谈家桢论文集

科 学 出 版 社

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内 容 简 介

本文集选录了谈家桢先生从1932—1985年在国内外发表的学术性论文、论文摘要和综述论著，共51篇. 内容主要包括群体遗传学、细胞遗传学、辐射遗传学和遗传毒理学，以及有关遗传学争鸣方面的文章. 可供遗传学和有关生命科学各分支学科的教学与科研人员参考.

谈 家 桢 论 文 集

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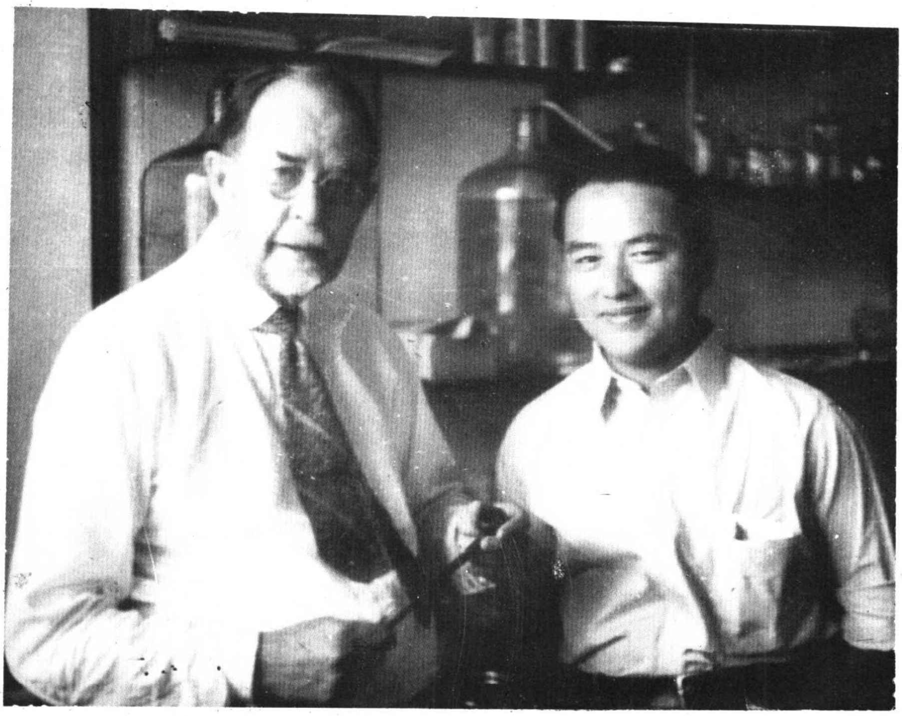
谈家桢在工作中



1935年，谈家桢与摩尔根教授在美国加州理工学院生物学部摩尔根实验室内。

1945年夏，谈家桢同分子生物学之父德尔布鲁克(Delbrück)合影于美国冷泉港生物学实验室。

自　　序

我从事遗传学教学和研究工作已有五十余年，回顾所走过的这段路程，深感自己贡献甚少，而社会给予我的却甚多，这使我深为不安．在这暮蔼之年，也想把在这半个世纪所做过的工作总结一下． 在学术界朋友的热情关怀和出版社的全力支持下，论文选集的编辑工作提上了日程． 我深切地感谢大家对我的鼓励和帮助．

我的一生似乎与遗传学结下了不解之缘． 在经典遗传学上升时期，开始了我的遗传学研究和教学生涯． 遗传学在中国经历着一条荆棘丛生、崎岖曲折的道路，我是历史的见证人．解放前，这门学科在经典遗传学研究和农业育种方面的工作具有一定的基础．解放后，遗传学虽有一定的发展，但曾两度险遭灭顶之灾，致使这门学科在我国的发展元气大伤．在这历史的沉浮中，我个人的荣辱得失算不了什么，使我深感忧虑的是遗传学几经挫折，将会后继无人，最终严重影响国家在基础科学与应用实践等方面的发展．在我的一生中，感到自慰的是，我对事业的赤诚之心从未改变．即使身处逆境，也没有忘记一个科学工作者应有的坚持真理、实事求是的探索态度，为发展我国遗传学事业竭尽绵薄之力．今天云开日丽，我们国家十分重视生命科学的发展，为遗传学工作者施展宏图创造了良好的环境和条件，我们应该珍惜这样美好的时机．这些年来，我国遗传学研究和教学队伍的素质有了明显的提高，中年遗传学工作者与茁壮成长的年轻一代携手合作，忘我地劳动，结出了丰硕的果实．他们是我们事业的精华和希望，肩负着历史的重任．可以预见，我们的事业将愈益兴旺发达，欣欣向荣，这也是家桢一生所梦寐以求的心愿．

本文集选编了我自 1932—1985 年以来在国内外发表的遗传学论文与综述文章．外文部分 33 篇(其中 7 篇是论文摘要)，中文部分 18 篇． 就研究专题而言，主要分成四大类，简单介绍如下：

第一类，是以亚洲异色瓢虫为实验材料，进行经典性群体遗传学研究．可以这样说，这是我一生中主要的研究领域．自三十年代初开始陆续发表有关这一领域的研究论文，直到七十年代，我还和我的学生一起发表这方面的论文．1944 年我曾发现异色瓢虫色斑遗传的嵌镶显性现象，经过进一步研究，于 1946

年正式提出嵌镶显性理论。通过对我国境内异色瓢虫的四种常见色斑类型在地理分布与季节性变化的测验，证明不同色斑类型可以自由交配，从而构成异色瓢虫的孟德尔式群体。同时，也表明地理隔离和生态条件是影响群体组成的因素，为开创群体遗传学研究提供了实验依据。

第二类，是以果蝇为实验材料，进行果蝇不同种的染色体遗传结构及遗传图研究。这一领域的研究始于1934年，这些论文是我作为摩尔根教授和杜布赞斯基教授的研究生之后所陆续发表的研究成果。我利用当时在果蝇唾腺巨大染色体上的发现，创造性地应用这个技术，分析果蝇的种内和种间遗传物质的结构及其变异，确认种内种间亲缘的远近同染色体结构差异的多少有着明显的正的相关关系；后来又进一步用细胞遗传学方法，发现果蝇种间的性隔离机制也是由多基因突变累积形成的。这些资料为现代综合进化论的建立提供了有力的证据。

第三类，是以猕猴为研究材料，我和我的助手从事的辐射细胞遗传学研究工作。这一领域的研究是从六十年代开始。确定以猕猴为辐射遗传学的研究材料，当时在国际上是首创。这类研究对于人类辐射遗传学上一系列理论问题的解决，以及辐射损伤与和平利用原子能等的实际应用方面，提供了科学依据。到七十年代末，这类研究进一步延伸，我和我的学生及助手，在国内首先从事环境化合物的毒理测试工作和有关环境诱变剂的研究，先后在两次国际学术会议上结合我们的研究成果和国内其他单位的成就宣读了我国有关研究进展的论文。

第四类，主要是在著名的1956年青岛遗传学座谈会前后发表的所谓“争鸣”性文章。在当时的气氛下，我只是介绍摩尔根遗传学说的发展与现状，强调其科学性，以及对毛泽东同志提出的“百家争鸣”方针的理解等方面进行论述，表达我对当时在学术上所推行的形而上学做法的不满，并为争得摩尔根遗传学说在百花园中的一席之地而呼吁。这方面的文章散布于国内的报刊上，考虑到本文集的容量等方面的原因，仅收录其中的两篇文章。

在这本文集出版之际，我要感谢作为我事业上的引路人胡经甫教授和李汝祺教授，我所取得的一些成绩是与他们对我的教育与提携分不开的。我也深切地怀念 T. H. 摩尔根和杜布赞斯基导师，以及在摩尔根实验室的同窗，他们的研究方法和教学思想对我影响甚深，为我日后的研究和教学奠定了良好的基础。我的一些重要的研究成果也是在他们的指导与合作下取得的。我还要感谢我的学生和助手，在我所从事的研究工作中渗透着他们的心血和智

慧．在这本论文集的整理、编辑工作中，我的助手赵功民同志及中国遗传学会的安锡培同志助我一臂之力，谨此致谢．

谈家桢

1986年8月

目　录

VARIATIONS IN THE COLOR PATTERNS IN THE LADY-BIRD BEETLES (*PTYCHANATIS AXYRIDIS* PALL)[1]

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INTRODUCTION

During the swarming season in the late fall of 1930, more than ten thousand ladybird beetles (*Ptychanatis axyridis*) were collected on the Yenching University campus and in its vicinity. A study of the variations of elytral and later the pronotal patterns of these beetles was made by the present writers. The whole collection divides itself naturally into two lots: the yellow-elytra and the black-margined elytra. Within each lot, the beetles were reexamined individually and subdivided into several arbitrary groups. Males and females were again separately considered so as to take in the sexual differences if any. The local and seasonal variations were not taken into consideration since all the beetles were collected in the same locality and practically during the same swarming season.

Following the elytral studies the pronotal patterns were taken up for further analysis. Arbitrary classes of the pronotal patterns were created according to the extent of black pigmentation. Then the beetles in the different groups of the elytral patterns were again classified into these classes. Besides the elytral and pronotal patterns, the variations of the pupal patterns were also noted during the breeding experiments. The results of these analyses are presented in the following pages.

THE ADULT PATTERNS

The Elytral Pattern

Altogether the total number of beetles studied for elytral pattern covered no less than 10,193 individuals, among which there were 517 specimens whose pattern could not be satisfactorily determined either because the black spots in the yellow elytra were too vague or the yellow patterns in the black-margined elytra were not clear. Among the remaining 9,676 good ones, there were 1,648 individuals which possessed the black-margined (Plate I) and 8,028 which possessed the yellow elytra. The yellow individuals were therefore approximately four times as many as the black-margined ones.

(1) The yellow series: Among 8,028 adults with yellow elytra, there exists a wide range of variation in the number of black spots. With the exception of very rare cases, the number of spots

1) Reprinted from *Peking Natural History Bulletin* **7:** 175—195. 1932—1933.

and their positions are symmetrical on both elytra. The series varies from pure yellow background with no black spot to that with ten spots or rather nine-and-half on each elytron. When the spots are present, they often assume definite positions on the elytron. With the nine-and-half spotted forms, there are two full round spots in a row at the upper region of the elytron. Below these there are two rows of spots, three in each row, in the middle region and one single spot in the lower corner of the elytron. These complete the nine of the nine-and half spotted form. The half spot is found in the humeral angle or the upper inner corner of the elytron. This crescent-shaped half spot of one elytron invariably matches up with a similar half spot on the other to make a total of nineteen spots on the two elytra (Plate II, 2). For the purpose of description, these spots are designated by letters. For instance: -using the right elytron as a standard, the two upper spots are A and B, A being the inner spot and B the lateral one; for the second row the inner-most spot is C, the middle one D and the marginal one E; for the third row, the inner-most one F, the middle one G and the marginal one H; the single spot in the lower corner of the elytron is I and the half spot in the humeral angle, J. It is an observed fact that individuals having the same number of spots may be different in regard to the positions the spots occupy.

Table 1 shows a comprehensive study of 8,028 yellow adults with the number of individuals and the percentage of the total for the different classes ranging from yellow without spots to the maximum number i.e. nine-and-half spots.

Table 1 Showing Variation in Number of Spots on Yellow Elytra

Class	Males		Females		Total	
	No.	%	No.	%	No.	%
0	1,235	31.92	274	6.59	1,509	18.80
1	799	20.65	628	15.10	1,427	17.78
2	270	6.98	196	4.71	466	5.81
3	226	5.84	161	3.87	387	4.81
4	180	4.65	149	3.58	329	4.10
5	177	4.58	145	3.49	322	4.01
6	159	4.11	180	4.33	339	4.22
7	191	4.94	304	7.31	495	6.17
8	292	7.55	510	12.26	802	9.99
9	213	5.51	731	17.58	944	11.76
9.5	127	3.30	881	21.18	1008	12.56
Total	3,869		4,159		8,028	

It is interesting to note from the table that among the males, the pure yellows and those with one black spot are more than 50% of the total number of males which is 3,869, while the reverse is true with the females, i.e. those with the maximum number of spots, 8, 9, and 9 1/2 amount to more than 50% among the 4,159 individuals. It seems that we have here a clear case of sexual dimorphism in the yellow elytral pattern. The distribution of the number of spots follows somewhat the bimodal curve. What is true with the total population is also true with either of the sexes. The highest mode for the male is the yellow without spot and that for the female is the nine-and-half-spotted form. The 4, 5 and 6-spotted forms are the least numerous. The inference would naturally be that these intermediate forms are the least stable in nature and easily modified into either extremes. The tendency seems to be that in the case of the males more individuals go in the direction of less spots and in the cases of females, more in the opposite direction i.e. more spots.

As indicated elsewhere, within the class having the identical number of black spots, there are always combinations of spots different in their positions. These various groupings in each class are given the term qualitative groups and named after the combinations of the positions of spots as designated by letters. The different qualitative groups of 10 classes are illustrated in Plate II, 2. Attempts were made to trace out, first, the most prominent qualitative groups in each class, (i.e. the one having largest number of individuals in the group) and, second, indirectly the relative order of importance of spots on the nine-and-half-spotted forms.

With the exception of the two extreme classes, viz., spotless and nine-and-half-spotted, in which no modification is possible, it has been found that there is quite a variation in the distribution of different qualitative groups. The detailed analyses were made and show that in each class, qualitative groups may occur in every possible combination. There are thus 6 groups in class 1, 11 in class 2, 15 in class 3, 21 in class 4, 30 in class 5, 22 in class 6, 15 in class 7, 6 in class 8, and 5 in class 9 (see Plate II, 2). With the class 5 in the center, which naturally has the largest number of chances for combinations of spots according to the different positions, the distribution of the other classes on either side of 5 is almost as uniform as a normal frequency distribution curve, which means that as far as number of combinations is concerned the distribution of the qualitative groups in each class follows the law of random combinations. These analyses further show that in class 1, the E, in class 2 the CE, in class 3 the CDE, in class 8 the ABCDEFGH, and in class 9 "ABCDEFGHI" are unquestionably the representive types in their respective classes. Now among the rest of the classes it is not quite so clear-cut as to which are the most popular or the typical qualitative groups (data not published).

Based on the above analyses it is now possible to speculate directly about the relative order of importance of these spots according to the positions on the elytron and indirectly the relative susceptibility or sensitiveness toward pigment development in the different regions on the elytra. Further analyses have been made, attempting to show the number of individuals and their percentages according to the various positions of spots in each class. The results are given in table 2.

All the figures seem to agree that position E, i.e. the marginal spot in the second row, ranks first as the most frequently occurring spot in the series; C, i.e. inner spot in the second row, second; J, the crescent shaped spot in the humeral angle, last or least frequent; I, the spot in the lower tip of the elytra next to the last; and F, the inner spot in the third row, third from the last. As to the other 5 positions, the sexes do not agree on the same spot (data not published), but differ to a certain extent within the range of 2%. It seems clear, however, that the positions E and C are more important than D and H, which, in turn, are more important than B, A, G and F and finally I and J,

Table 2 Showing Variation of Position of Spots in Different Classes of the Yellow Series

Class	Position of spot	E	C	D	H	B	G	A	F	I	J
1	No.	1,120	5	7	...	4	1	1			
	%	98.6	.44	6.62	...	0.35	0.09	0.09			
2	No.	333	172	99	45	15	10	10			
	%	48.65	25.13	14.43	6.57	2.19	1.46	1.46			
3	No.	274	224	139	61	45	35	38	5	1	
	%	38.40	27.35	16.95	7.45	5.49	4.27	4.64	0.61	0.12	
4	No.	235	211	107	111	92	69	83	40	...	
	%	24.68	22.20	11.80	11.65	9.66	7.25	8.71	4.20	...	
5	No.	268	253	164	165	154	140	122	86	3	
	%	19.82	18.88	12.25	12.40	11.40	10.35	9.04	6.36	0.22	
6	No.	283	278	168	236	189	243	169	124	7	1
	%	16.70	16.40	9.91	13.91	11.40	14.33	9.96	7.32	0.41	0.06
7	No.	396	349	280	377	379	384	329	242	35	1
	%	14.28	12.58	10.08	13.59	13.66	13.85	11.85	8.72	1.26	0.04
8	No.	662	662	633	662	644	662	643	655	71	2
	%	12.58	12.58	12.03	12.58	12.24	12.58	12.23	12.43	1.35	0.04
9	No.	741	741	738	741	720	741	740	741	734	32
	%	11.11	11.11	11.07	11.11	10.80	11.11	11.10	11.11	11.00	0.48
Total	No.	4,312	2.895	2.335	2.398	2.242	2.285	2,135	1.893	851	36
	%	20.26	13.60	10.97	11.25	10.55	10.68	10.00	8.90	4.00	0.17

made the least number of appearances. These observations are suggestive as to the possible range of susceptibility of the different regions of elytra for pigment development. The second horizontal row, on which C, D and E are situated, illustrates the influence of the first factor, viz., regional susceptibility, because it is the region where the pigment deposition most frequently occurs. In the same region we also see the working of a second factor viz., marginal susceptibility: E and C being on the margin, show more susceptibility to pigmentation. Incidentally, the evidence shows that the pigment deposition must have started from the outer margin of the elytron. Embryological observations that the writers have made on the appearance of elytral spots of the newly emerged adult seem to add further support to this view. Still a third factor viz., neighboring influences may be appealed to in accounting for the appearance of spots in the first, third and finally the fourth row occupied by the spots B, A, H, G, F and I respectively. In both the first and third rows the principle of marginal susceptibility also applies. This may explain why B is of more frequent occurrence than A in the first row and H is more frequent than G and F. I and J occupy rather secluded positions; despite their nearness to the margin, they are too far away from the second row.

Table 3 Showing Variation of Types in Class A

Types	Males		Females		Mixed	
	No.	%	No.	%	No.	%
A1	130	38.920	160	40.010	290	39.400
A2	30	8.960	37	9.280	67	9.400
A3	1	0.299	0	—	1	0.136
A4	3	0.897	2	0.502	5	0.680
A5	0	—	1	0.251	1	0.136
A6	5	1.495	5	1.255	10	1.360
A7	1	0.299	0	—	1	0.136
A8	1	0.299	0	—	1	0.136
A9	0	—	1	0.251	1	0.136
A10	97	29.020	59	14.800	156	21.190
A11	14	4.180	13	3.254	27	3.670
A12	4	1.196	4	1.004	8	1.088
A13	0	—	1	0.251	1	0.136
A14	0	—	1	0.251	1	0.136
A15	1	0.299	1	0.251	2	0.272
A16	0	—	1	0.251	1	0.136
A17	3	0.897	14	3.510	17	2.310
A18	3	0.897	12	3.010	15	2.038
A19	2	0.598	19	4.760	21	2.850
A20	5	1.495	23	5.770	28	3.801
A21	0	—	1	0.251	1	0.136
A22	0	—	1	0.251	1	0.136
A23	0	—	1	0.251	1	0.136
A24	0	—	4	1.004	4	0.543
A25	0	—	1	0.251	1	0.136
A26	31	9.260	31	7.770	62	8.420
A27	4	1.196	6	1.505	10	1.360
Total	335		399		734	

Table 4 Showing Variation of Types in Class B

Types	Males		Females		Mixed	
	No.	%	No.	%	No.	%
B1	262	70.500	261	48.300	523	57.500
B2	6	1.613	3	0.555	9	0.990
B3	15	4.030	45	8.330	60	6.600
B4	9	2.421	54	10.000	63	6.930
B5	3	0.807	32	5.920	35	3.850
B6	0	—	1	0.185	1	0.110
B7	0	—	1	0.185	1	0.110
B8	1	0.269	1	0.185	2	0.220
B9	0	—	7	1.295	7	0.770
B10	0	—	1	0.185	1	0.110
B11	0	—	1	0.185	1	0.110
B12	0	—	1	0.185	1	0.110
B13	0	—	1	0.185	1	0.110
B14	0	—	1	0.185	1	0.110
B15	0	—	1	0.185	1	0.110
B16	0	—	1	0.185	1	0.110
B17	0	—	1	0.185	1	0.110
B18	1	0.269	0	—	1	0.110
B19	0	—	1	0.185	1	0.110
B20	52	13.990	105	19.440	157	17.290
B21	1	0.269	3	0.555	4	0.440
B22	0	—	1	0.185	1	0.110
B23	0	—	1	0.185	1	0.110
B24	1	0.269	0	—	1	0.110
B25	3	0.807	4	0.740	7	0.770
B26	0	—	1	0.185	1	0.110
B27	1	0.269	1	0.185	2	0.220
B28	12	3.228	6	1.110	18	1.760
B29	1	0.269	3	0.555	4	0.440
B30	0	—	2	0.370	2	0.220
B31	1	0.269	0	—	1	0.110
B32	1	0.269	0	—	1	0.110
B33	1	0.269	0	—	1	0.110
B34	1	0.269	0	—	1	0.110
B35	1	0.269	0	—	1	0.110
Total	373		541		914	