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Author(s): H. G. Kribs

Source: *Biometrika*, Vol. 6, No. 1 (Mar., 1908), pp. 103-105

Published by: [Biometrika Trust](#)

Stable URL: <http://www.jstor.org/stable/2331559>

Accessed: 18/06/2014 20:39

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Interval 8.

Ordinary interpolation gives	Line 1, 1 gives	Line 1, 2 gives	Line 1, 3 gives	Line 1, 4 gives
0, 1	1, 1	1, 2	1, 3	1, 4
0, 2	2, 2	2, 4	2, 6=2, 3	
0, 3	3, 3	3, 6=3, 2		
0, 4	4, 4			

Average interval in $x = 5.71$

" " " $y = 13.71$

Maximum interval in $x = 8$

" " " $y = 32$

The interval 9 gives quite a good result, certainly better than 8, but considering the fewer number of values that would be required 11 seems preferable to either, and it is far better than the common decimal interval. When the number representing the interval has factors the "interpolation-lines" do not give as many values as they do when a prime number is used because, owing to the factors, there is repetition.

6. *Conclusions.* The conclusions to which these notes lead us would seem to be

- (1) that interpolation can be effected by means of the ordinary one-variable formulae in n -dimension tables;
- (2) that the method *can* give reasonably accurate results;
- (3) that if the intervals can be chosen, (a) the same interval in all the variables will generally be better than different intervals even if the latter are rather smaller, and (b) the interval should be given by a prime number.

II. Note on the Relative Variability of the Sexes in *Carabus auratus*, L.

By H. G. KRIBS.

(From the Zoological Laboratory of the University of Pennsylvania.)

The majority of biometrical investigations, which have been made regarding the comparative variability of the sexes as such, seem to have been confined to the human species*. Many observations have been made among lower organisms however, on the existence and variability of secondary sexual characters, or those morphological differentiations, apart from the sexual organs *per se*, by which the male is easily distinguished from the female of the same species. The possible significance of secondary sexual characters for evolution was first pointed out by Darwin†, as suggested by the disproportionate development of these characters in the males and females of the same species where sexual dimorphism is present, and by the difference in behaviour seemingly correlated with it. The data furnished by Darwin covered a wide range in the animal kingdom, and his conclusions have received very general acceptance.

One conclusion reached by Darwin was that in a bisexual species the female ordinarily lies closer to the morphological norm of the species than the male, and that her contribution in reproduction is inherently conservative and tends to maintain the organic stability of the norm. The male, on the other hand, was thought to vary considerably more about the species, norm.

[* The relative variability of the sexes has been dealt with in crabs, wasps, toads and a variety of other published cases, not hitherto collected together, but all tending in much the same direction as in *Carabus auratus*. Ed.]

† *Descent of Man*, Chap. VIII.

Entirely lacking in definite quantitative evidence in its favour, this general point of view regarding the relative variability of the sexes has been widely prevalent among biologists. Now it is obvious that if this generalization is a valid one the general principle involved should find expression, in some measure at least, in all sexual organisms. Whether it does or not, may be determined in a perfectly definite way by application of modern biometrical methods to the analysis of data collected by actual measurement of various characters in individuals of the two sexes.

As a small contribution toward such data, I have determined the chief variation constants of some very carefully collected material presented by Dr A. Porta*. The published data give measurements of fifteen similar characters of 84 males and 84 females of the beetle *Carabus auratus*, L. The characters measured were the following:

(1) Length of body. (2) Maximum breadth of body. (3) Length of head. (4) Width of head. (5) Length of prothorax. (6) Width of prothorax. (7) Length of antenna. (8) Length of first four joints of antenna. (9) Length of anterior leg. (10) Length of median leg. (11) Length of posterior leg. (12) Length of tarsus of anterior leg. (13) Length of mandible. (14) Length of elytra. (15) Length of first joint of antenna.

The measurements are expressed in millimetres.

In the table presented herewith, we have given, in the first column, the mean of each several character with its probable error. In the second column are likewise arranged the standard deviations from the mean of each character with their probable errors. In the third column are given the coefficients of variability and their probable errors.

From the evidence of the means of the fifteen characters measured, four—the length of posterior leg, length of anterior leg, length of tarsus of anterior leg, and total length of antenna—are so nearly equal in length that any difference is more than covered by the probable error. These characters can hardly be held to possess any secondary sexual significance. In these four characters, whose mean size is the same in both male and female, there is, furthermore, no evidence that one sex varies any more than the other. In the case of the anterior leg, the female shows a slight tendency to vary more than the male. This difference is not significant, however.

In all the other characters measured the mean is distinctly larger in the female than in the male, and we may safely assume that these differences represent a greater or less degree of secondary sexual differentiation. In four of these characters—length of first four joints of antenna, length of prothorax, length of head, and width of body—the female shows a higher index of variability than the male. In none of these, however, is the higher rate of variability of real significance, as in no case does it exceed double the probable error.

In the seven remaining characters the male shows a tendency to be more variable than the female. In four of these—length of mandible, length of first joint of antenna, length of body, and width of prothorax—the excess of variability is so slight as not to be appreciable. It is much more than offset by the size of the probable error. In the last three characters the male is probably significantly more variable than the female. In the length of elytra, length of median leg, and width of head, the excess of variability in the male is practically three times the probable error for the same.

On account of the small numbers of individuals taken in each case little emphasis can be laid upon the details of the results noted. It is worthy of consideration, however, that the four characters of equal size in each sex are equally variable, and that in the eleven remaining characters when there is a difference in size between the two sexes, only three show a greater variability in the male than in the female.

The general conclusion can only be, that, so far as the present data indicate, there is no uniform tendency for the individuals of one sex to be more variable than those of the other sex in the beetle, *Carabus auratus*, L.

* Porta, A., "Le Differenze sessuali secondarie quantitative nel *Carabus auratus*, L." *Bull. Soc. Entom. Ital. Ann.* 34, 1902.

TABLE I.

Character	Mean	S. D.	C. of V.
Length of body	♂ 22·506 ± ·077	1·041 ± ·054	4·62 ± ·24
	♀ 22·851 ± ·081	1·095 ± ·057	4·40 ± ·23
	Difference	·054 ± ·078	·22 ± ·33 ♂
Width of body	♂ 8·994 ± ·030	·410 ± ·021	4·56 ± ·24
	♀ 10·176 ± ·038	·521 ± ·027	5·12 ± ·27
	Difference	·111 ± ·034	·56 ± ·36 ♀
Length of head	♂ 3·750 ± ·020	·270 ± ·014	7·20 ± ·38
	♀ 4·036 ± ·023	·318 ± ·017	7·89 ± ·41
	Difference	·286 ± ·030	·69 ± ·56 ♀
Width of head	♂ 3·152 ± ·015	·199 ± ·010	6·30 ± ·33
	♀ 3·396 ± ·011	·145 ± ·008	4·25 ± ·22
	Difference	·244 ± ·019	2·05 ± ·40 ♂
Length of prothorax	♂ 4·589 ± ·018	·248 ± ·013	5·40 ± ·28
	♀ 4·946 ± ·021	·289 ± ·015	5·84 ± ·30
	Difference	·357 ± ·028	·44 ± ·41 ♀
Width of prothorax	♂ 6·693 ± ·024	·322 ± ·017	4·82 ± ·25
	♀ 7·292 ± ·024	·332 ± ·017	4·55 ± ·24
	Difference	·599 ± ·034	·27 ± ·35 ♂
Length of elytra	♂ 14·411 ± ·051	·693 ± ·036	4·80 ± ·25
	♀ 16·066 ± ·047	·639 ± ·033	3·98 ± ·21
	Difference	1·655 ± ·069	·82 ± ·33 ♂
Length of anterior leg ...	♂ 15·613 ± ·051	·698 ± ·036	4·47 ± ·39
	♀ 15·589 ± ·056	·766 ± ·040	4·92 ± ·26
	Difference	·024 ± ·076	·45 ± ·47 ♀
Length of median leg	♂ 17·857 ± ·071	·965 ± ·050	5·40 ± ·28
	♀ 18·304 ± ·057	·774 ± ·040	4·23 ± ·22
	Difference	·447 ± ·091	1·17 ± ·36 ♂
Length of posterior leg ...	♂ 24·423 ± ·081	1·099 ± ·057	4·51 ± ·24
	♀ 24·423 ± ·080	1·088 ± ·057	4·46 ± ·23
	Difference	·000 ± ·114	·05 ± ·33 ♂
Length of tarsus of anterior leg	♂ 5·176 ± ·029	3·980 ± ·021	7·68 ± ·40
	♀ 5·176 ± ·029	3·980 ± ·021	7·68 ± ·40
	Difference	·000 ± ·041	·00 ± ·57
Length of antenna	♂ 13·750 ± ·046	·629 ± ·033	4·58 ± ·24
	♀ 13·685 ± ·046	·619 ± ·032	4·52 ± ·24
	Difference	·065 ± ·065	·06 ± ·34 ♂
Length of first four joints of antenna	♂ 5·329 ± ·017	·232 ± ·012	4·36 ± ·23
	♀ 5·483 ± ·020	·269 ± ·014	4·90 ± ·26
	Difference	·154 ± ·026	·54 ± ·35 ♀
Length of first joint of antenna	♂ 2·063 ± ·010	·128 ± ·007	6·10 ± ·32
	♀ 2·128 ± ·009	·122 ± ·006	5·73 ± ·30
	Difference	·065 ± ·013	·37 ± ·44 ♂
Length of mandible	♂ 3·304 ± ·015	·208 ± ·011	6·30 ± ·33
	♀ 3·607 ± ·015	·205 ± ·011	5·63 ± ·29
	Difference	·303 ± ·021	·67 ± ·44 ♂