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ON THE BIOMETRY AND EVOLUTION OF THE GENUS *ORNIDIA* (DIPTERA, SYRPHIDAE)

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ABSTRACT

This is an attempt at analyzing the evolution of Ornidia, *a genus that I consider to include three species*: obesa, aemula *and* major. *I have used not only the morphological data of current usage and the geographical distribution, but also a statistical study of some body proportions and especially, of their geographical differentiation.*

The shape of wing and thorax were studied statistically; both characters show sexual dimorphism, and in obesa *and* major *they vary geographically. The data were insufficient for an analysis of* aemula.

I propose a model of geographical speciation followed by overlap of ranges and consequent character displacement, absolute size being the principal character displaced. I see two evolutionary lineages, one leading to aemula *and other to* major *through* obesa.

SYSTEMATICS

For practical purposes *Ornidia* Lepeletier & Serville, 1828, is considered here as a valid genus (not a subgenus) of Syrphidae, with three species: *O. obesa* (Fabricius, 1775), *O. aemula* (Williston, 1888) and *O. major* Curran, 1930.

Volucella obesoides Giglio-Tos, 1892, has its diagnosis based principally on color. Giglio-Tos mentioned again the species in his "Ditteri del Messico" (1892a). Aldrich (1905) included the name *V. obesoides* in his catalog. Curran (1930) included *obesoides* in his key to the species of *Ornidia,* giving as characteristic the femora basally reddish. Since there is much color variation in the three species, the data now available do not permit a decision on this form; pending an examination of the type, I consider it a "species inquirenda".

According to current dipterological criteria the three species can be distinguished as follows:

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Genitalia

I adopt Vockeroth's (1969) terminology.

The first thing to be noted is the difference in size, the genitalia of *aemula* being much larger than those of *obesa* and *major*. The main morphological differences (figs. 1, 2, and 3) are:

Shape of the 9th tergite. In dorsal view, the lateral margins are approximately parallel in *aemula* (fig. 1c); in *major* (fig. 3c) they are convex, almost angular, and in *obesa* (fig. 2c) they are rounded and have an intermediate aspect, closer to that of *major*. The emargination of the cerci is shallower and more rounded in *obesa* and *major*, deeper and more angular in *aemula*.

In lateral view, the 9th tergite of *major* (fig. 3d) is diamond-shaped; in *aemula* and *obesa* (figs. 3d and 1d) it is roughly triangular.

Shape of the surstylus. In *aemula* it is conical, elongate; in *major*, obtuse, almost triangular; in *obesa* intermediate.

Shape of the 9th sternite. This is rather difficult to describe verbally; the figures show the diferences to better advantage. In *Ornidia* the upper lobes are fused. The lateral aspect of the lateral margin is quite characteristic in *major* (figs. 1e, 2e and 3e), especially in having a reduced number of teeth. In ventral view the 9th sternite of *obesa* (fig. 2a) is pear-shaped, distinctly narrowed in the subapical region. This constriction is much less marked in *major* (fig. 3a).

The aedeagus. In *aemula* (fig. 1f) there is a recurved process on the distal portion of the aedeagus that is much better developed than in the other species.

Scutellum

O. obesa and *aemula* show a single, simple depression on the posterior submarginal region of the scutellum (figs. 4a and 4c). In *major* (fig. 4b) the depression is longitudinally divided, or two separate, symmetrical depressions are seen (as noted by Curran, 1930, in the description of the species).

Wing spots

All species show two very dark spots on the wing. A larger one, approximately on the middle of the anterior margin of the wing, reaches inside the second posterior cell, and presents some individual variation. The other spot is smaller, subapical, and varies from species to species: it is limited to the area of the bend of R_{3+2} in *obesa* and *major*; in *aemula* it is much larger (fig. 5).

Key (modified from Curran, 1930)

1. Apical spot of wing beginning at Costa and extending beyond bend of R_{3+2} (fig. 5c); scutellar depression shallow (fig. 4) .... *aemula* (Williston, 1888)

Apical spot of wing more or less restricted to area around confluence of R_1 and R^{2+3} (figs. 5a, 5b) but never extending beyond bend of latter 2

2. Two to four prescutellar bristles; the slight scutellar depression more or less divided in the middle (fig. 4b) .... *major* Curran, 1930

Without prescutellar bristles; scutellar depression deepest in the middle (fig. 4a) .... *obesa* (Fabricius, 1775)

Geographical distribution

The genus *Ornidia* is originally Neotropical, but *obesa* has been carried by man to many parts of the world.

O. obesa occurs in the Americas from southern Arizona to 30° S latitude. Shannon & Aubertin (1933) do not mention it from Chile, although Macquart (1849) seems to have had materials from that country; I have seen none. Outside of America, Lepeletier & Serville (1828) mention it from the warmer parts of Asia and from Mauritius; Macquart (1849) cites Africa and Madagascar; Giglio-Tos (1895) the Seychelles. I have seen specimens from several Pacific islands through western Melanesia.

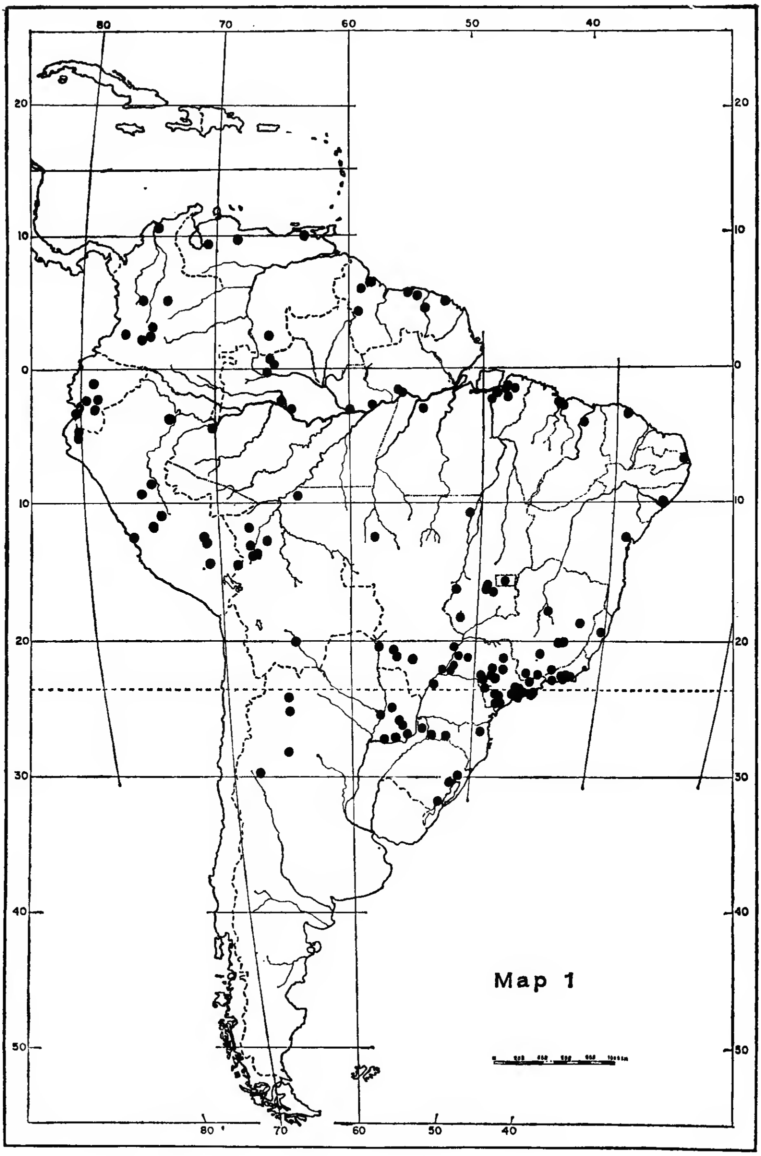
In Brasil it has not been reported from the states of Bahia, Pernambuco, Paraíba, Rio Grande do Norte, Ceará, Maranhão, and Piauí. This may be due to lack of collecting, but may otherwise indicate that *O. obesa* does not live in the xerophytic *caatingas* that cover much of the states named. In Amazonia the species has only been reported from the main course of the river; this is no doubt due to lack of collecting in the tributaries.

Ornidia major occurs from Guatemala to Paraguay and southern Brasil (approximately 32 degrees South). The localities of the available specimens are rather scattered, central and northeastern Brasil and the Guianas being very poorly represented. The map suggests that two areas of higher density of the species may occur, since in the intervening regions of low or zero density of *major* many specimens of *obesa* were collected; this distributional feature seems to be real and not an artifact due to lack of collecting.

The type locality of *Ornidia aemula* is Piedra Blanca, Santa Cruz, Bolivia, a small village on the Rio Paraguay west of Corumbá, Brazil. The species is also known from northern Colombia and Venezuela and from northern Brasil (Amazonia and Maranhão). Doesburg (1963) cites the species from several localities in Surinam.

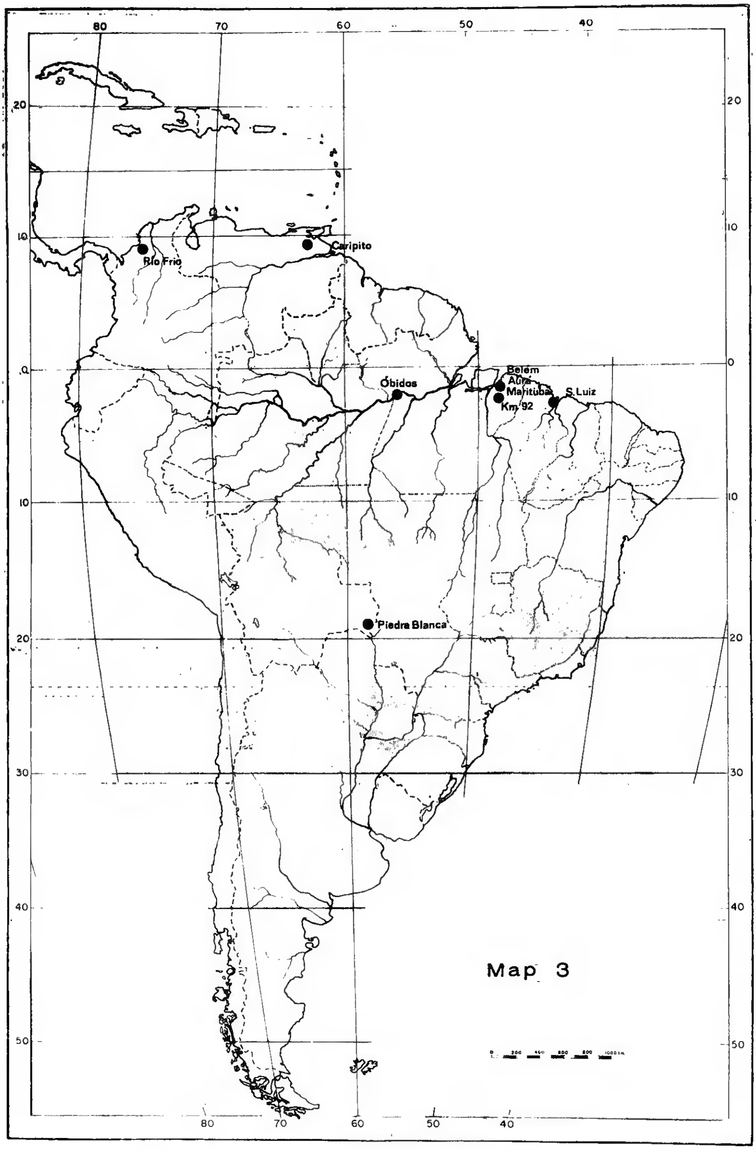
Materials

I have examined 2275 specimens, of which 217 were used in the statistical analysis.



Map 1. South American localities of *Ornidia obesa*.

Map 2. South American localities of *Ornidia major*.



Map 3. Localities of *Ornidia aemula.*

Ornidia obesa

For each of three localities (Barueri, Itatiaia and Guanabara) the number of specimens available was sufficient to constitute geographically homogenous samples. In the case of the northern (Pará) and southern (Rio Grande do Sul) areas the working samples were assembled by grouping localities within a uniform ecological area.

The samples used for the study of the wing and of the thorax were not always the same. In the case of Guanabara (a large collection), two separate random samples were made. In the case of Barueri all specimens with perfect wings were used for the wing studies; for the thorax a sub-sample was established. In the samples "Pará", "Rio Grande do Sul" and "Itatiaia" all specimens with perfect wings or thorax were used, but they were not always the same.

The samples obtained by grouping localities showed increased variability relative to the geographically homogenous samples in the case of the wing (Table 1), but not of the thorax (Table 2).

The samples used were:

a) for wing measurements

Samples	Localities	♀	♂
Pará	Belém; Marituba; Mocajuba; R. Acará; Abaeté; Óbidos; Santarém; Lago Jacaré	23	7
Barueri	Barueri	19	26
Itatiaia	Itatiaia	9	6
Guanabara	Districts of the City of Rio de Janeiro	22	22
R. Grande do Sul	S. Leopoldo; Pelotas; Dois Irmãos	9	11

b) for thorax measurements

Samples	Localities	♀	♂
Pará	Belém; Marituba; Óbidos; Santarém; Lago Jacaré	15	8
Barueri	Barueri	15	16
Itatiaia	Itatiaia	9	6
Guanabara	Districts of the City of Rio de Janeiro	17	17
R. Grande do Sul	S. Leopoldo; Pelotas; Dois Irmãos	9	11

Ornidia major

From no locality was a sufficient number of specimens available, so all samples were constituted by grouping localities from areas more or less uniform ecologically. For the study of sexual dimorphism and inter-specific differentiation, "general samples" (one for wing and one for thorax) were assembled by random sampling.

The samples used were:

a) for wing measurements

Samples	Localities	♀	♂
North	Serra do Navio; Coraci; Uaupés	9	—
West	Pôrto Cabral; Serra do Diabo; Pôrto Primavera; Iguaçu; Maracaju	11	6
East	Angra dos Reis; Maromba, Itaiaia; Itatiaia; Magé; Muri; Nova Friburgo; Passa Quatro; Serra dos Cochos; Virgínia; S. Paulo; Salesópolis; Juquiá	11	4
General	Serra do Navio; Uaupés; Coraci; Maracaju; Passa Quatro; Virgínia; Muri; Itatiaia; Angra dos Reis; Pôrto Cabral; Salesópolis; Serra do Diabo; Ponta Grossa; Iguaçu; Nova Teutônia; Pelotas	21	12

b) for thorax measurements

Samples	Localities	♀	♂
North	Serra do Navio; Coraci; Uaupés	9	—
West	Pôrto Cabral; Serra do Diabo; Pôrto Primavera; Iguaçu; Maracaju	11	5
East	Angra dos Reis; Itatiaia; Magé; Passa Quatro; Serra dos Cochos; Virgínia; São Paulo; Salesópolis; Juquiá	11	5
General	Serra do Navio; Uaupés; Coraci; Maracaju; Passa Quatro; Virgínia; Muri; Itatiaia; Japuiba; Pôrto Cabral; Salesópolis; Serra do Diabo; Ponta Grossa; Iguaçu; Nova Teutônia; Pelotas	15	12

Ornidia aemula

I had only 7 females and 6 males of this species, which is thus represented by one single "general sample".

Methods

The general routine of the statistical study described, for each character: (i) sexual dimorphism within samples; (ii) geographical differentiation within species; (iii) inter-specific differentiation.

All problems of shape were treated by means of regression analysis, taking length as the independent and width as the dependent variable.

In a few cases, duly noted, there was no regression; in the remainder it was found that linear regressions adequately described the relationships investigated.

The fitting of the lines, the studies of differences between pairs of samples (males and females of the same locality) and the analyses of variance among several samples (the same sex of one given species in several localities) were all done by routine methods, such as in Ostle (1966). When the analysis of variance indicated heterogeneity among localities, the respective regression coefficient and constants were compared by Duncan's (1970) method of multiple comparisons.

In the cases where one samples showed significant regression; but the contrasting one did not, comparisons were made graphically.

The results of the analyses are shown in Graphs 1 to 9 and Tables 1 to 4.

In each table are shown

N number of specimens in the sample
R_x range of the independent variable
b regression coefficient ± its standard deviation
a regression constant ± its standard deviation
y_1' and y_2', values of the dependent variable for given values (x_1 and x_2) of the independent variable.
r^2 coefficient of determination (square of the coefficient of correlation).

All measurements were made under a dissecting scope with a micrometric eyepiece. Measurements were repeated without reference to previous results until they were routinely consistent within one micrometer unit.

The length of the wing (one micrometer unit = 0.14749 mm) was measured between the apex of the wing and the limit between basicosta and costa. Wing width was taken as the maximum width perpendicular to the costa.

The length of the thorax (one micrometer unit = 0.0977 mm) was measured between the level of the front margins of the humeral calli and the posterior margin of the mesonotum. The width was taken at the middle of the humeral calli.

RESULTS: WING

SEX DIMORPHISM

Wing shape and size were found sexually dimorphic in all samples studied. In absolute measurements the shortest and the broadest wings belong to the females. In general the males have the longest wings, but *O. aemula* is an exception, since the range of male lengths and widths is included in the female range.

With respect to shape (Table 1 and Graph 1), in all samples studied the males have relatively longer and narrower wings. The regression lines for males and females are parallel (the regression coefficients do not differ significantly); a significant difference is found in the regression constants.

In two samples (males of *aemula* and of Pará *obesa*) the regression was not significant, but graphic comparison (Graph 2) shows a distinct difference between males and females.

GEOGRAPHICAL DIFFERENTIATION IN *O. obesa*

As can be seen in Graph 3, the regression lines for the several samples are approximately parallel but definitely not coincident: there are significant differences in the regression constants.

Females. Rio Grande do Sul and Pará have the narrowest wings, and differ significantly from Guanabara, with the broadest wings.

Samples Barueri and Itatiaia are intermediate, not differing significantly from the extreme ones.

The range of wing length also varies from samples to samples. Guanabara has the widest range, spanning all the variation of the character. Barueri has equally long wings, but its range is smaller to the left.

Males. On the narrower side we have Pará, on the broader Rio Grande do Sul and Guanabara; the differences are significant. Again Barueri and Itatiaia are intermediate.

The longest and broadest wing is in the Barueri samples; the shortest and narrowest in the Guanabara one.

Dimorphism. The patterns for males and females are generally in agreement, with the exception of the sample Rio Grande do Sul, which has the narrowest female and the broadest male wings, thus showing minimum sexual dimorphism. As to the remaining samples, Pará shows maximum distance between the male and female lines, next Guanabara and Itatiaia, and, finally, Barueri.

No clinal regularities were found in these patterns of geographical distribution.

Geographical differentiation in *O. major*

Comparisons between samples West, East and North (females) and West and East (males) revealed no significant differences for the wing characters, so further wing studies are based on a single grouped samples of each sex.

Interspecific differentiation

In comparing the three species, *O. obesa* will be spoken of as a single unit for brevity's sake, but comparisons were made with all geographical samples. In Graph 1 we show only the Guanabara lines, that have the widest ranges. As mentioned above, *O. major* will be represented by a single "general" sample of each sex.

Graph 1 shows clearly that the species of *Ornidia* differ both in absolute size and in shape of the wing.

The length of the wing of *O. obesa* varies from 7.37 to 10.77 mm in females and from 7.96 to 11.21 mm in males. The wing of *O. major* ranges from 10.62 to 12.24 mm in females and from 10.62 to 12.54 mm in males. The longest wings belong to *O. aemula*: respectively 12.39 to 14.31 mm and 13.27 to 13.86 mm in females and males. Wing length is thus almost perfectly complementary among the three species.

As to wing width: *obesa* (both sexes) 2.65 to 3.83 mm; *major*, females 3.83 to 4.42 mm, males 3.98 to 4.72 mm; *aemula*, females 4.28 to 5.01 mm, males 4.28 to 4.57 mm. Wing width is complementary between *obesa* and *major*, but there is some overlap between *major* and *aemula*.

Results: Thorax

Sexual dimorphism

Although in general females have a broader thorax, the sexual differences are not so consistent as in the case of the wing.

In *obesa,* females have the smallest (shortest and narrowest) thoraces; in *major* and *aemula* the range of male variation is contained within the female range.

It can be seen from Graph 4 and Table 2 that there are no significant differences between the sexes in *O. aemula.* In *O. major* there is a difference, as in the case of the wing, in the regression constant.

The situation in *obesa* is complex and linked to the problem of geographical differentiation. There are no significant differences in the samples Pará and Rio Grande do Sul; there are significant differences in the regression constant in Barueri and Itatiaia, and in the regression coefficient in Guanabara.

Geographical differentiation in *O. obesa*

The geographical variation of the thorax of *O. obesa* is more complex than that of the wing.

In the females (Graph 5), the picture is: Guanabara has a significantly larger regression coefficient than Pará, Barueri and Itatiaia; Rio Grande do Sul is intermediate. Taking the groups that are homogenous with regard to the regression coefficient, we find differences in the regression constant. Thus Guanabara has broader thoraces than Rio Grande do Sul. In the second group (Pará, Itatiaia, Barueri, Rio Grande do Sul), Pará has significantly broader thoraces than all others. Barueri still differs significantly from Rio Grande do Sul, but not from Itatiaia, and the latter does not differ significantly from either Barueri or Rio Grande do Sul.

As to the males (Graph 6) the only difference, and that in the regression constant, occurs between Pará on one side and the remaining localities on the other.

Comparing the results for both sexes, it seems that the only common feature is the situation of the Pará sample.

Geographical differentiation in *O. major*

The three samples of females were found to be homogeneous.

Of the samples of males, one, West, showed no significant regression. However, graphic comparison (Graph 7) shows that the West thoraces are significantly broader than the East ones.

Interspecific differentiation

The general procedure here was the same as for the wing; the same caveats apply.

It is seen in Graph 3 that the regression lines for the 3 species are well separated in space.

The ranges of variation for thorax length are: *obesa,* females 2.34 to 3.32 mm, males 2.64 to 3.61 mm; *major,* females 3.42 to 4.20 mm, males 3.62 to 4.01 mm; *aemula,* females 3.91 to 4.40 mm, males

4.10 to 4.20 mm. There is no overlap between *obesa* and *major* in either sex. Between *major* and *aemula* there is no overlap in males, but some in the females.

As to thorax width: *obesa,* females 3.52 to 4.89 mm, males 3.81 to 5.28 mm; *major,* females 5.28 to 6.39 mm, males 5.18 to 5.76 mm; *aemula,* females 5.47 to 6.06 mm, males 5.57 to 5.86 mm. There is thus complementarity between *obesa* and *major,* but overlap between *major* and *aemula.*

Structure of the genus

In size and morphology of the male genitalia, *obesa* and *major* are very similar, while *aemula* has much larger genitalia, with a well developed distal process on the aedeagus. Also with regard to the wing spot, *obesa* and *major* have a smaller one than *aemula.* Contrariwise, the scutellar depression of *obesa* and *aemula* are alike, that of *major* being double or divided.

As to wing shape, the regressions cannot be directly compared, given the complementarity of wing lengths. It is possible to see, however, that the several *obesa* regressions fall in line with both *aemula* and *major;* while the last two obviously differ. In fact, if the samples of *obesa* are combined on one side with *aemula,* or on the other with *major,* the fit of the resulting regressions is comparable to those of the individual samples (Table 3 and Graph 8).

With regard to thorax shape, the overlap between *major* and *aemula* is sufficient for a direct comparison; the difference is so large that further statistical testing is superfluous. In this case, as in that of the wing shape, all samples of *obesa* fall in line with those of *aemula* and *major* (Table 4, Graph 9).

The fact that *obesa* is in many ways intermediate between *major* and *aemula* may be explained in at least 3 plausible ways: (1) *obesa* would be closer to a primitive stock, from which the two others would be derived; (2) descent would be linear, with *aemula* and *major* at the ends and *obesa* in the middle; (3) *obesa* and *aemula* would be branches of a common stock, with *major* derived from *obesa.*

If it is accepted that former character displacement simply enhanced differences that already existed, the data on wing and thorax shape tend to indicate that it is less probable that *obesa* is the middle link in a linear sequence, since this would involve two simultaneous reversals of evolutionary direction in two uncorrelated characters. On the other hand, we need to know whether the *obesa* type of aedeagus is more primitive than that of *aemula* before we can say that *obesa* represents the primitive stock.

I prefer, then, to believe that two lineages derived from the primitive stock, one leading to *aemula* (aedeagus with apical process, wing spot larger) and one to *obesa,* and through it to *major.* The marked geographical differentiation of *obesa* makes it pausible that *major* was derived from it by an orthodox model of geographical speciation (Mayr, 1963).

Relevant geographical data can be gathered only from the distribution of *aemula* and *major,* since *obesa* is disseminated by man. *O. aemula* is essentially associated with the Amazonian forest; its area is considerably smaller than that of the other species. *O. major* shows two areas of higher density, but these may not be completely separated, as one specimen from northern Mato Grosso (Utiariti) indicates.

I suggest that the three species arose by geographical differentiation, in the manner just described. Then they would have met again, undergoing character displacement. It is possible to imagine that the meeting of the 3 species was simultaneous or that first 2 species met, and later a third met the other two; since *aemula* is restricted to Amazonia, this would be the place of overlap and displacement. Consequently, the isolation of the primitive populations that give rise to the three species may have been in forest refuges on the periphery of the present area of continuous forest, as described by Vanzolini & Williams (1970) for the lizard *Anolis chrysolepis*.

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Appendix

The specimens used in statiscal analysis were the following:

Ornidia obesa: Brasil. Belém, Pará (7 ♀, 6 ♂); Aurá, Belém, Pará (6 ♀, 1 ♂); Maguari, Belém, Pará (1 ♀); Ananindéua, Belém, Pará (2 ♀); Marituba, Pará (1 ♀); Mangabeira, Mocajuba, Pará (1 ♀); Rio Acará, Belém, Pará (1 ♀); Piratuba, Abaeté, Pará (1 ♀); Óbidos, Pará (3 ♀, 1 ♂); Fazenda Taperinha, near Santarém, Pará (2 ♀); Barueri, São Paulo (19 ♀, 30 ♂); Itatiaia, Rio de Janeiro (8 ♀, 7 ♂); Fazenda Penedo, Itatiaia, Rio de Janeiro (1 ♀); Deodoro, Rio de Janeiro, Guanabara (2 ♀, 3 ♂); Gávea, Rio de Janeiro, Guanabara (1 ♀, 5 ♂); Rio de Janeiro, Guanabara (7 ♀, 4 ♂); Escola Superior de Agronomia (Praia Vermelha), Guanabara (6 ♀); Jardim Botânico, Rio de Janeiro, Guanabara (4 ♀, 1 ♂); Corcovado, Rio de Janeiro, Guanabara (1 ♀, 2 ♂); Botafogo, Rio de Janeiro, Guanabara (3 ♂); Tijuca, Rio de Janeiro, Guanabara (1 ♀, 3 ♂); Copacabana, Rio de Janeiro, Guanabara (1 ♀, 3 ♂); Santa Tereza, Rio de Janeiro, Guanabara (1 ♀, 1 ♂); Paineiras, Rio de Janeiro, Guanabara (1 ♂); Silvestre, Rio de Janeiro, Guanabara (1 ♀); Sumaré, Rio de Janeiro, Guanabara (1 ♂); Leme, Rio de Janeiro, Guanabara (1 ♀); Guaratiba, Guanabara (2 ♀); Jacarepaguá, Guanabara (1 ♂); Rio Comprido, Guanabara (1 ♂); Dois Irmãos, Rio Grande do Sul (1 ♂); São Leopoldo, Rio Grande do Sul (5 ♀, 4 ♂); Pelotas, Rio Grande do Sul (4 ♀, 6 ♂); Pôrto Alegre, Rio Grande do Sul (1 ♂).

Ornidia major: Brasil. Serra do Navio, Amapá (8 ♀); Uaupés, Rio Negro, Amazonas (1 ♀); Coraci, 15 km NO de Canindé, Rio Gurupi, Pará (1 ♂); Maracaju, Mato Grosso (2 ♀); Passa Quatro, Serra dos Cochos, Minas Gerais (1 ♂); Virgínia, Minas Gerais (1 ♀); Muri, Nova Friburgo, Rio de Janeiro (1 ♀); Itatiaia, Rio de Janeiro (1 ♀, 3 ♂); Japuíba, Angra dos Reis, Rio de Janeiro (1 ♀); Pôrto Cabral, Rio Paraná, São Paulo (3 ♀, 2 ♂); Estação Biológica de Boracéia, Salesópolis, São Paulo (1 ♀); Serra do Diabo, São Paulo (1 ♂); Ponta Grossa, Paraná (1 ♀); Iguaçu, Paraná (1 ♀, 3 ♂); Nova Teutônia, Santa Catarina (2 ♀); Pelotas, Rio Grande do Sul (1 ♀, 1 ♂).

Ornidia aemula: BRASIL. Belém, Pará (1 ♂); Curuçambá, Óbidos, Pará (1 ♀, 1 ♂); Óbidos, Pará (2 ♀, 2 ♂); Aurá, Belém, Pará (1 ♂); Colônia Rio Branco, Óbidos, Pará (1 ♀); Marituba, Pará (1 ♀); Br 14, km 92, Pará (1 ♀); São Luiz, Maranhão (1 ♂).

REFERENCES

ALDRICH, J. M.

1905. A catalogue of North American Diptera. *Smithson. Misc. Coll. 46* (2 = publ. 1444): 1-680.

CURRAN, C. H.

1930. New species of Volucellinae from America (Syrphidae, Diptera). *Amer. Mus. Nov. 413*: 1-23, 1 fig.

DOESBURG, P. H. VAN, SR.

1963. Preliminary list of Syrphidae known from Suriname and British and French Guiana. *Stud. Fauna Suriname and other Guyanas 5*: 1-33, 5 figs.

DUNCAN, D. B.

1970. Multiple comparison methods for comparing regression coefficients. *Biometrics 26* (1): 141-143.

FABRICIUS, J. C.

1775. *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus.* 832 pp. Flensburgi et Lipsiae = Flensburg and Leipzig.

GIGLIO-TOS, E.

1892. *Ditteri del Messico 1*: 72 pp., 1 pl. Torino. (Also published in *Mem. R. Accad. Sci. Torino 43* (Cl. di Sci. Fis., Mat. e Nat.): 99-168, 1 pl., 1893).

1892a. Diagnosi di nuove specie di Ditteri. VI. Sirfidi del Messico. *Boll. Mus. Zool. Anat. Comp. Torino 8* (123): 1-7.

1895. *Ditteri del Messico 4*: 74 pp., 1 pl. Torino (Also published in *Mem. R. Accad. Sci. Torino 45* (Cl. di Sci. Fis., Mat. e Nat.): 1-74, 1 pl., 1896).

LEPELETIER, A. L. M. & J. G. A. SERVILLE

1828. *Article Volucelle*, pp. 783-786, *in* Lepeletier, Serville & Guérin-Meneville, 1825.

LEPELETIER, A. L. M., J. G. A. SERVILLE & F. E. GUÉRIN-MENEVILLE

1825. Entomologie, ou histoire naturelle des crustacés, des arachnides et des insectes Pt. 2 (Insectes i.e., Arthropoda Pt. 7), Vol. 10: 1-344 (= livrs. 96), 1825; pp. 345-833 (= livr. 100), 1828, *In* Societé de gens de lettres, de savans et d'artistes, *Encyclopédie Méthodique. Histoire Naturelle.* Paris.

MACQUART, J.
1842. *Diptéres exotiques nouveaux ou peu connus. Vol. 2,* Pt. 2, pp. 5-140, 22 pls., Paris.

MAYR, E.
1963. *Animal species and evolution.* xiv + 797 pp. Cambridge, Mass.: the Belknap Press of Harvard University Press.

OSTLE, B.
1963. *Statistics in research.* Second edition. Ames, Iowa: The Iowa State University Press, xv + 585 pp.

SHANNON, R. C. & D. AUBERTIN
1933. Syrphidae, pp. 120-170, 35 figs., *in* British Museum (Natural History), *Diptera of Patagonia and South Chile 6*: 1-499. London.

VANZOLINI, P. E. & E. E. WILLIAMS
1970. South American Anoles: The geographic differentiation and evolution of the *Anolis chrysolepis* species group (Sauria, Iguanidae). *Arq. Zool.*, S. Paulo, *19* (1-4): 1-298, ills.

VOCKEROTH, J. R.
1969. A revision of the genera of the Syrphini. *Mem. Ent. Soc. Canada 62*: 1-176.

WILLISTON, S. W.
1888. Diptera Brasiliana. Part I, Stratiomyidae, Syrphidae. *Trans. Amer. Ent. Soc. 15*: 243-292.

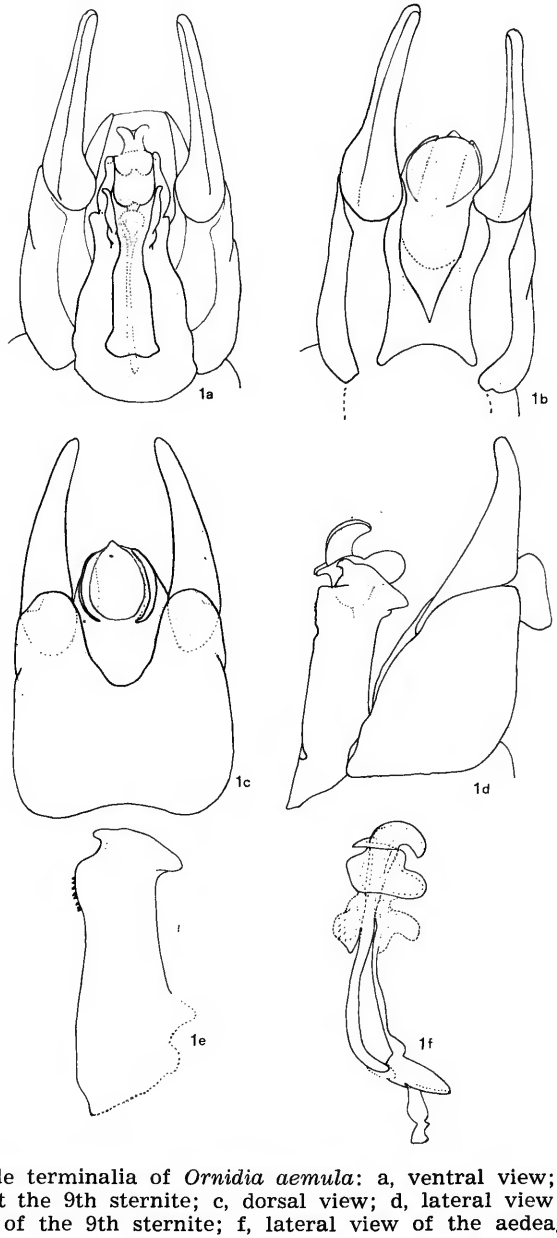

Fig. 1. Male terminalia of *Ornidia aemula*: a, ventral view; b, ventral view without the 9th sternite; c, dorsal view; d, lateral view; e, lateral view of the 9th sternite; f, lateral view of the aedeagus.

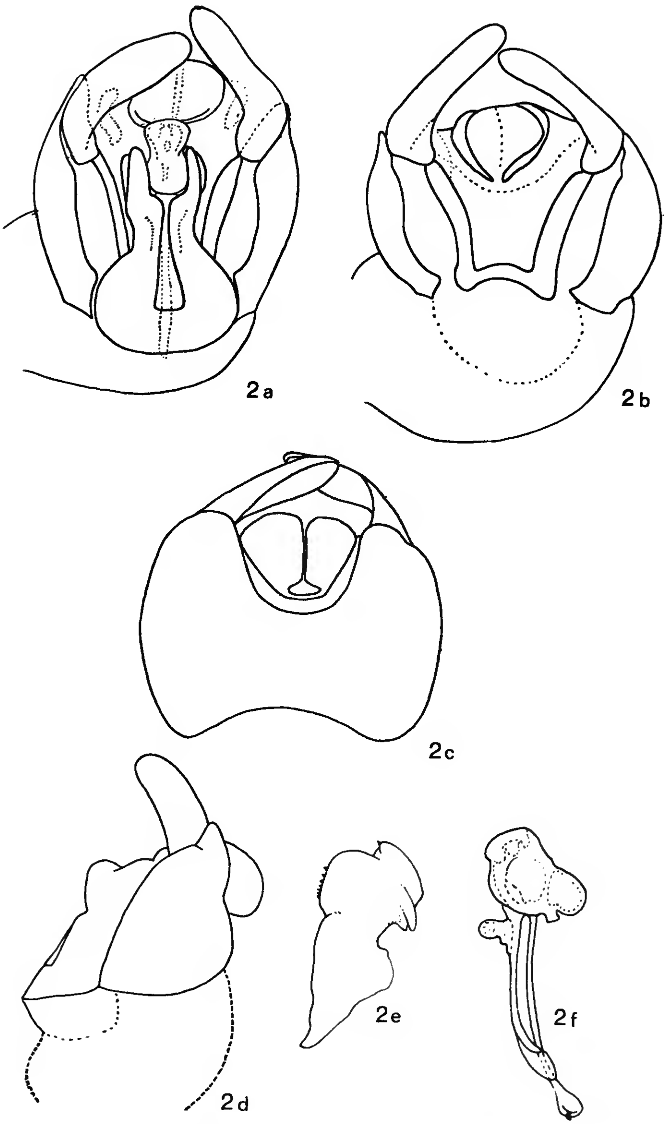

Fig. 2. Male terminalia of *Ornidia obesa*: a, ventral view; b, ventral view without the 9th sternite; c, dorsal view; d, lateral view; e, lateral view of the 9th sternite; f, lateral view of the aedeagus.

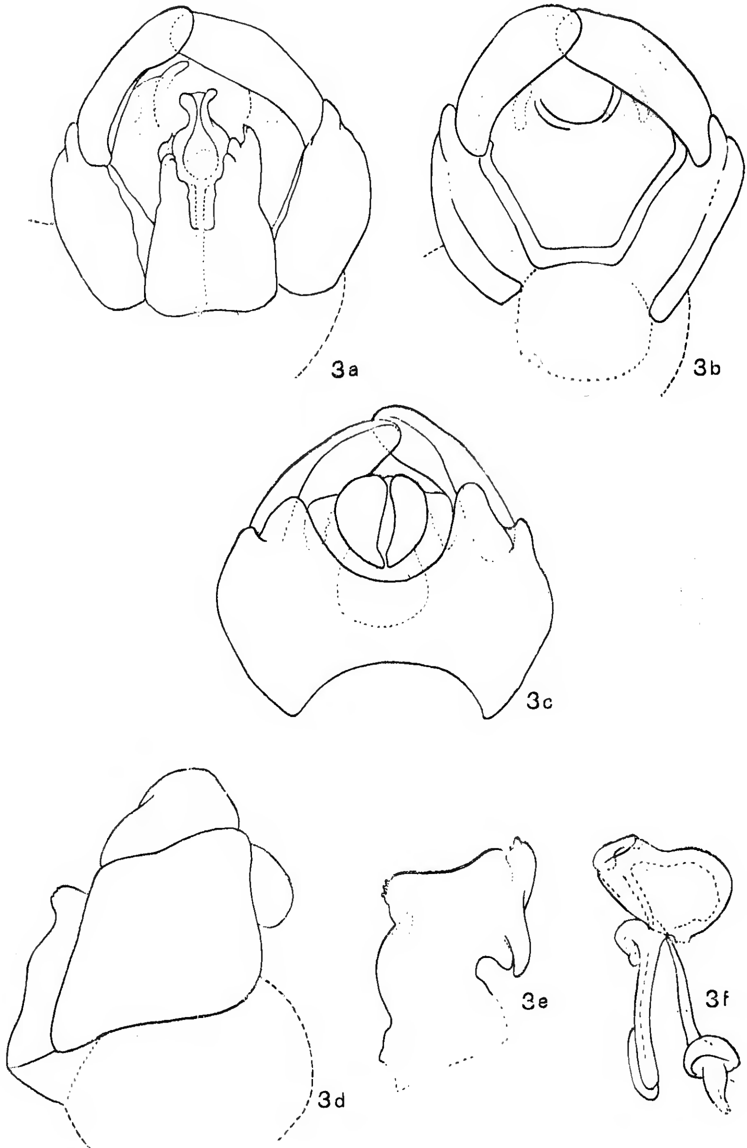

Fig. 3. Male terminalia of *Ornidia major*: a, ventral view; b, ventral view without the 9th sternite; c, dorsal view; d, lateral view; e, lateral view of the 9th sternite; f, lateral view of the aedeagus.

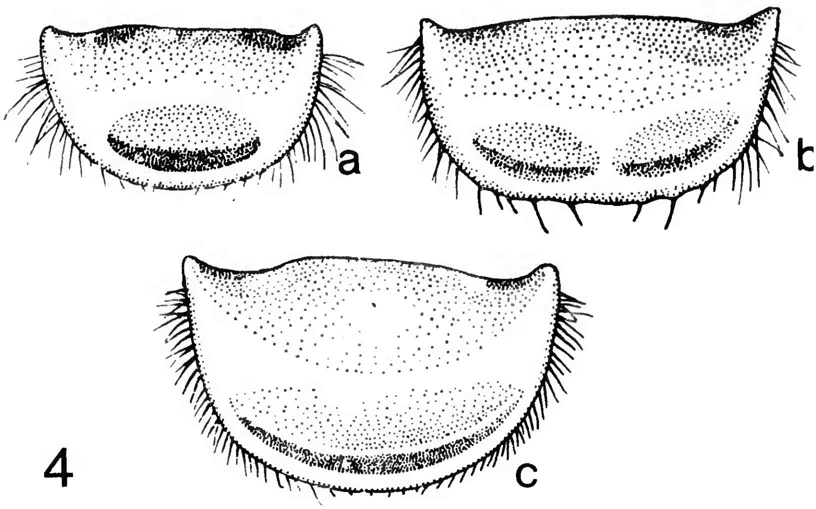

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Fig. 4. Scutellum of *Ornidia*: a, *obesa;* b, *major;* c, *aemula.*

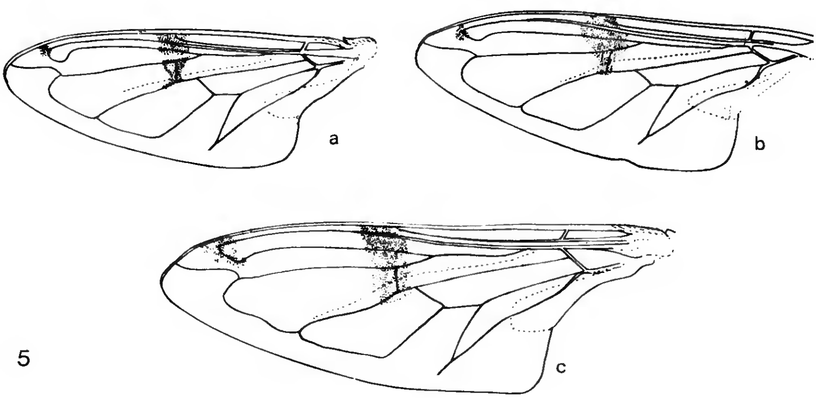

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Fig. 5. Wing of *Ornidia*: a, *obesa;* b, *major;* c, *aemula.*

Table 1

Ornidia, regression of wing width on wing length

Species	Sample	Sex	N	R_x	b	a	x_1	y'_1	x_2	y'_2	r^2
aemula	General	♀	7	12.39 - 14.31	0.396 ± 0.0768	-0.62 ± 1.033	12	4.13	14	4.92	0.84
"	"	♂	6	13.27 - 13.86	0.227 0.2185						
major	North	♀	6	10.62 - 11.36	0.203 ± 0.1558						
"	West	♀	11	11.06 - 12.36	0.261 0.0751	1.25 0.863	10	3.85	12	4.37	0.57
"		♂	6	11.50 - 12.39	0.266 0.1430	1.09 1.698	10	3.76	12	4.29	0.47
"	East	♀	11	10.03 - 12.54	0.381 0.0608	-0.04 0.719	10	4.57	12	5.33	0.81
"	'	♂	4	10.62 - 11.95	0.331 0.1302	0.32 1.514	10	3.64	12	4.29	0.76
"	General	♀	21	10.62 - 12.24	0.402 0.0438	-0.30 0.499	10	3.72	12	4.53	0.81
"	"	♂	12	10.62 - 12.54	0.368 0.0852	-0.14 0.998	10	3.54	12	4.28	0.65
obesa	Pará	♀	23	8.55 - 10.32	0.273 0.0506	0.84 0.481	8	3.02	11	3.84	0.58
"	"	♂	7	9.14 - 10.32	0.286 0.2126						
"	Guanabara	♀	22	7.37 - 10.77	0.383 0.0281	-0.14 0.276	8	2.93	11	4.08	0.90
"	"	♂	22	7.96 - 10.47	0.372 0.0397	-0.31 0.396	8	2.67	11	3.78	0.81
"	Itatiaia	♀	9	8.85 - 10.32	0.421 0.0274	-0.53 0.267	8	2.84	11	4.10	0.97
"	"	♂	6	9.14 - 10.77	0.306 0.0557	0.32 0.561	8	2.76	11	3.68	0.88
"	Barueri	♀	19	9.00 - 10.77	0.356 0.0658	0.08 0.658	8	2.92	11	3.99	0.63
"	"	♂	26	9.29 - 11.21	0.347 0.0397	-0.09 0.412	8	2.69	11	3.73	0.76
"	R.G. Sul	♀	9	9.29 - 10.62	0.353 0.0950	0.04 0.956	8	2.86	11	3.92	0.66
"	"	♂	11	9.73 - 10.77	0.368 0.1073	-0.26 1.099	8	2.69	11	3.79	0.57

Table 2

Ornidia, regression of thorax width on thorax length

Species	Sample	Sex	N	R_x	b		a		x_1	y_1'	x_2	y_2'	r^2
aemula	General	♀	7	3.91 - 4.40	0.997	± 0.1916	1.58	± 0.819	4	5.56	4.5	6.06	0.84
"	"	♂	5	4.10 - 4.20	2.650	0.5590	-5.30	2.337	4	5.31	4.5	6.63	0.88
major	North	♀	9	3.42 - 3.91	1.007	0.2089	2.01	0.761	3.5	5.53	4.5	6.54	0.76
"	West	♀	11	3.42 - 3.81	1.117	0.2027	1.54	0.734	3.5	5.45	4.5	6.56	0.77
"	'	♂	5	3.71 - 3.91	0.475	0.3640							
"	East	♀	11	3.13 - 4.20	1.093	0.1188	1.66	0.458	3.5	5.48	4.5	6.58	0.90
"	"	♂	5	3.62 - 4.01	1.413	0.1504	0.11	0.577	3.5	6.06	4.5	7.47	0.97
"	General	♀	15	3.42 - 4.20	1.196	0.1066	1.30	0.394	3.5	5.48	4.5	6.68	0.91
"	"	♂	12	3.62 - 4.01	0.932	0.2639	2.07	1.002	3.5	5.33	4.5	6.23	0.55
obesa	Pará	♀	15	2.74 - 3.22	1.124	0.12[illegible]3	1.29	0.365	2.5	4.10	3.5	5.23	0.87
'	'	♂	8	2.83 - 3.52	0.932	0.1970	1.87	0.631	2.5	4.20	3.5	5.13	0.79
'	Guanabara	♀	16	2.34 - 3.32	1.488	0.0729	0.12	0.224	2.5	3.84	3.5	5.32	0.97
"		♂	17	2.64 - 3.42	1.014	0.1945	1.43	0.622	2.5	3.97	3.5	4.98	0.64
"	Itatiaia	♀	9	2.83 - 3.32	1.098	0.1469	1.26	0.461	2.5	4.11	3.5	5.10	0.89
"	'	♂	5	3.12 - 3.52	1.172	0.0896	0.82	0.296	2.5	3.75	3.5	4.92	0.98
"	Barueri	♀	15	2.64 - 3.22	1.184	0.1177	1.03	0.366	2.5	3.99	3.5	5.18	0.88
"	"	♂	16	2.93 - 3.61	1.349	0.1221	0.35	0.414	2.5	3.72	3.5	5.07	0.90
"	R.G. Sul	♀	9	3.03 - 3.32	1.253	0.0897	0.74	0.286	2.5	3.87	3.5	5.12	0.96
"	"	♂	10	3.13 - 3.52	1.338	0.2713	0.39	0.899	2.5	3.73	3.5	5.07	0.75

Table 3

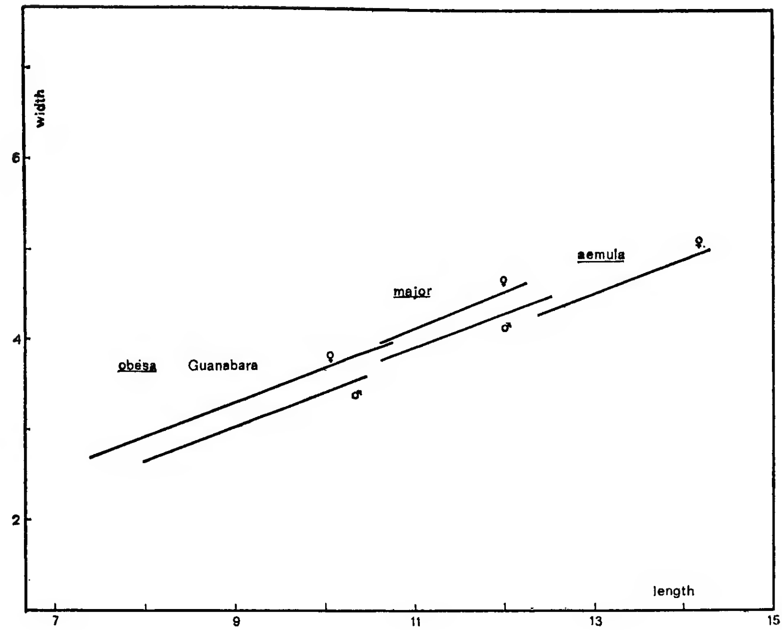
***Ornidia*, additions of regressions of wing width on wing length**

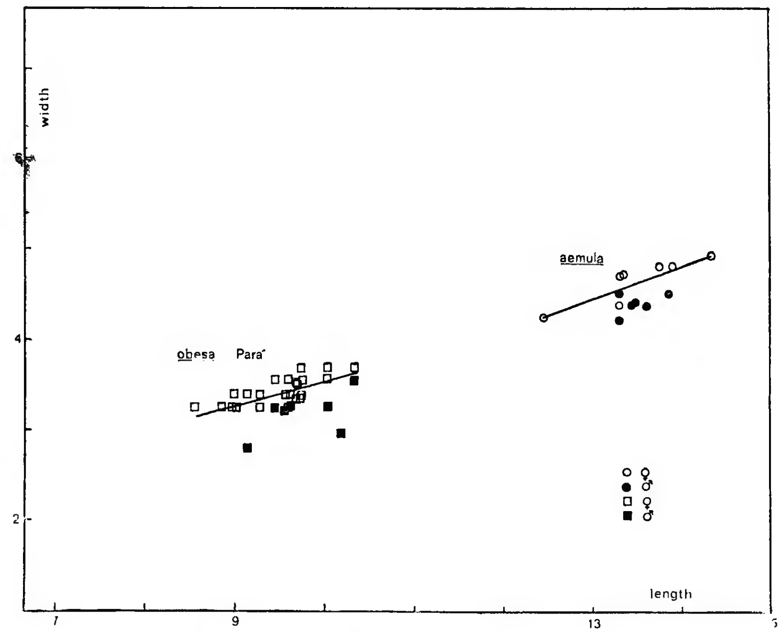
Samples	Sex	N	R_x	b		a		x_1	y_1'	x_2	y_2'	r^2
aemula + *obesa* Pará	♀	30	8.55 - 14.31	0.321	± 0.0108	0.38	± 0.114	8	2.95	14	4.88	0.97
" " "	♂	13	9.14 - 13.86	0.339	0.0245	-0.13	0.285	8	2.59	14	4.62	0.95
aemula + *obesa* Guanabara	♀	29	7.37 - 14.31	0.314	0.0128	0.53	0.138	8	3.04	14	4.92	0.96
" " "	♂	28	7.96 - 13.86	0.309	0.0136	0.31	0.147	8	2.78	14	4.63	0.95
aemula + *obesa* Itatiaia	♀	16	8.85 - 14.31	0.311	0.0119	0.53	0.137	8	3.02	14	4.89	0.98
" " "	♂	12	9.14 - 13.86	0.308	0.0137	0.30	0.162	8	2.76	14	4.61	0.98
aemula + *obesa* Barueri	♀	26	9.00 - 14.31	0.314	0.0133	0.50	0.146	8	3.00	14	4.89	0.96
" " "	♂	32	9.29 - 13.86	0.308	0.0134	0.32	0.148	8	2.78	14	4.62	0.95
aemula + *obesa* R.G. Sul	♀	16	9.29 - 14.31	0.332	0.0154	0.24	0.179	8	2.90	14	4.89	0.97
" " "	♂	17	9.73 - 13.86	0.291	0.0162	0.53	0.186	8	2.86	14	4.60	0.96
major + *obesa* Pará	♀	44	8.55 - 12.24	0.430	0.0150	-0.64	0.157	8	2.80	12	4.52	0.95
" " "	♂	19	9.14 - 12.54	0.478	0.0387	-1.45	0.427	8	2.38	12	4.29	0.90
major + *obesa* Guanabara	♀	43	7.37 - 12.24	0.405	0.0137	-0.34	0.146	8	2.90	12	4.52	0.95
" " "	♂	34	7.96 - 12.54	0.422	0.0205	-0.79	0.217	8	2.58	12	4.27	0.93
major + *obesa* Itatiaia	♀	30	8.85 - 12.24	0.423	0.0152	-0.54	0.166	8	2.84	12	4.54	0.96
" " "	♂	18	8.85 - 12.54	0.434	0.0327	-0.94	0.366	8	2.54	12	4.28	0.92
major + *obesa* Barueri	♀	40	9.00 - 12.24	0.443	0.0192	-0.78	0.206	8	2.77	12	4.34	0.93
" " "	♂	38	9.29 - 12.54	0.442	0.0252	-1.05	0.273	8	2.48	12	4.25	0.90
major *obesa* R.G. Sul	♀	30	9.29 - 12.24	0.479	0.0251	-1.19	0.276	8	2.64	12	4.56	0.93
" " "	♂	23	9.73 - 12.54	0.430	0.0306	-0.87	0.337	8	2.56	12	4.28	0.90
aemula + *major*	♀	28	10.62 - 14.31	0.245	0.0231	1.47	0.276	10	3.92	14	4.90	0.81
" "	♂	18	10.62 - 13.86	0.195	0.0364	1.86	0.449	10	3.81	14	4.59	0.64

Table 4

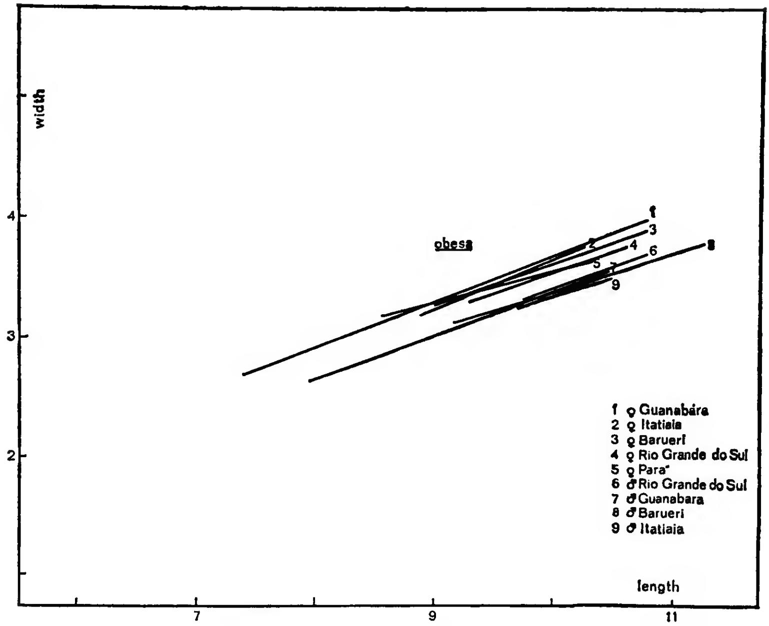
***Ornidia*, additions of regressions of thorax width on thorax length**

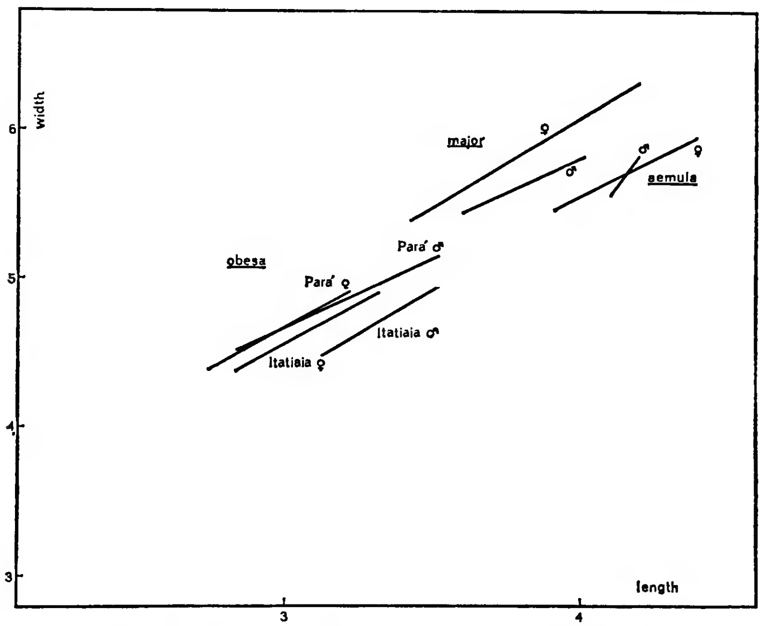
Samples		Sex	N	R_x	b		a		x_1	y_1'	x_2	y_2'	r^2
aemula + *obesa*	Pará	♀	22	2.74 - 4.40	0.925 ±	0.0272	1.89 ±	0.094	2.9	4.57	4.4	5.96	0.98
' "	'	♂	13	2.83 - 4.20	0.952	0.0558	1.80	0.201	2.9	4.57	4.4	5.99	0.96
aemula + *obesa*	Guanabara	♀	23	2.34 - 4.40	1.043	0.0495	1.45	0.172	2.9	4.47	4.4	6.04	0.96
' "	"	♂	22	2.64 - 4.20	1.110	0.0701	1.13	0.242	2.9	4.35	4.4	6.02	0.93
aemula + *obesa*	Itatiaia	♀	16	2.83 - 4.40	1.000	0.0312	1.57	0.114	2.9	4.47	4.4	5.96	0.99
" "	"	♂	10	3.12 - 4.20	1.247	0.0406	0.57	0.153	2.9	4.19	4.4	6.06	0.99
aemula + *obesa*	Barueri	♀	22	2.64 - 4.40	0.976	0.0291	1.67	0.102	2.9	4.50	4.4	5.97	0.98
" "	"	♂	21	2.93 - 4.20	1.142	0.0540	1.04	0.194	2.9	4.35	4.4	6.06	0.96
aemula + *obesa*	R.G. Sul	♀	16	3.03 - 4.40	1.023	0.0280	1.47	0.103	2.9	4.43	4.4	5.97	0.99
' "	"	♂	15	3.13 - 4.20	1.129	0.0583	1.08	0.211	2.9	4.35	4.4	6.04	0.97
major + *obesa*	Pará	♀	30	2.74 - 4.20	1.428	0.0503	0.40	0.170	2.9	4.55	4.2	6.40	0.97
"	"	♂	20	2.83 - 4.01	1.188	0.0825	1.08	0.294	2.9	4.53	4.2	6.07	0.92
major + *obesa*	Guanabara	♀	31	2.34 - 4.20	1.527	0.0504	0.03	1.171	2.9	4.46	4.2	6.45	0.97
' "	"	♂	29	2.64 - 4.01	1.409	0.0907	0.21	0.314	2.9	4.30	4.2	6.13	0.90
major + *obesa*	Itatiaia	♀	24	2.83 - 4.20	1.551	0.0854	-0.07	0.298	2.9	4.43	4.2	6.45	0.94
" "	"	♂	17	3.12 - 4.01	1.631	0.1352	-0.62	0.495	2.9	4.12	4.2	6.24	0.91
major + *obesa*	Barueri	♀	30	2.64 - 4.20	1.533	0.0643	-0.00	0.220	2.9	4.45	4.2	6.44	0.95
" "	"	♂	28	2,93 - 4.01	1.518	0.0882	-0.19	0.315	2.9	4.21	4.2	6.18	0.92
major + *obesa*	R.G. Sul	♀	24	3.03 - 4.20	1.618	0.0954	-0.33	0.335	2.9	4.37	4.2	6.47	0.93
" "	"	♂	22	3.13 - 4.01	1.521	0.0999	-0.19	0.358	2.9	4.22	4.2	6.20	0.92
aemula + *major*		♀	22	3.42 - 4.40	0.616	0.1188	3.36	0.462	3.4	5.46	4.4	6.07	0.57
" "		♂	17	3.62 - 4.20	0.602	0.1413	3.28	0.553	3.4	5.35	4.4	5.96	0.55



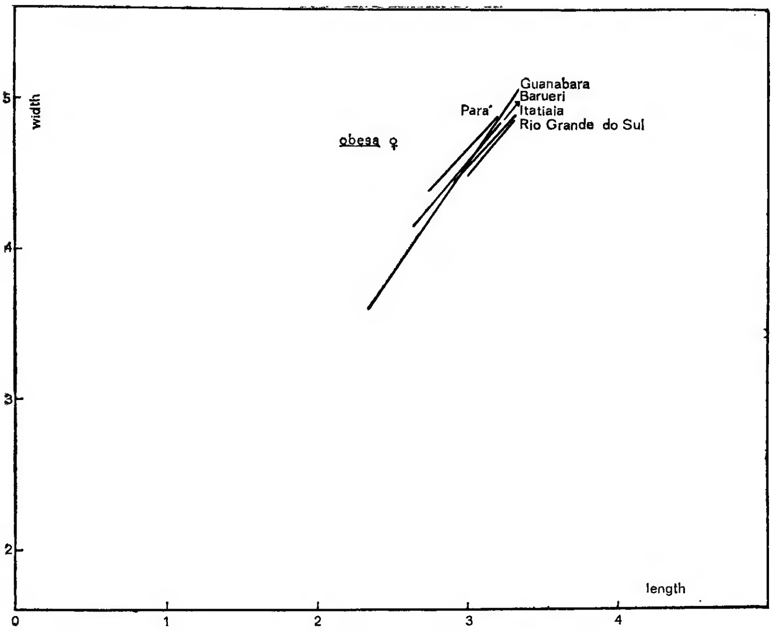


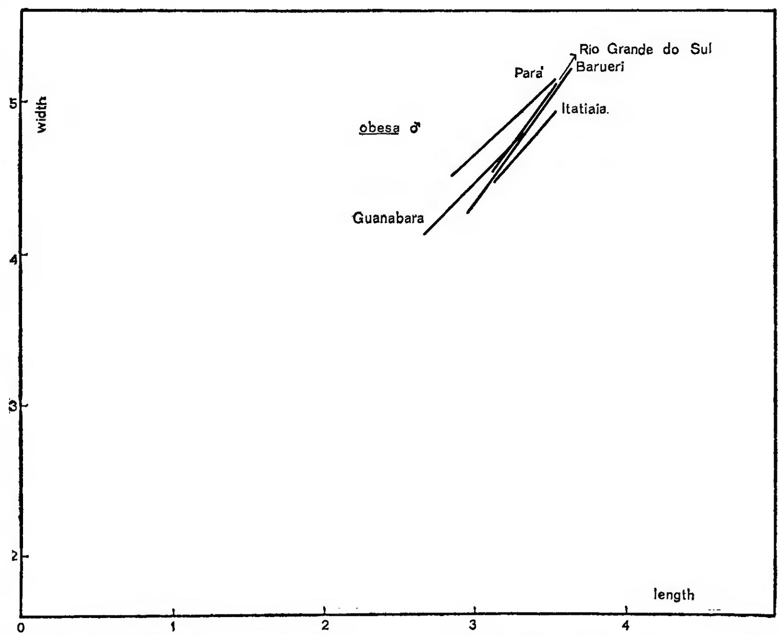
Graph 1: *Ornidia,* regression of wing width on wing length; graph 2: graphical comparison between males and females of *Ornidia obesa* Pará and *Ornidia aemula.*



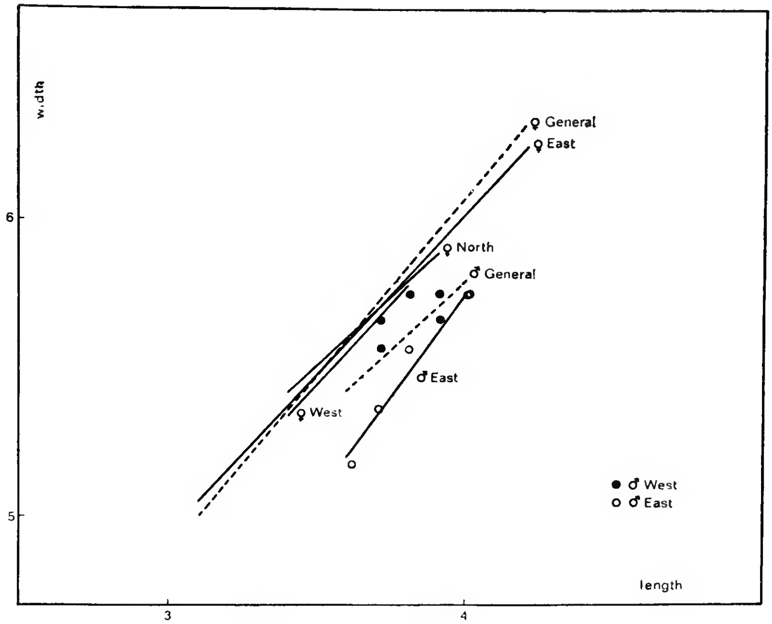


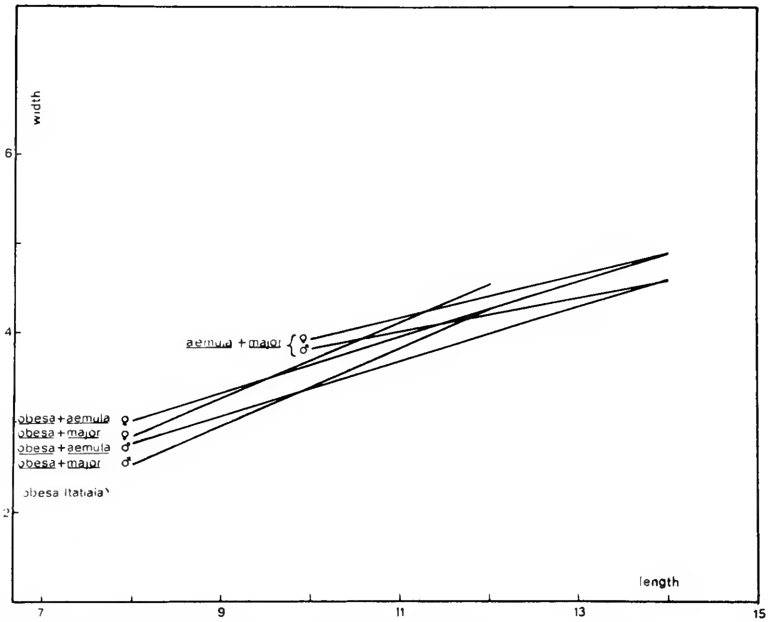
Graph 3: *Ornidia obesa,* geographical samples, regression of wing width on wing length; graph 4: *Ornidia,* regression of thorax width on thorax length.



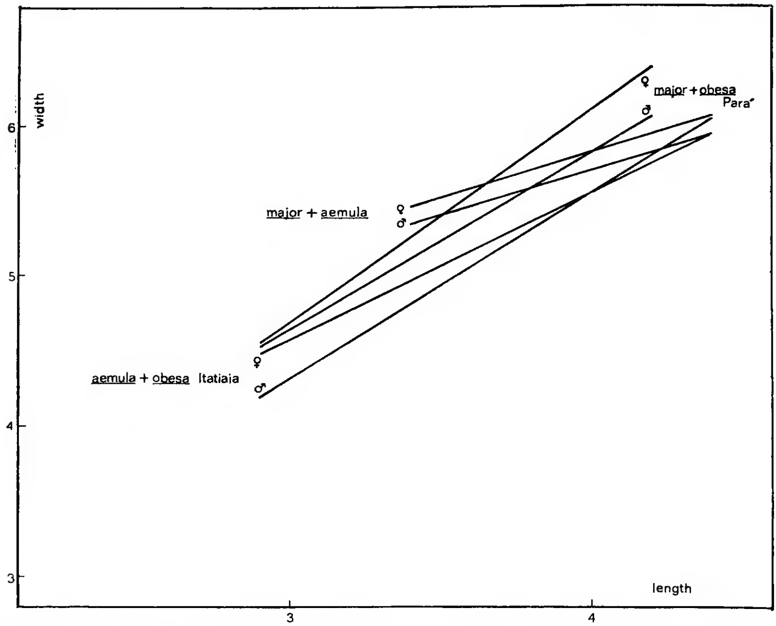


Graph 5: *Ornidia obesa,* females, geographical samples, regression of thorax width on thorax length; graph 6: *Ornidia obesa,* males, geographical samples, regression of thorax width on thorax length.





Graph 7: *Ornidia major*, geographical samples, regression of thorax width on thorax length; graph 8: *Ornidia*, additions of regressions of wing width on wing length.



Graph 9: *Ornidia,* additions of regressions of thorax width on thorax length.