

STUDY ON THE POLYMORPHISM IN  
**ZYGOTHRICA DISPAR** AND **Z. PRODISPAR**, AND  
DESCRIPTION OF **Z. LATICEPS** SP. N. (**DROSOPHI-**  
**LIDAE, DIPTERA**)

H. Burla

Centro de Pesquisa de Genética,  
Faculdade Nacional de Filosofia,  
Rio de Janeiro, Brasil

SEPARATA  
DOS  
ARQUIVOS DO MUSEU PARANAENSE  
CURITIBA

Volume X — Artigo V — Estampas XI e XII — Págs. 231 à 252

1954

TIPOGRAFIA JOÃO HAUPT & CIA, LTDA.  
CURITIBA

STUDY ON THE POLYMORPHISM IN *ZYGOTHRICA*  
*DISPAR* AND *Z. PRODISPAR*, AND DESCRIPTION OF  
*Z. LATICEPS* SP. N. (*DROSOPHILIDAE*, *DIPTERA*)<sup>1</sup>

by

H. Burla

Centro de Pesquisa de Genética, Faculdade Nacional de Filosofia,  
Rio de Janeiro, Brasil

The males of *Z. dispar* are conspicuous by their broadened heads. They vary, however, in this character, since besides male with extremely broad heads there also occur others with normal heads, as well as a complete series of intermediates (STURTEVANT 1920). Furthermore, the species varies in a number of other characters, such as body color and bristle pattern, from sex to sex and within the sexes (HENDEL 1936, STURTEVANT 1920).

A second species with broadened heads in males was described by DUDA (1927) as *Z. prodispar*. It resembles *Z. dispar* considerably. DUDA himself was not quite sure of the species rank, and gave it the designation of "new species or variety of *Z. dispar*".

In March and May of 1952, fairly large samples of both species were recorded in collections made in the Parque da Cidade of Rio de Janeiro. The flies were captured by means of sweeping a net over numerous fungi growing on a heap of cut trees. The two species were found crowded over these fungi together with other species of *Zygothrica*, especially *Z. nitidifrons* and *Z. poeyi*, and various species of *Hirtodrosophila*.

In the sample of *Z. dispar* the males with very broad and those with relatively narrow heads were frequent, while the intermediate type was rare. An investigation of the possible cause of this peculiar frequency pattern was made. On the basis of the material collected it was possible to revise the des-

---

1) Publication N.º 9 of the Centro de Pesquisa de Genética of the Faculdade Nacional de Filosofia, Rio de Janeiro, Brazil. This work was made under the auspices of the Conselho Nacional de Pesquisa, and the Rockefeller Foundation.

cription of the two species, to distinguish the females of them and to describe the polymorphism and sexual dimorphism in both species.

So far it has not been possible to breed these two species under laboratory conditions, but they develop easily from fungi and flowers which are brought to the laboratory (MAGALOGOLOWKIN 1952). A small number of such individuals were secured and compared with the specimens caught over fungi, and proved to belong to the same two species.

In a later sample of *Zygothrica* species collected by Dr. A. Brito da Cunha in Cantareira near São Paulo and kindly sent to us, two males with broadened heads but belonging to a new species were found, the description of which shall be given below. There are, therefore, now recorded three species of *Zygothrica* in which the males have broadened heads.

#### KEY TO THE SPECIES

##### Males:

- 1 Wing darkened on the front border and apically ..... 2
- Wing clear ..... 3
- 2 Head very broad, mesonotum light brown. ....
- Z. dispar*, excessive male type
- Head not or only slightly enlarged, mesonotum dark brown .....
- Z. dispar*, moderate male type
- 3 mesonotum dark brown, head as in the moderate male type of *Z. dispar*
- Z. prodispar*
- Mesonotum brownish yellow, head as in *Z. prodispar*; front shining; eight rows of acrostichal hairs ..... *Z. lateiceps*

##### Females:

- 1 Median spot on the fifth tergite not reaching the anterior border. Spermathecae relatively small, their height 37-50 micra ..... *Z. dispar*
- Median spot on the fifth tergite reaches in general the anterior border. Spermathecae relatively large, their height 73-94 micra ..... *Z. prodispar*
- The female of *Z. lateiceps* is not known as yet.

The assumption that the two male types of *Z. dispar* belong to the same species, is proved by the study of the genitalia.

The darkened wing in *Z. dispar* was already mentioned by WIEDEMANN. In males, this character allows a safe distinction between *Z. dispar* and *Z. prodispar*, workable even in observations with naked eye. The light color of the mesonotum in *Z. dispar* was likewise mentioned already by WIEDEMANN. It is less reliable than the first mentioned character, for the color of the mesonotum varies in both *Z. dispar* and *Z. prodispar*.

The question as to which species either of the two types of females belong, can be answered by means of indirect evidence only. The following facts were indicative for our giving the first-mentioned female type as *Z. dispar*: i) the median spot on the fifth tergite is, as a rule, smaller in males of *Z. dispar* than of *Z. prodispar*, ii) the body length of males of *Z. dispar* and what is supposed to be its female type is correspondingly smaller than in *Z. prodispar*, iii) our records from collections by net and from flowers show that the predominance of *Z. dispar* in males is accompanied by a predominance of the first female type.

SEXUAL DIMORPHISM IN *Z. dispar* AND *Z. prodispar*.

In *Z. dispar* and *Z. prodispar*, the following characters differ in both sexes (the differences marked with an asterisk were mentioned already by HENDEL 1936):

- 1) \* In males only, the head is broadened;
- 2) \* in males only, the position and size of various front bristles are modified in relation to the broadening of the head;
- 3) \* the color of the third antennal joint, the face and the palpi is dark in females, and light in males;
- 4) in females only, there is a dark spot on the cheek between the eye and the first oral bristle;
- 5) \* the color of the mesonotum is uniformly blackish brown in females, while in males of *Z. dispar* it varies from light yellowish brown to brown; in males of *Z. prodispar* it is either blackish brown as in females, or brown with darker longitudinal stripes;
- 6) in males of *Z. dispar* only, there is a varying number of erect acrostichal hairs on the anterior part of the mesonotum, and the wing is darkened along its anterior border and at the tip. In the same males, the color of the front varies from light brown to dark brown, while in females the front is of a uniformly blackish brown color.

With the exception of the differences mentioned under point six, all are common to both species. It is likely that these secondary sex characters are homologous traits that outlasted the evolutionary divergence of the two species from a common ancestor. However, these traits are not completely identical in both species.

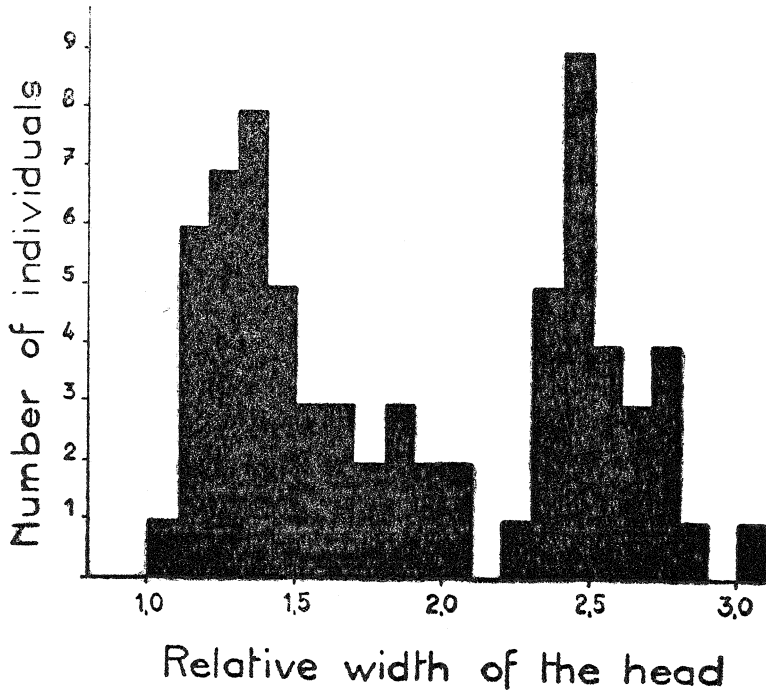
## RELATIVE WIDTH OF HEAD

Since the width of the head varies in both species, attempts were made for an objective evaluation thereof. The ratio of width of head to width of thorax seemed to be the best means for demonstrating the feature. The measuring of the width of the thorax proved to be unexact, therefore the relative width of the head was computed by the formula: width of head / length of thorax x 0.75. The last number is the rounded mean from the ratio of width of thorax to length of thorax, taken from about 20 individuals. The computed values are given in table 1. The frequency distribution of the values recorded in males of *Z. dispar* is shown in figure 1.



Table 1 — Relative width of head.

Species	Date of collection	N.º of individuals	Head broader than thorax	
			Range	Mean
<i>Z. dispar</i> , excessive male type	March 1952	13	2.31 - 2.78	2.53 ± 0.04
	May 1952	16	1.90 - 3.03	2.36 ± 0.08
	Bred from flowers	7	2.42 - 2.86	
moderate male type	March 1952	14	1.27 - 1.82	1.52 ± 0.05
	May 1952	14	1.17 - 1.67	1.36 ± 0.04
	Bred from flowers	4	1.43 - 1.89	
female	March 1952	12	1.12 - 1.25	
<i>Z. prodispar</i> , male	March 1952	20	1.28 - 1.89	1.51 ± 0.04
	female	March 1952	11	1.10 - 1.20
<i>Z. laticeps</i> , male	January 1953	2	1.41 - 1.43	
<i>Z. nitidifrons</i> , male	March 1952	5	1.03 - 1.17	

Fig. 1 — Distribution of relative width of the head in males of *Z. dispar*, two samples joined.

The data in table 1 and figure 1 show, that in males of *Z. dispar*, intermediate values of relative head width connect the extreme values. The smallest values for narrow-headed males (1.17) lies inside the range of the values drawn from females.

The existence of two types of males in *Z. dispar* is evident in the frequency histogram. It is rather unlikely that the influence of the environment would account for the appearance of the two types within the same population, and we shall therefore look for another explanation.

In the few males reared from flowers the two types were found simultaneously.

In *Z. prodispar* the broadening of the head amounts to about the same as in the moderate male type of *Z. dispar*, regarding both mean and range.

#### ALLOMETRIC BROADENING OF THE HEAD

In males of *Z. dispar* and *Z. prodispar*, the broadening of the head was observed to be related to the body size, as in large males the head is broader than in small ones. The pairs of the log values of the two variates, thorax length and width of head, are plotted in fig. 2. In such a representation, a regression coefficient significantly higher than 1 is proof of an allometric growth of the dependent part of the body (HUXLEY, 1932). In a and b of fig. 2, the upper groups of points together with their corresponding lines show the conditions in the excessive male type of *Z. dispar*, while the points and lines below represent the moderate male type. The limit between the two types is set arbitrarily, based on the distinction made in fig. 1.

In both samples of *Z. dispar*, the upper line is shifted toward the left when compared with the lower line. Moreover, the slope of the regression line of the moderate male type collected in May is significantly different from the line of the excessive male type of the same sample, and from the line of the moderate male type of the first sample (Table 2).

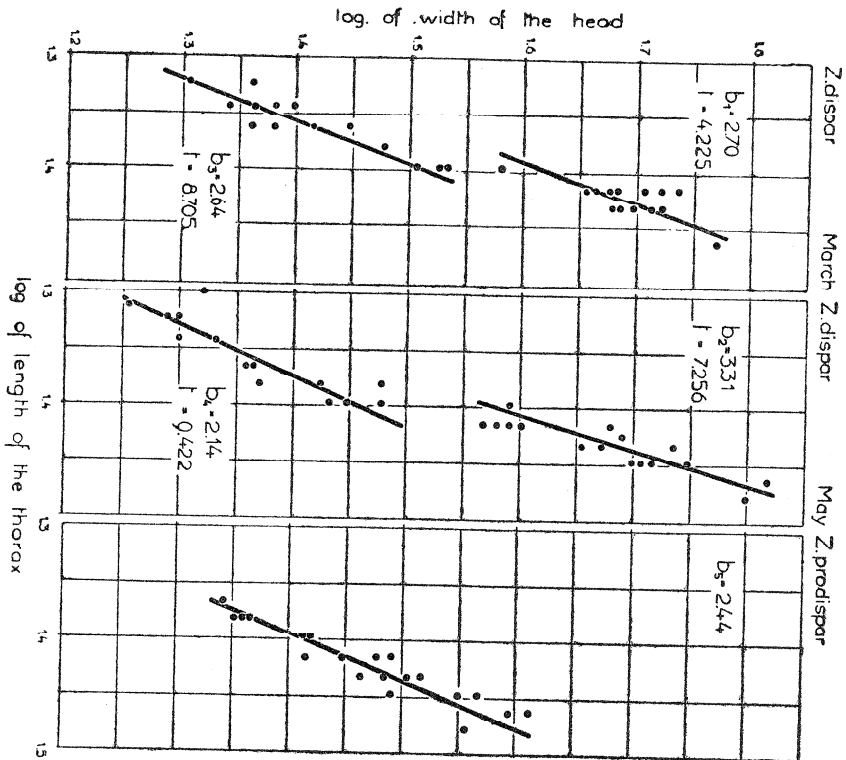


Fig. 2 — Allometric growth of the head in *Z. dispar* and *Z. prodisspar*. The lines indicate the logarithmic regression. In *Z. dispar*, the upper lines represent the excessive male type, and the lower lines the moderate male type.

Table 2 — Difference between the regression coefficients; test of significance.

Difference between	t	p
$b_1$ and $b_2$	2.673	0.01 — 0.02
$b_3$ and $b_4$	5.929	> 0.001
$b_1$ and $b_3$	0.277	> 0.05
$b_2$ and $b_4$	10.081	> 0.001

Assuming that the width of head depends upon the body size, the regression lines obtained indicate a strong positive

allometry governing the broadening of the head. It remains to decide whether these findings may explain why the relative width of head shows a bimodal frequency distribution (fig. 1). Three possible explanations shall be considered.

1) The two male types of *Z. dispar* might differ genetically regarding width of head. According to the presence of one or the other of a pair of genetic factors, an individual will belong to the upper or lower group of points in fig. 2, irrespective of its body size. This hypothesis would explain the shift toward the left of the upper lines. However, this shift is not pronounced enough. It would have to be assumed that as a secondary event, the thorax length would become increased in males with genetically broad head, resulting in placing the upper curve toward the right again.

2) Assuming that in fig. 2 the division of the regression line in an upper and a lower half is only artificial, and that, in reality, the points of both male types fit into one straight line, it would be necessary to postulate the existence of two genetically different types of growth, whereby the same coefficient of allometry would make the lot of the small individuals relatively narrow-headed, and the lot of the large individuals relatively broad-headed. In this case, the thorax length ought to show a bimodal frequency distribution too. A test of normality (SNEDECOR, 1950) revealed in both samples a slight negative kurtosis in the distribution of the thorax lengths, which, however, was far from being significant. The same result was obtained when putting the two samples together.

3) It looks as if the points of each sample would fit into one slightly S-shaped curve. Such an allometric curve would account for the bimodal frequency distribution shown in fig. 1, for in the very steep middle part of the curve, the widths of head would vary more than in the flatter parts. This third explanation seems at present the most satisfactory one.

As regarding the significant aberration of  $b_1$  from the others, further samples should be studied until its meaning can be understood. The line may be aberrant by mere error of sampling, or may be the consequence of shifts within the population, possibly due to environmental influences.

Also for *Z. prodispar* allometric broadening of the head is demonstrated (fig. 2, c). In this species, the slope of the

regression line is intermediate between the slopes of the two lines of the moderate male type of *Z. dispar*. The relative width of the head in *Z. prodispar* is about the same as in the moderate male type of *Z. dispar* (Table 1). The shift of the line toward the right and above when compared with *Z. dispar*, corresponds with the body size of *Z. prodispar*, larger than of the moderate male type of *Z. dispar*.

#### CONTRIBUTION OF THE FRONT TO THE BROADENING OF THE HEAD

The most striking feature of the extremely broad heads of the excessive male type of *Z. dispar* is the laterally protruding and pointed eyes. However, the basal parts on which the eye cones rest, i. e. the front, the occiput and the cheeks are also enlarged (fig. 3.)

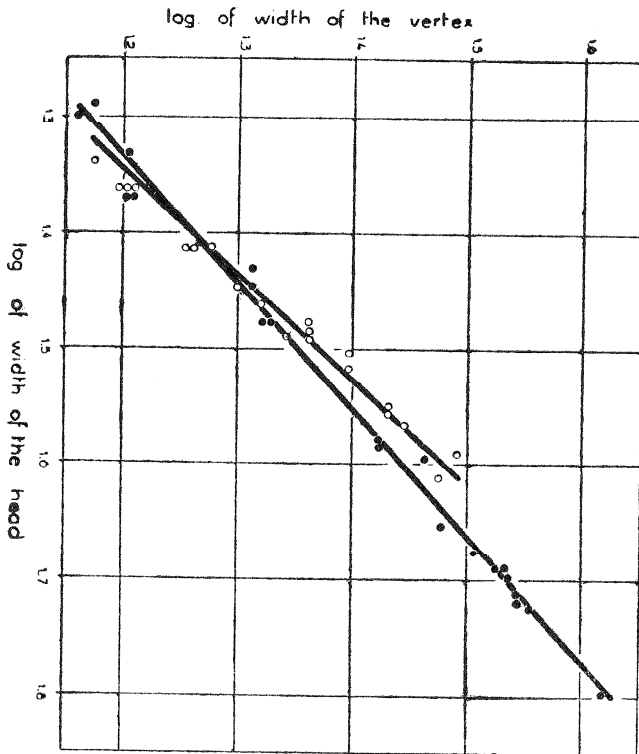


Fig. 4 — Allometric growth of the vertex in *Z. dispar* (black points) and *Z. prodispar* (white points).

In fig. 4, the width of the vertex is plotted against the width of the entire head, the log values being used again. For both species, the slope of the lines is close to 1, indicating that the proportion of the vertex to width of head remains roughly the same in all the males. In *Z. prodispar*, the difference of  $b = 1.118$  from 1 is not significant, while in *Z. dispar*  $b = 0.917$  is significantly lower than 1 ( $t = 4.219$ ), proving a slightly negative allometric growth of the vertex.

The broadening of the front is paralleled by a distortion of its different parts, most evident in the region of the vertex. In the excessive type, the orbits are enormously broadened on the upper part, which is separated from the front part by a furrow wherein the middle orbital bristle is situated. On both sides of the large heart-shaped ocellar triangle the edges of the vertex are concave. The lateral borders of the vertex are parallel, while they are divergent in females, as well as in the moderate male type and in males of *Z. prodispar*. This difference is due to the fact, that the line of the longest distance between the eyes, which in females lies in the region of the neck on the occiput, moves upward to the vertex with increasing width of head.

#### MODIFICATION OF THE FRONT BRISTLES

In both species the position and the size of the front bristles vary with increasing width of head. Males with narrow heads have the same bristle pattern as the females, while in broad heads the ocellars and the orbitals are smaller and the middle orbital moves outward, becoming minute or lacking altogether in excessively broad heads. On the vertex there appears a row of stiff, erect occiput bristles which in *Z. prodispar* are at most as long as the postverticals, while in the excessive male type of *Z. dispar* they may become longer than normal verticals. The verticals themselves become also stronger than normal. The modification, therefore, follows a scheme, which consists of an accentuation of the vertex by a number of long, erect bristles, and a reduction of the front bristles situated in front of the vertex.

#### VARYING NUMBER OF ERECT ACROSTICHALS

In the excessive male type of *Z. dispar*, a group of vertically erect acrostichal and dorsocentral hairs situated in the



foremost part of the mesonotum can be observed. These hairs are about twice as long as the flat hair of the posterior part of the mesonotum. Some flat hairs are intercalated between the erect ones, and others have an intermediate direction, but all these are also enlarged, while in females no enlarged hairs can be found on that region of the thorax. In moderate males of *Z. dispar* the erect hairs are less numerous or completely absent, and shorter. In fig. 5 the number of vertically erect hairs is plotted against the relative width of head for each of 28 males. The regression is highly significant statistically.

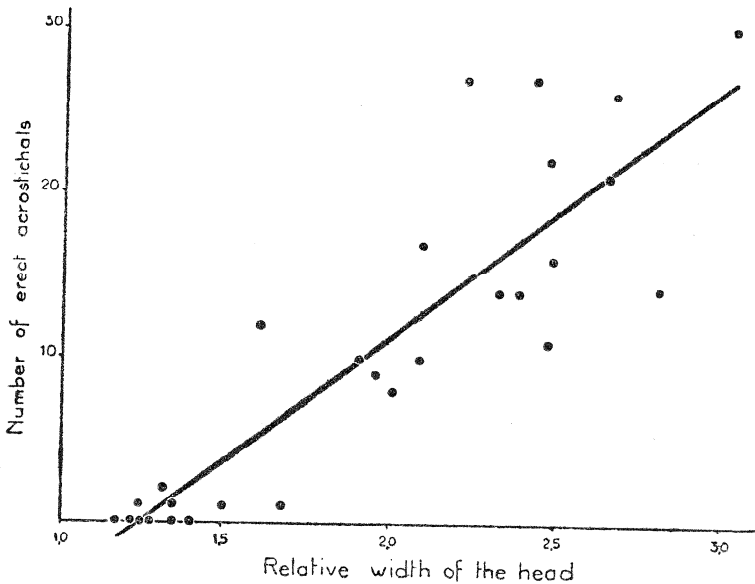


Fig. 5 — Regression of number of erect acrostichal hairs on relative width of the head, in males of *Z. dispar*.

There is a strong analogy between this characteristic and the enlargement of occiput bristles mentioned in the foregoing section. In both cases bristles are affected in a similar way, and the degree of affection is depending upon the width of the head. It is possible that the erection and enlargement of the thorax bristles is an incident, brought about by diffusion of inducing substance, during metamorphosis, from the region of the vertex where giant growth is primarily induced.

## VARIATION IN THE COLORATION OF THE MESONOTUM

In about three fourths of the females of the two species, the mesonotum is lighter, but still dark brown. In two fifths of the females a pattern of two longitudinal stripes is found, irrespective of the lighter or darker timbre of the color of the mesonotum.

In males of *Z. prodispar*, the lighter mesonotum is more frequent than the blackish brown one, and as a rule two broad longitudinal stripes are visible, but the ground color is always darker than in the darkest males of *Z. dispar*. Judging from the material observed, the different types of coloration in *Z. prodispar* are not only determined by age, but represent a true polymorphism. However, the delimitations between these types are rather vague and the character is not easily applied for investigative purposes.

In *Z. dispar*, the males of the excessive type have, as a rule, a uniformly yellowish brown mesonotum. In some darker individuals very irregular spots can be seen, forming two indistinct longitudinal stripes, and a lateral spot in front of the transverse suture. When killed, the unspotted males become darker and slightly spotted within a few hours. In the moderate male type, the lateral spot is always present, the longitudinal stripes are rather distinct, and the ground-color varies from light grayish brown to brown. When comparing the coloration of the mesonotum in the two types of males, broad heads seem to be associated with a light mesonotum, and narrow heads with a dark mesonotum. Of thirty freshly killed males collected in May, the color intensity of the mesonotum has been estimated by means of a scale ranging from 1 = very light, to 5 = very dark. The estimated values were compared with the relative width of the head of the individuals tested and a regression computed which proved to be significant ( $t = 4.6$ ). Similar results could be obtained by comparing the color intensity of the front or of the dark pattern of the tergites, in both cases the excessive males being distinctly tically that in the excessive males the pigmentation of the large eyes affects the pigmentation of the other parts of the body.

## VARIATION IN THE COLOR PATTERN OF THE ABDOMEN

In both species there is a slight variation in the color

pattern of the tergites (fig. 6). This may partly be due to differences in age, assuming that it takes a relatively long time for the flies to develop their final color pattern after hatching from the pupae. On the other hand, variability irrespective of age is evident in those cases, in which obviously young specimens show a greater extension of the dark areas than fully colored ones.

In the key to the species, the spot on the fifth tergite is used as a discriminating character for females. It is, however, not very reliable, since the extension of the spot varies in both species. In 44 females of *Z. dispar*, all with small spermathecae, only 30 showed the median spot being of a characteristically small size. In seven other females the spot was abnormally small, while in the remaining seven females the spot was very large, reaching the anterior border of the tergite as in females of *Z. prodispar*. In 25 females out of the 44 examined, a lateral spot occurred on the same tergite, and in some of these females it was even connected with the median one by a dark marginal band. It is evident that for a safe determination of single females, the size of the spermathecae is the only reliable character.

In the excessive male type of *Z. dispar*, the dark pattern is lighter than in the moderate male type, as already mentioned in the foregoing section.

#### DESCRIPTION OF SPECIES

To our knowledge the only description of *Z. dispar* which allows the exclusion of males of *Z. prodispar*, is the one by WIEDEMANN. A full modern description of the species follows. The description of *Z. prodispar*, by DUDA, is based on a single male. The female shall be described below, and it would seem worthwhile to include also a differential description of the males.

✓ *Zygothrica dispar* WIEDEMANN, 1830.

List of synonyms see STURTEVANT (1920, 1921).

Male, excessive type. Head (fig. 3) 2 — 3 times larger than the thorax. Antennae tannish white, length of third joint 2.4 — 2.8 of its width, or 2.1 — 2.4 of the length of the second joint. Arista with 8 — 10 branches, 1 — 2 below basal to the terminal fork. Front light brown, shining, lunula and vertex darker brown, ocellar triangle and orbits more brilliant. Ocellar triangle large, with convex lateral bor-

ders reaching the anterior border of the front. Orbits strongly enlarged posteriorly. Outer vertical bristle at the same level as the inner one and close to it. Posterior reclinate orbital twice as distant from the inner vertical as from the proclinate orbital. The minute middle orbital sometimes lacking, if present, it is always situated outwards the other two orbitals. A row of long, erect bristles on the vertex, which are probably homologous to the hairs bordering the eye on the occiput. About 10 hairs on the anterior pair of the front. Face almost white, its inferior border prominent (fig. 7); carina high, long and prominent, with narrow back. One strong vibrissa, the four other orals minute. Proboscis tannish white, apex brown. Palpi whitish. Cheeks white, forming a basal prolongation of the eye. Distance from vibrissa to eye 0,3 of greatest distance from inferior eye border to apex of eye. Eye dark red, almost bare, conical, the ommatids growing in size gradually toward the apex of the cone, where they are extremely large and partially confluent.

Mesonotum and scutellum slightly shining, light yellowish brow. In a few males there are visible two very indistinct longitudinal strips, which are only a little darker than the surrounding area and are confluent posteriorly. Pleurae brownish white. Acrostichals in 6 rows. About 20 erect and enlarged bristles on the anterior part of the mesonotum. Two humerals. Anterior scutellars convergent. Sterno index 0.4. Legs brownish white; apical of the first tibia small, yellow, of the second tibia very strong, dark. Preapical of the first tibia very small, of the third tibia distinct. Wings (fig. 8) darkened along the front border and apically, otherwise clear, veins light tan. Two bristles at apex of first costal section. Third costal section with heavy bristles on its basal  $2/5$  —  $3/5$ . Costal index 2.2 — 2.6; 4th vein index 1.3 — 1.4; 5x index 1.1 — 1.8 (10 wings measured). Halteres brownish white.

Tergits of abdomen shining, yellowish, with a tan pattern shown in fig. 6. Genital arch more shining than the tergits.

Length of body (in live specimens) 2.7 — 3.5 mm,

length of wing 2.5 — 3.1 mm (16 specimens measured).

The genital apparatus was described by MALOGOLOWKIN (1952), see also fig. 9 and 10.

**Internal characters** — Malpighian tubes tannish white, the distal part of the anterior tubes bent backwards, white; posterior tubes fused apically with continuous lumen. Proximal part of the testes a colorless, fine tube, apically dilated to form two white coils; distal part yellow with 4 large coils. Ejaculatory sac with two minor globular diverticula.

Male, moderate type. Differs from the excessive male type in the following characters: Head 1.2 — 2.0 times wider than the thorax, the smaller number lying within the range of the respective ratio in females. A number of characters that are obviously connected with the broadening of the head vary from the condition typical in females to that

typical in excessive males; compared with the latter, the front is darker, the ocellar triangle is narrower with almost straight lateral borders, on the vertex there are fewer and smaller or no accessory bristles. Furthermore, the mesonotum is darker ranging to brown, the longitudinal stripes being always present, and the erect acrostichals on the anterior part of the mesonotum are smaller and fewer or completely lacking. Dark areas on the tergites (fig. 6) black.

Length of body (in live specimens) 2.3 — 2.0 mm,

length of wing 1.9 — 2.6 mm (14 specimens measured).

Regarding the internal characters as well as the genital apparatus the two types of males proved to be alike.

Female. Head 1.1 — 1.25 times broader than the thorax. Third antennal joint dark tan, length 2.0 — 2.5 of width. Front blackish brown, dull. Orbits, a narrow margin along the eye and ocellar triangle tan; orbits narrow anteriorly, widely broadening toward the vertex. Ocellar triangle shining. Outer vertical bristle rather distant from the inner one. Proclinate orbital 0.9 — 1.0 of length of posterior reclinate, the latter situated in the middle between the proclinate and the inner vertical or a little closer to the former. Middle orbital closer to the proclinate than the posterior reclinate, 0.6 — 0.7 of length of the former. Face grayish brown. Vibrissa resting in a small dark cone. Palpi grayish brown, the base lighter. Cheeks with a dark grayish or blackish spot between the vibrissa and the eye; width of cheek 0.4 of greatest diameter of eye,

Mesonotum and scutellum dorsally dark brown to blackish brown, lighter laterally. In two fifths of the specimens observed two longitudinal stripes were present. Wings clear. Costal index 1.8 — 2.4 (10 wings measured).

Tergites of abdomen (fig. 6) with black pattern, anal tubercle grayish.

Length of body (in live specimens) 2.7 — 3.8 mm,

length of wing 2.4 — 3.3 mm (12 specimens measured).

The vaginal plate was described by MALOGOLOWKIN (1942), see also fig 11.

Internal characters — Ventral receptacle proximally with about six coils, the last being rather large, and distally with one and a half loops. The three parallel arms forming a U of which the lateral parts point to the front and are wavy. Spermathecae (fig. 11, see also MALOGOLOWKIN 1952) hatshaped, light brown, the apical surface covered with small protuberances; height 27 — 50 micra (17 measurements).

Eggs with two minute apical filaments that are scarcely longer than the micropyle and much thinner.

Distribution — The type material was collected in Brazil (WIEDEMANN, 1830). The identification of the other ma-

terial recorded (see STURTEVANT 1921 and HENDEL 1936) should be checked, since confusion with *Z. prodispar* is possible. In Rio de Janeiro it seems that the species occurs during the whole year (Dr. Frota-Pessoa, personal communication, and MALOGOLOWKIN, 1952). During two collection trips in March and May 1952 to the Parque da Cidade, Rio de Janeiro, hundreds of individuals were observed that concentrated over fungi on a few square meters. On other days within and after the same period, the fungi had disappeared and not a single individual of the species could be collected at that place.

Part of the specimens will be deposited in the Museu Nacional of Rio de Janeiro.

✓ *Z y g o t h r i c a p r o d i s p a r* DUDA. 1927.

Male. Differs from the moderate male type of *Z. dispar* in the following characters: Front tan. Mesonotum dark brown or blackish brown; in lighter individuals two broad longitudinal stripes are visible. No erect acrostichal bristles. Wings clear. Costal index 1.9 — 2.5; 4th vein index 1.2 — 1.7; 5x index 1.2 — 1.6 (10 measurements). Abdominal pattern blackish brown (fig. 6).

Length of body (in live specimens) 2.9 — 3.5 mm,

length of wing 2.5 — 2.9 mm (8 specimens measured).

Genital apparatus (fig. 9 e 10) — Point of the genital arch a little projected forming a curved line together with the inferior border of the forceps. In *Z. dispar* this line is straight. Forceps with 13 — 17 strong bristles (in *Z. dispar*: 11 — 13), 10-13 of which form a posterior regular row (in *Z. dispar*: 7 — 8). The anterior bristles of this row are as long as the largest bristles on the median margin of the forceps, in *Z. dispar* the former are relatively short. Penis shorter but thicker than in *Z. dispar*. The apodem of the penis does not surpass the hypandrium.

Internal morphology — In some specimens the Malpighian tubes are orange or yellow.

Female. Differs from the males of the same species as well as from the females of *Z. dispar* in the following characters: Arista with 8 — 11 branches. Median spot on the fifth tergite (fig. 6) reaches as a rule the anterior margin of the tergite. The dark zone on the 8th tergite interrupted in the midline.

Length of body (in alive specimens) 3.2 — 3.9 mm,

length of wing 2.7 — 3.1. mm (4 females measured).

Vaginal plate with 11 black stout bristles arranged in two lines, the dorsal one containing 3 bristles (2 in *Z. dispar*).

Internal morphology — Spermathecae (fig. 11) without protuberances on the apical surface; height 73 — 94 micra (12 spermathecae measured).



Distribution — Since the species has not been distinguished from *Z. dispar* in every instant, little is known about its distribution. It is probable that the two species are sympatric over a wide area. In the two trips in which we collected *Z. prodispar*, it formed a mixed population with *Z. dispar* and with a number of other species of *Zygothrica* and *Hirtodrosophila*. Furthermore, it developed from flowers together with *Z. dispar*. In both cases *Z. prodispar* proved to be less numerous. DUDA recorded it from Peru. Between the description by DUDA and the form described herewith, there exist, however, a number of small differences:

Character	MALE	MALE
	<i>Z. prodispar</i> in Duda 1925	<i>Z. prodispar</i> collected in Rio
Postverticals	minute	as long as the proclinate orbital
cheeks between vibrissa and rear angle	bare	3—4 minute orals
color of 7th tergite	yellow	dorsally brown in every specimen
anal papille	yellow	brown

The male on which DUDA based the description was collected 16 years before, therefore the differences mentioned above may largely depend on damage of some kind of the type individual.

Part of the specimens will be deposited in the Museu Nacional of Rio de Janeiro.

### ✓ *Zygothrica laticeps* n. sp.

Male. Head about 1.5 times broader than the thorax. Antennae yellow, third joint a little darker. Length of third joint about twice its width, and more than twice the length of the second joint. Arista with 9 branches, two below basal to the terminal fork. Front (fig. 12) enlarged, brilliant, brownish yellow. Proclinate orbital stronger and longer than the posterior reclinate one. Face light yellowish brown, its inferior border prominent; carina high, long and prominent, with narrow back. One strong oral, the others minute. Proboscis yellowish white, slender, long. Palpi yellowish white. Distance from vibrissa to eye 0.33 of greatest distance from inferior eye border to apex of eye. Eye dark red, almost bare, conical.

Mesonotum and scutellum slightly shining, brownish yellow, without the slightest indication of longitudinal stripes. Acrostichal hairs in 8 or more irregular rows. Two humerals. Anterior scutellars convergent. Pleurae

whitish yellow. Stern index about 0.4. Legs whitish proximally, and yellow distally. Apicals on the midleg, preapicals on the hindleg.

Wings clear, veins tan. Two bristles at the distal costal break. Heavy bristle index about 0.6. Costal index about 2.4; 4th vein index about 1.1; 4c index about 0.7; 5x index about 1.3. Halteres brownish yellow.

Tergites yellow, with the following blackish brown pattern: on the second, third and fourth tergites broad marginal bands which have a median incision that almost reaches the posterior border of the tergites; on the fifth, sixth tergites and on the genital arch a median marginal spot. Length of body 3.2 mm, length of wing 2.9 mm.

Genital apparatus (fig. 12) — On the distal part of the forceps there are three rows of bristles one behind the other, the bristles of the two outer rows being dent-like. The outermost (lateral) row is prolonged proximally and reaches the proximal border of the forceps. The inferior border of the genital arch is straight, the heel forming a right angle, and on the slightly pointed toe there are two small bristles. Anal plates acuminate distally. Penis very broad in the preapical region, distally pointed and with a cleft.

Internal characters — Malpighian tubes as in *Z. dispar*. Testes similar to that of *Z. dispar*, completely yellow, with two inner and 7 outer coils. Ejaculatory sac with two diverticula that are about twice as long as the sac.

Distribution — Two males from Cantareira, near São Paulo, Brazil. These specimens, as well as the slides with mounted parts, deposited in the Museu Nacional, Rio de Janeiro.

Diagnosis and discussion — *Z. laticeps* belongs to the species of *Zygothrica* of which the males have broadened heads. It is characterized by a shining front, an intense brownish yellow color of front and mesonotum and by clear wings. From *Z. dispar* and *Z. prodispar*, the only two neotropical species of *Zygothrica* hitherto known to have enlarged heads in males, it differs also by the median incisions of the dark marginal bands of the tergites, by the eight rows of acrostichal hairs, by the shape of the penis and the bristle pattern of the forceps. It resembles *Z. nitidifrons* in the intense, relatively light color of the mesonotum and front, in the eight rows of acrostichal hairs and in the anterior dorsocentral bristles which are reduced in size. However, in addition to the male genitalia being different in both species, *Z. nitidifrons* has dark longitudinal stripes on the mesonotum lacking in *Z. laticeps*, and no enlarged heads in males. By the use of DUDA's key (1927) one might also arrive at *Z. laevifrons* of which only the female was described, which however, has six rows of acrostichal hairs and a distinctly banded mesonotum.

## ACKNOWLEDGMENTS

The writer wishes to express his gratitude to P. - D. Dr. S. Rosin, Bern, for continuous advice in the statistical treatment of the data; to Mrs. Margot Berlin of the Rockefeller Foundation in Rio de Janeiro for revising the English text; to Dr. O. Frota-Pessoa for useful criticism and suggestions concerning the systematic part of the work; to Dr. Chana Malogolowkin and Dr. O. Frota-Pessoa for their assistance in making the excursions; to Dr. J. Lyra Madeira for reading the manuscript.

## SUMMARY

1. In *Zygothrica*, two species are known in which the males have broadened heads, *Z. dispar* and *Z. prodispar*. They resemble each other considerably but can be distinguished by means of a few characters. A third species, *Z. laticeps* n.sp., is described.

2. In addition to the broadening of the head in males, there exist other sexually dimorphic traits in *Z. dispar* and *Z. prodispar*, such as the coloration of the antennae, face, palpi, cheeks and mesonotum. Typical for *Z. dispar* only is the sexual dimorphism consisting in darkening of the wings and the occurrence of erect acrostichals, in males.

3. The relative width of the head is expressed in term of the ratio of width of head to width of thorax. In males of *Z. dispar* this ratio ranges from 1.2 (i.e. normal, as in females or other species) to 3.0. In males of *Z. prodispar* the ratio ranges from 1.2 to 1.9.

4. In males of *Z. dispar*, the frequency distribution of the relative width of head is bimodal. Two types are therefore distinguishable the excessive type of broad-headed males and the moderate type of narrow-headed males.

5. The broadening of the head in males is shown to be governed by a positively allometric growth process. It is assumed, that in *Z. dispar* the logarithmic curve of allometry is S-shaped. This would best explain the bimodality of the frequency histogram of the relative width of the head.

6. The relative width of the vertex remains roughly the same in narrow and broad heads. The logarithmic lines of allometry for the vertex prove to have a different slope in both species studied.

7. With broadening of the head, the bristle pattern of the front changes, leading to an accentuation of the vertex by strong and erect bristles, and to a reduction in size of bristles of other parts of the front.

8. In males of *Z. dispar*, the number of erect acrostichals ranges from zero in some males of the moderate type, to 30 in a male of the excessive type. The regression of the number of the erect acrostichals on the width of the head is statistically significant.

9. The coloration of the mesonotum is variable in males and in females of both species. In males of *Z. dispar*, broad heads are associated with a light color of mesonotum, and narrow heads with a darker color.

10. The variability of the abdominal color pattern is described.

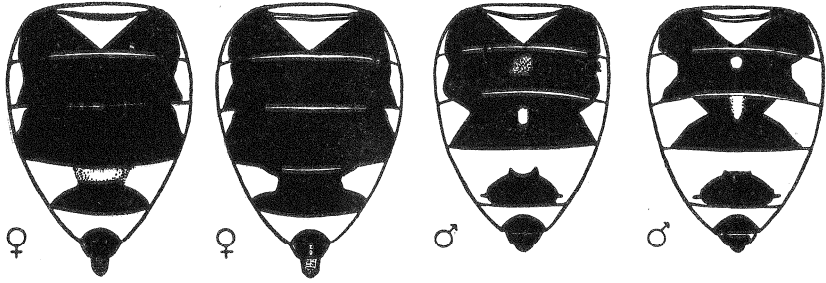
11. A redescription of *Z. dispar* and *Z. prodyspar* are given, as well as a description of the new species *Z. laticeps*.

#### BIBLIOGRAPHY

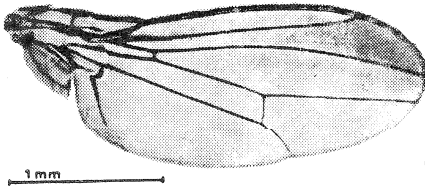
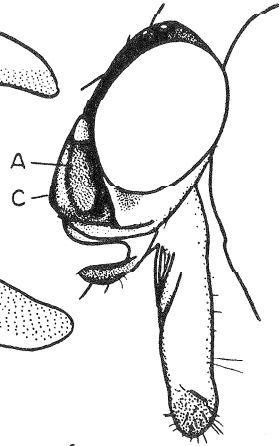
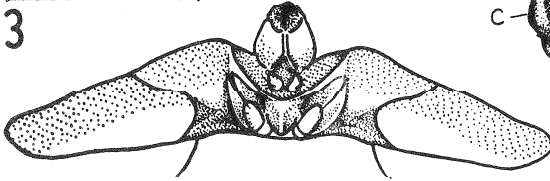
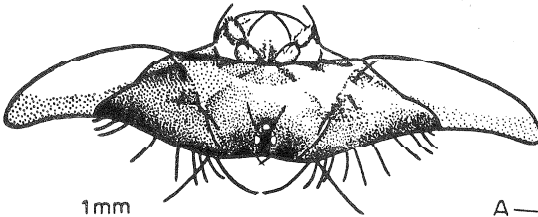
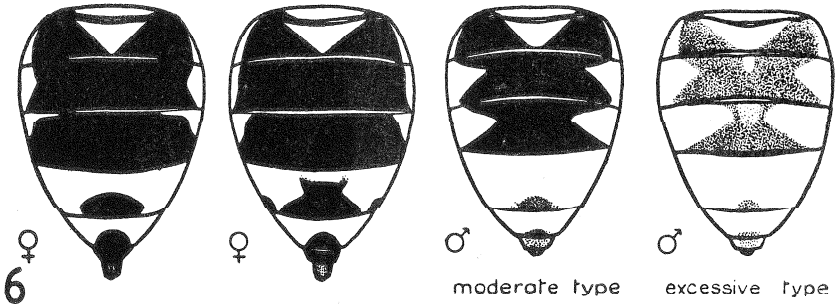
- DUDA, O., 1925, Die costaricanischen *Drosophiliden* des Ungarischen National-Museums zu Budapest. Ann. hist.-nat. Mus. hung. 22: 149-220.
- DUDA, O., 1927, Die südamerikanischen *Drosophiliden* (Dipteren) unter Berücksichtigung auch der anderen neotropischen sowie nearktischen Arten. Arch. f. Naturg., 1925, 91 A 11-12: 1 — 228.
- HENDEL, F., 1936, Ergebnisse einer zoologischen Sammelreise nach Brasilien, insbesondere in das Amazonasgebiet, ausgeführt von Dr. H. Zerny. Ann. nat.-hist. Mus. in Wien, 47:61-106.
- HUXLEY, J., 1932, Problems of relative growth. London.
- MALOGOLOWKIN, C., 1952 Notas sobre "*Zygothrica dispar*" (Diptera, *Drosophilidae*). Rev. Brasil. Biol., 12(4):
- STURTEVANT, A. H., 1920, The dipterous genus *Zygothrica* of Wiedemann. Proc. U. S. Nat. Mus. 50:155-156.
- STURTEVANT, A. H., 1921, The North American species of *Drosophila*. Carneg. Inst. Wash. Publ. 301. 150 pp.
- WIEDEMANN, C. R. W., 1830, Aussereuropäische zweiflügelige Insekten, 2. Teil. Hamm. p. 507.

- Fig. 3** — Head of the excessive male type of *Z. dispar*, seen from above and below.
- Fig. 6** — Variation in the banding pattern of the tergites in *Z. dispar* and *Z. prodispar*, schematically.
- Fig. 7** — Head of *Z. dispar*, female. C., carina; A, third antennal segment.
- Fig. 8** — Wing of the male of *Z. dispar*.
- Fig. 9** — Male genitalia of *Z. prodispar* (a and b), and *Z. dispar* (c).  
A, anal plate; B, bridge connecting the two forcipis;  
F, forceps; GA, genital arch; H, heel; P, point of the genital arch; VA, ventral process of the anal plate.
- Fig. 10** — Hypandrium and penis of *Z. dispar* (a and b) and *Z. prodispar* (c). AP, apodem of the penis; H, hypandrium.
- Fig. 11** — Female genitalia in *Z. dispar* (a and b) and *Z. prodispar* (c).
- Fig. 12** — *Z. laticeps* male: a, head; b, abdomen; c, genitalia; d, hypandrium; e, penis.

Z. prodisar



Z. dispar



6 ♀

3

moderate type

excessive type

8

7



