		X
* <i>Verbascum</i> sp.					X

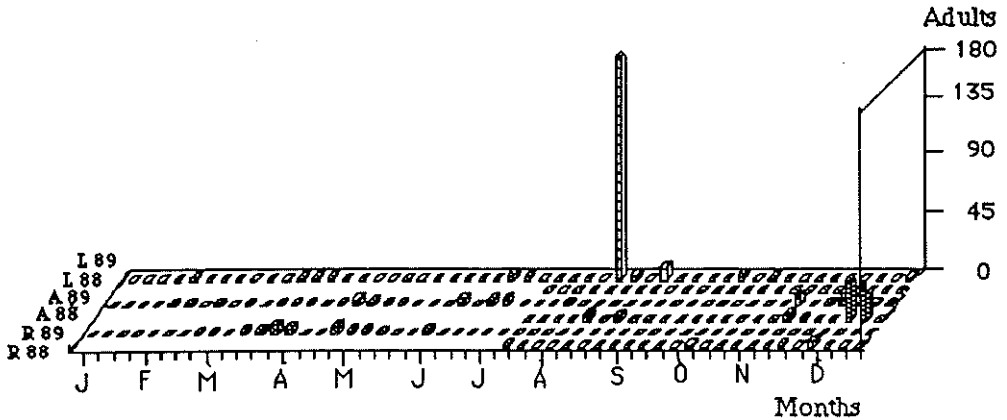


Figure 1- Number of *A. ipsilon* adults captured weekly, at Ribeira Grande (R), Arribanas (A) and Lagoa do Congro (L), from July 1988 to December 1989.

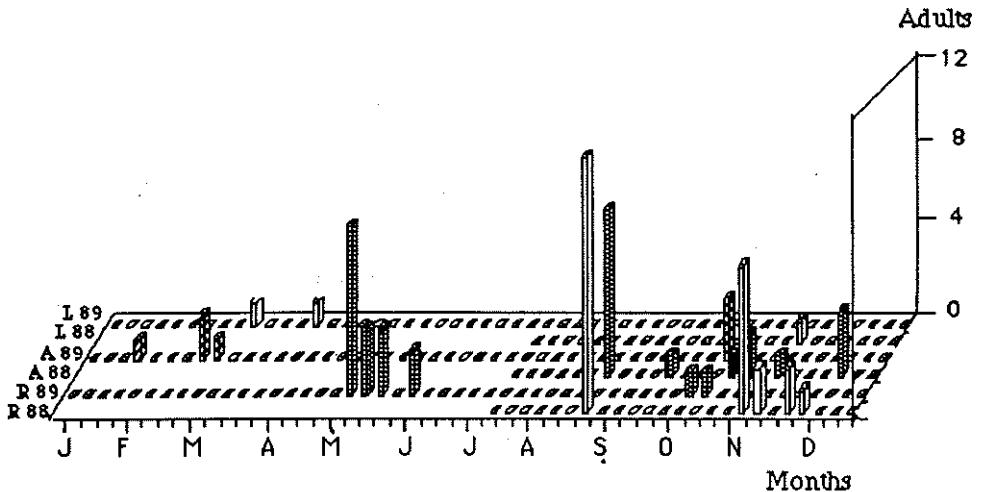


Figure 2- Number of *A. segtum* adults captured weekly, at Ribeira Grande (R), Arribanas (A) and Lagoa do Congro (L), from July 1988 to December 1989.

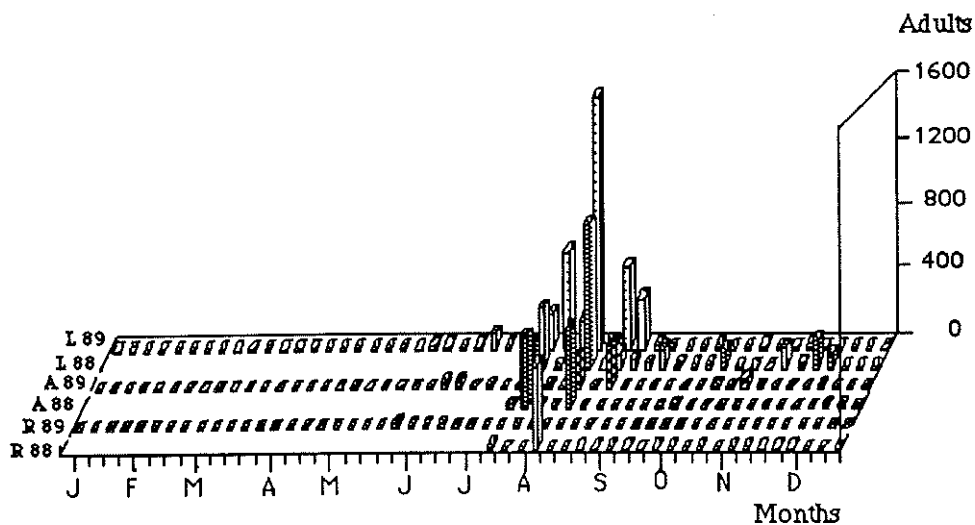


Figure 3- Number of *N. pronuba* adults captured weekly, at Ribeira Grande (R), Arribanas (A) and Lagoa do Congro (L), from July 1988 to December 1989.

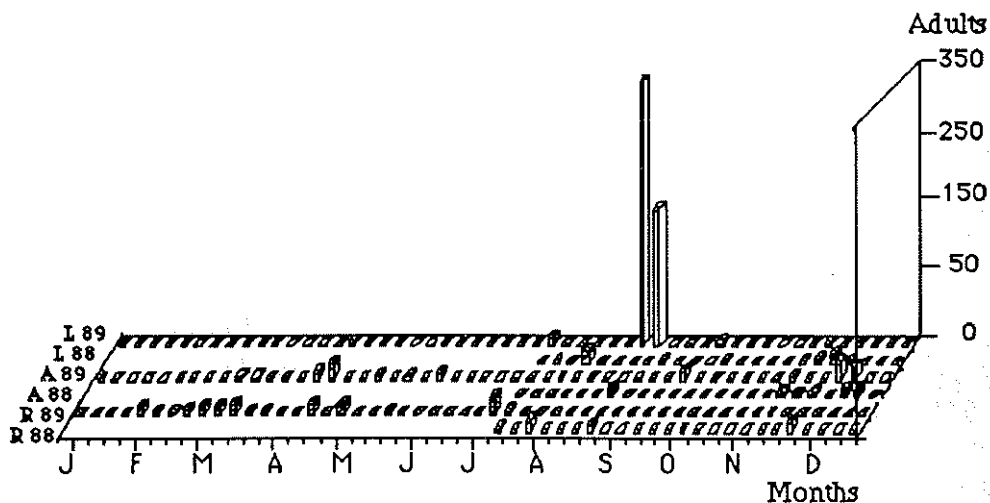


Figure 4- Number of *P. saucia* adults captured weekly, at Ribeira Grande (R), Arribanas (A) and Lagoa do Congro (L), from July 1988 to December 1989.

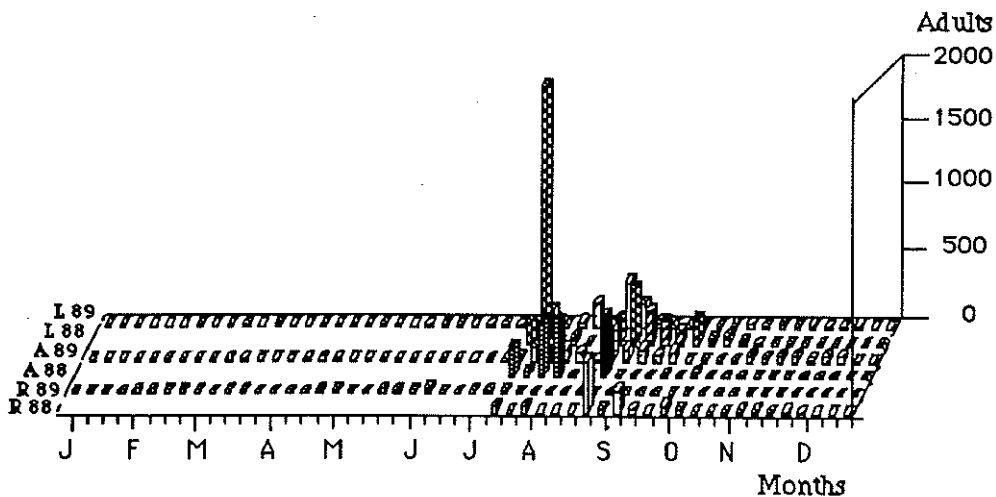


Figure 5- Number of *X. c-nigrum* adults captured weekly, at Ribeira Grande (R), Arribanas (A) and Lagoa do Congro (L), from July 1988 to December 1989.