王鸣岐文集

河南大学名家文存

王守正 编

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图书在版编目（CIP）数据

王鸣岐文集／王守正编．—开封：河南大学出版社，2006．6

ISBN 7-81091-457-X

Ⅰ．王… Ⅱ．王… Ⅲ．①王鸣岐(1906～1995)－文集 ②作物－病害－研究－文集 Ⅳ．S432-53

中国版本图书馆CIP数据核字（2006）第016252号

书　　名　王鸣岐文集

　　王守正　编

责任编辑　余建国

装帧设计　工四朋

出版发行　河南大学出版社

　　地址：河南省开封市明伦街85号　　邮编：475001

　　电话：0378-2864669（行管部）　0378-2825001（营销部）

　　http://www.hupress.com　E-mail:bangong@hupress.com

排　　版　河南大学出版社印务公司

印　　刷　河南省瑞光印务股份有限公司

版　　次　2006年6月第1版

印　　次　2006年6月第1次印刷

开　　本　787mm×1092mm　1/16

印　　张　29.5

字　　数　529千字

插　　页　2

印　　数　0 001—1 000册

书　　号　ISBN 7-81091-457-X/S·8

定　　价　58.00元

王鸣岐先生像

王鸣岐论文手稿

病毒颗粒表面赖氨酸残基可与三硝基苯磺酸(TNPS)结合起反应,反应后的TNP-HRV56颗粒的感染力丧失90%以上,又以甲基乙亚胺甲酯(MEI)对HRV56进行修饰,修饰后MEI-HRV56颗粒的感染力同样丧失90%。进一步证明从TNP-HRV56中分离得到的RNA能与天然的HRV56外壳蛋白重建病毒颗粒同样具有感染力,事实说明经修饰后并未受影响。而同位素双标记等节病毒用经与不经TNPS修饰分别接种于系统感染寄主一天后在非接种叶片上都测得35S放射性记数,但其中前者的35S/32P的比值不变,后者的比值降低。从同位素双标记结果表明可能是修饰作用阻止了感染中必需的脱壳。本此显示通过修饰在分子水平上揭开控制病毒机理並进一步研究HRV56感染和复制是有价值的。

7. 在植物病毒相对抑生 相互相乘的相互关

前　言

著名植物病理学家、微生物学家、植物病毒学家、博士生导师、复旦大学一级教授、国家有突出贡献的专家王鸣岐先生1906年2月17日生于河南滑县一个农民家庭。明年(2006年)是王鸣岐先生诞辰100周年,河南大学将出版《王鸣岐文集》,复旦大学生命科学学院将隆重纪念生命科学学院建院20周年和王鸣岐先生诞辰100周年,王鸣岐文集编委会还将出版《王鸣岐先生诞辰100周年纪念》一书。

王鸣岐先生早年求学河南大学,后求学美国明尼苏达大学,获哲学博士学位。1937年回国后,先后在河南大学、东吴大学和复旦大学从事植物病理学、微生物学及植物病毒学教学和研究工作。在粟黑粉菌、河南植物病害调查和研究、粮食安全贮藏和粮食微生物以及植物病毒和病毒病等许多方面都有深入研究,成绩卓著,为国家培养了大批栋梁之材,声震寰宇。

主要研究成就有:

一、粟黑粉菌研究——在国际上首次发现粟黑粉菌的异宗配合;在人工培养基上完成了粟黑粉菌的生活史,从此结束了黑粉菌不能人工培养的时代。这些研究使他成为国际上少数著名黑粉菌学者之一。

二、河南省植物病害调查和研究——先后调查河南省20多个县市,鉴定植物病害624种。推广药粉拌种,有效地控制了小麦黑穗病的发生为害。枣疯病病毒病原的发现,猴头菌人工栽培研究,都是首次研究报道。筹建黄泛区农场等,为河南省农业发展作出重要贡献。

三、粮食安全贮藏和粮食微生物研究——研究发现稻谷含水量与稻谷安全贮藏有密切关系,研究出稻谷安全贮藏的水分指标为13.5%,至今还在全国推广应用,为稻谷安全贮藏作出重要贡献。研究中还发现粮食贮藏期间发热、变质、变色、变味、带毒和种子生活力与粮食微生物有密切关系,创建了粮食微生物学新兴学科,成为粮食微生物学科的创始人。

四、植物病毒和病毒病的研究——首次揭开了我国江、浙、沪等地稻麦玉米矮缩病大流行的奥秘,是由国内尚未报道过的水稻黑条矮缩

病毒所致，并进行了深入研究。王鸣岐先生是我国粮食作物病毒病研究的先驱和奠基人，先后研究了粮食作物 10 多种病毒病的鉴定、发病规律和防治，发现国内外尚未报道的两种新的小麦病害（类立克次氏体病和类病毒病），还发现绿牡丹所以呈绿色是由类菌原体所致。首次提出用生态学方法来控制植物病毒病，并获得成功。他还研制出防治植物病毒病的第一个化学农药 TA（TS 型），并广泛推广应用。晚年他还深入研究了病毒分子生物学和植物病毒遗传工程，其研究成果达到国际先进水平。

王鸣岐先生的研究成果极为丰硕，发表的论文很多，这仅是其中的一部分，而非全部。论文按年代顺序排列。

这本文集是由他在国内外的学生、复旦大学生命科学学院、河南大学的领导、好友和子女等组成的编辑委员会编辑而成。编辑委员会的成员主要有在美国的付维宁教授、王守三教授，河南大学的关爱和教授、黄亚彬教授，复旦大学的陈永清教授、郑兆鑫教授，在台湾的胡开仁教授、张庆恩教授，河南农业大学的王守正教授，还有王芝兰、王守仁、王秀兰、王桂兰等也参加了编辑工作。这本文集的出版得到河南大学的领导和河南大学出版社的大力支持，特致深诚谢意。

《王鸣岐先生诞辰 100 周年纪念》一书另出专集。

《王鸣岐文集》编委会

2005 年 12 月

序　言

王鸣岐教授(1906－1995),原籍河南省滑县。1932 年毕业于河南大学农学院,成绩优异,留校任助教。1934 年赴美国明尼苏达大学研究生院,主修植物病理学,副修遗传学。夜以继日,孜孜不倦,他的研究成果受到国际学术界的重视。1937 年获得哲学博士学位。此时国内抗日战争爆发,他谢绝了导师的一再挽留,决定立即回国,以报效祖国。在回国途中他访问了许多国家的著名大学和研究单位。

回国后,先后任河南大学教授、农学系主任、农学院院长;东吴大学教授,江南大学教授;复旦大学教授、生物系主任、病毒研究室主任,兼任中国科学院上海植物生理研究所研究员。

1945 年我考取了河南大学农学院,有幸成为王教授的学生,同学们都深有同感,王老师不仅是我们的良师益友,对同学们的关心爱护胜过父母,我们终生难忘。

王鸣岐教授是著名的植物病理学家、微生物学家、植物病毒学家、一级教授、博士生导师。他一生为祖国的科学教育事业作出了重要贡献,声震寰宇。他在 20 世纪 30 年代发现粟黑粉菌的异宗配合,结束了黑粉菌不能人工培养的时代。他在 20 世纪 40 年代广泛调查了河南省植物病害;开展了小麦黑穗病防治工作;在国际上首次提出枣疯病的病原为病毒;猴头菌人工栽培获得成功;筹建黄泛区农场。他在 20 世纪 50 年代研究稻谷安全贮藏,发现稻谷含水量与稻谷安全贮藏有密切关系,还创建了粮食微生物学新兴学科。他在 20 世纪 60 年代后进行植物病毒和病毒病的研究,其研究成果达到国际先进水平,他是我国粮食作物病毒病研究的先驱和奠基人。我为王老师的卓越成就和丰硕成果而鼓舞。

在王鸣岐先生诞辰 100 周年之际,他在国内外的学生、好友和子女等选择了他的 47 篇论文,编辑成《王鸣岐文集》,以纪念这位著名的科学家,河南大学的优秀学子,我敬爱的老师。《王鸣岐文集》的出版将对植物病理学、微生物学和植物病毒学的发展产生深远影响。为此乐于为序,纪念这位艰苦卓绝的一代恩师——著名的科学家。

受业

付维宁　谨识

2005 年 5 月 1 日于美国康州中央大学

目　录

STUDIES ON CYTOLOGY OF *USTILAGO CRAMERI*[①]

C. S. WANG

(Accepted for publication May 22, 1943)

INTRODUCTION

Ustilago crameri (smut of millet) is one of the few smuts known to complete its life cycle on artificial substrata[28]; therefore, it affords an exceptional opportunity to study the nuclear behavior in saprophytic as well as in parasitic stages.

It has been shown frequently that new physiologic races of certain smut fungi may arise through hybridization or mutation[8,19,23]. Nevertheless, many of the investigations have not dealt with the actual mechanism concerned in the behavior of the nuclei, that is, the cytological basis for the possible origin of new races. It is well known that meiosis in most smuts occurs during chlamydospore germination, but it is not known at what stages during germination the reduction of chromosomes takes place[10,12,23]. Moreover the nuclear behavior of the hyphal cells in either parasitic or saprophytic stages varies in different species, and in the same species at different stages of development[15,24,25]. Therefore, the writer investigated these phases of the problem as thoroughly as possible.

Practically, the resistance or susceptibility of the host to smut fungi is determined by the presence or absence of smutted kernels,

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① A portion of a thesis presented to the Graduate School, University of Minnesota, July, 1937, in partial fulfillment of the requirements for the degree of Doctor of Philosophy. Published as Paper 2086 of the Journal Series of the Minnesota Agricultural Experiment Station.

but actually this is not proof that the fungus can or cannot penetrate into the host. In fact Brefeld[5,6] and others[16,20] thought that the hyphae of certain smuts grew so slowly that they were unable to reach the meristem before the surrounding stelar tissue hardened. Recently, from a histological study, Western[30] concluded that there are three different bases for resistance in oats smut: a reaction of the epidermal cell wall which prevents penetration, necrosis of the host cells, and a retarding effect on the growth of mycelium within the host. Since there is virtually no information on the relationship of *Ustilago crameri* to the host plant the writer also investigated this problem.

The literature on the cytology and host parasite relations in the smuts has recently been adequately reviewed[12,13,15,22,29,30] and therefore will not be repeated here, but literature which is pertinent to particular phases of this study will be referred to whenever necessary.

EXPERIMENTAL RESULTS

Cytology of *Ustilago crameri*

Nature and Type of Chlamydospore Germination. The chlamydospores of *Ustilago crameri* Kcke. are ovoid to subspherical and 8 to 11μ long. Under ordinary conditions the spores are capable of germination without dormancy and have been shown to remain viable for at least 62 years[27]. On germination, a promycelium emerges through a gap in the spore wall. It may branch considerably, but no sporidia have been observed. Sometimes 2 or more promycelia may arise from a single chlamydospore.

Meiosis. In order to study the nuclear behavior during germination, spores were dusted with a camel-hair brush, on a thin film of 1 per cent malt agar or 1.5 per cent potato-dextrose agar, spread upon slides, then put in a sterilized moist chamber until the desired stage of germination had been reached. The material was then killed in Flemming's weak solution, washed, and stained in iron-alum haematoxylin.

The mature chlamydospore of *Ustilago crameri* contains a single

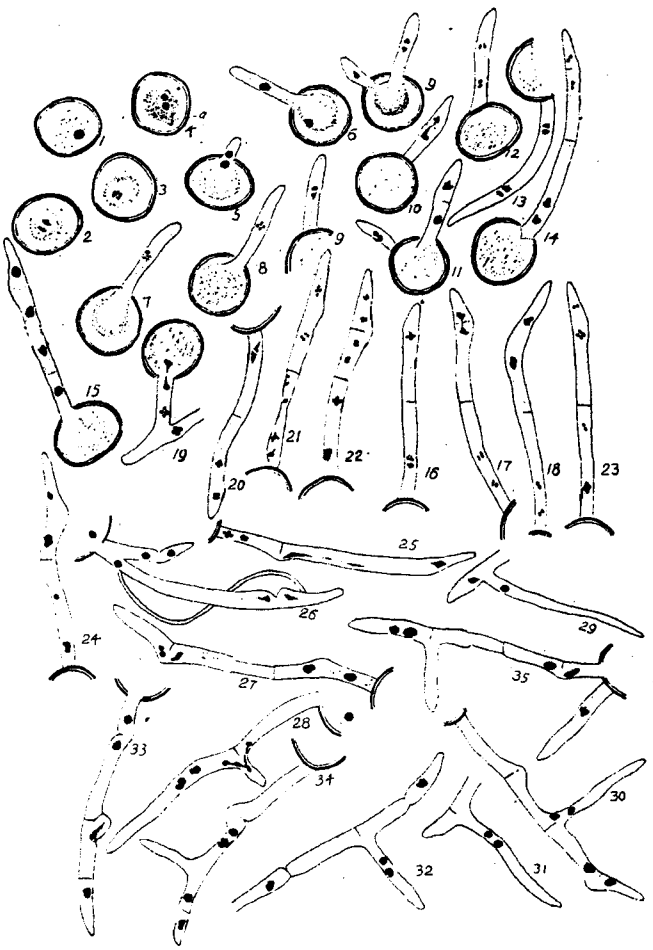

PLATE 1. Fig. 1. A mature chlamydospore with a diploid nucleus. Figs. 2～4. Different stages of the first division in the chlamydospores. In figure 4, *a* is a papilla. Figs. 5～6. Showing the migration of a nucleus from the chlamydospore to the promycelium. Figs. 7～11. Various stages of first division in the promycelium, showing the division figure. Figs. 12～14. Various stages of second division, showing reduction in chromosome number in first division. Fig. 15. A normal promycelium with four haploid nuclei, after two divisions. Figs. 16～18. Reductions in chromosome number in second division. Figs. 19 ～ 24. Abnormal reduction division. Figs. 25 ～ 32. Initiation of dikaryophase by "knee joint" between two adjacent cells, showing migration of nucleus. Figs. 33～34. Nuclear migration and association, slightly different from figures 25～32. Drawn free-hand; approximately×1000.

nucleus (Pl. 1, Fig. 1), which is diploid. This also is generally true for other smut fungi[9,17,18,24,29]. In *U. crameri* at germination, the first division of the diploid nucleus takes place either in the chlamydospore or in the promycelium (Pl. 1, Figs. 1 to 10). Unfortunately, the early stages of the prophase were not observed. Later, 4 small deeply staining units, which are probably the chromosomes, can be seen in the nuclear membrane, but the chromosomes are too small to allow one to see the actual split. Subsequently, the chromatin masses move apart and contract into 2 daughter nuclei (Pl. 1, Figs. 1 to 4). In the meantime a papilla appears with dense cytoplasm (Pl. 1, Fig. 4). The papilla, which has grown gradually toward the wall, then breaks through it and finally passes outward, forming the promycelium. At the same time the diploid nucleus migrates into the young promycelium and divides (Pl. 1, Fig. 7). The nuclear division in the promycelium is more clearly visible than that in the spore, but it still has not been possible to observe the early prophase of the division. The stages from late prophase to the end of the telophase are shown in plate 1, figures 7 to 11. A typical telophase figure with a single strand of fibers between the two daughter nuclei and the newly forming septum is shown in plate 1, figure 10.

The second division quickly follows the first; in fact, a resting stage is rarely found. In plate 1, figure 12, is shown a 2-celled promycelium with 2 nuclei, each nucleus containing 2 chromosomes (haploid number for *Ustilago crameri*) with a more or less indistinct nuclear membrane. The subsequent stages are shown in plate 1, figures 13 to 15. It is evident that in the prophase of the second division (Pl. 1, Fig. 12) only 2 chromosomes are shown, and at the end of this division there are 2 chromosomes in each daughter nucleus (Pl. 1, Fig. 14). It appears, therefore, that reduction in number of chromosomes has taken place at the first division. In contrast to this, the reduction occurs at the second division in the promycelia shown in plate 1, figures 16 to 18, as there are 4 chromosomes at the beginning of the second division (Pl. 1, Fig. 16). Variations in the chromosome conditions are shown in plate 1, figures 19 to 22, and 23 to 24. In figures 19 to 22, there apparently is no reduction in chromosome

numbers either at first division or second division. Particular attention is called to figure 21, because the nucleus is now in the third division, with 4 chromosomes still distinctly visible, and the spindle fibers are clearer than any others so far observed. In plate 1, figure 23, it will be seen that there are 2 nuclei with 4 chromosomes each and 2 with 2 each ; consequently, there are 2 large nuclei alternating with 2 small nuclei in the same promycelium (See also pl. 1, Fig. 24).

The frequency of fusion between the 2 middle cells and the 2 end cells of the promycelium support cytological evidence that reduction in chromosome number may occur in either the first or second division. Therefore, in order to obtain more definite information on the frequency of segregation in either division, observations were made on promycelial cell fusions. Chlamydospores were germinated in potato—dextrose agar at 25℃; after 72 hours, 300 counts were made on the frequency of cell fusion. The actual ratio of the middle to adjacent end cell fusion was 38.7 : 61.3 as compared with the theoretical ratio 37.5 to 62.5 (3 : 5) if the frequency of segregation in the first division and in the second division were equal. ①

Bauch[2] and Hüttig[14] have shown that temperature has considerable influence on the time of chromosome reduction in certain smuts. Four different temperatures were tested for their effect on the time of chromosome segregation. The results are given in table 1 from which it can be seen that the ratio of middle cell fusions to adjacent end cell fusions is approximately 3 : 5 at all temperatures. This also indicates that the ratio of segregation of sex factors in the first division is about equal to that in the second division and that the ratio was not modified materially by temperature.

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① If segregation for sex factors occurs at random in either the first or second division, then the frequency of segregation of sex factors in the first and second division should be equal, unless crossing over occurs. However, 25 per cent of the cell fusions of the second division should resemble those that occur when segregation takes place in the first division, that is, the fusion of the two middle cells and two end cells of the promycelium, hence the 3 : 5 ratio.

TABLE 1. Effect of temperature on segregation of factors for sex in *Ustilago crameri*, as indicated by the fusion of promycelial cells

Temperature, ℃	Fusion			
	Middle cells		Distal cells	
	Actual number	Per cent	Actual number	Per cent
15	115	37.8	189	62.2
20	118	41.0	170	59.0
25	130	38.7	206	61.3
30	121	38.9	190	61.1

Origin of Haploid Colonies

It is difficult to isolate haplonts in *Ustilago crameri* because no sporidia are produced. The writer attempted to obtain haploid lines by the method described by Christensen[7] for *Ustilago tritici* (Pers.) Rostr. To isolate haploid lines of *Ustilago crameri*, single chlamydospore cultures were made on hanging drops. As soon as the cultures could be seen with the naked eye, the resulting small colonies were immediately transferred to agar tubes and finally to 2 per cent malt agar in 250cc. flasks to which enough water had been added to cover the surface in a thin film. After 2 to 3 days the flasks were shaken vigorously to bring about fragmentation of the hyphae, in the expectation that single haploid cells might become isolated in the film of water on the agar. When colonies developed, further isolations were made in the usual manner. By this method a number of haploid colonies were obtained.

It is known that a dicaryotic hypha of smut may dissociate and give rise to haploids[4,10,12]. It seems possible that sectors in culture, which are not uncommon in *Ustilago crameri*, may in some instances originate by means of nuclear dissociation. In one case 4 different sectors were obtained from a single chlamydospore culture and these, in subsequent tests, proved to be haploid (Fig. 1). Altogether, 47 haploid lines from 8 chlamydospores were isolated from sectors.

In testing the compatibility or sexual reaction of these haploid lines on a susceptible host, no infection resulted when inoculations were made with single lines. Some of the paired combinations, how-