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ARKANSAS ACADEMY OF SCIENCE

Forty-seventh Annual Meeting
Hendrix College
April 5-6, 1963

OFFICERS

President ............................................... Robert W. Shideler
President-elect ...................................... Dwight M. Moore
Secretary ............................................... R. Reece Corey
Treasurer ............................................... Edward E. Dale

SECRETARY’S REPORT

The first business meeting was called to order by President Shideler at 11:00 A.M., April 5, 1963 with 31 members in attendance. The members of the academy and its affiliated groups were welcomed to Hendrix College by Dr. William C. Buthman, Academic Dean.

The Secretary’s Report, read by Sec. R. R. Corey, was accepted as read. The Treasurer’s Report was submitted to the Auditing Committee by Treas. E. E. Dale. Dr. James Dale presented a verbal Editor’s Report concerning the Proceedings. The Secretary reported that AAAS Research Grants of $50.00 each were awarded to:

Mr. Billy Boykin
Jacksonville High School
Jacksonville, Arkansas

Miss Jerry Lou Nicholson
Jacksonville High School
Jacksonville, Arkansas

President Shideler appointed the following ad hoc committees.

Nominations:
H. L. Bogan, Chairman
W. W. Everett
J. R. Mundie

Auditing:
Mrs. Virginia Kirk, Chairman
Curtis C. Love

Meeting Place:
Neal D. Buffaloe, Chairman
Joe Guenter
Charles C. Smith

Resolutions:
Truman McEver, Chairman
Mrs. Ruth Armstrong
I. A. Wills
Old business. President Shideler reported no progress on an outstanding science teachers award.

New business. None.

With no further business the meeting was adjourned at 11:30 A.M.

The second business meeting was called to order by President Shideler at 1:30 P.M., April 6, with 43 members present. Treas. E. E. Dale was appointed Secretary pro tem in the absence of the secretary. The audited Treasurer’s report was read and accepted.

Committee reports. The Nominating Committee presented the following slate for officers:

President-elect Lowell F. Bailey
Secretary R. R. Corey
Treasurer E. E. Dale
Editor J. L. Dale

The motion was made by Mr. Bogan, that the slate of officers presented by the Nominating Committee be elected. The motion was seconded and passed.

Dr. Curtis C. Love reported for the Auditing Committee, in the absence of the Chairman Mrs. Kirk, that the Treasurer’s books had been audited and accepted.

Dr. Buffaloe presented the report of the Meeting Place Committee that a decision on the meeting place had not been made and requested that the decision be deferred for about a month because: (1) meeting can not be at the University of Arkansas next year due to the building program, (2) a central location in the state is preferable, possibly Little Rock, but a survey would need to be made for the exact location. The motion was made, seconded, and passed, that the committee be allowed delay in selecting a meeting place.

Dr. Wills reported for the Resolutions Committee in the absence of the Chairman, Mr. McEver.

Resolutions, Arkansas Academy of Science.
Hendrix College, Conway, Arkansas
April 6, 1963

"Be it resolved that the Arkansas Academy of Science in its Forty-seventh Annual Meeting at Hendrix College, Conway, express its appreciation for the gracious hospitality and courtesies extended by the administration and faculty of Hendrix College in furnishing the excellent, convenient, comfortable facilities for our meetings.

"Secondly, we desire to commend the program and arrangement committees along with the many students of Hendrix College for the smoothly organized programs and services
furnished, and in the excellent coordination of all the activities of the Senior, Collegiate, and Junior Academies of Science along with the Science Fair. We especially wish to commend the officers and program committee in the carrying out of the directive concerning the suggested change of arrangements in the organization of the activities of all the various groups and sections.

"Be it further resolved that we express our appreciation by a letter written by our secretary to Dr. Matt L. Ellis for the stimulating and scholarly address given to the academy at its banquet. Likewise we wish to express our thanks to Dr. Dwight L. Moore for the compilation and presentation of the "History of the Arkansas Academy of Science."

"We also wish to commend the following for the services faithfully and efficiently rendered. All the officers of the past year. Dr. James Dale for the editing of the Proceedings. Dr. Lowell F. Bailey and Mr. Robert Berry for the sponsoring of the Arkansas State Science Fair. Mrs. Sally Lee Hines for sponsoring the Junior Academy. Dr. Arthur Johnson for the sponsoring of the Collegiate Academy."

Respectfully submitted:

Truman McEver
Irvin A. Wills
Ruth Armstrong

The resolutions were adopted unanimously.

Pres. Shideler called attention to two changes for the coming year: Mr. Robert Kirkwood as the new Science Fair Director replacing Mr. Berry, and Mrs. Florence McCormick as the Junior Academy Sponsor replacing Mrs. Hines.

Old business. None.

New business. Dr. Shideler requested suggestions concerning the schedule of the meetings. It was suggested that the first business meeting be started later in the morning. It was further suggested that a dues collector be appointed for each college. That the call for dues should be January 1 rather than March 1 with a reminder of arrears to be sent out May 1. Mr. Bogan stated that he wished to go on record as recommending that the list of paid members be continued to be sent out with the dues notice.

The motion of Dr. Buffaloe, that the secretary be instructed to send statements to those in arrears, was seconded and passed.

An additional suggestion was presented that the list of papers to be presented at the meeting be prepared far enough
in advance that it could be sent to the members prior to the meeting.

It was moved by Mr. Bogan and seconded by Dr. Sears, that Dr. Dwight Moore be recognized as new President for the ensuing year. The motion passed unanimously. The gavel was turned over to Dr. Moore by retiring President Shideler, Dr. Moore thus becoming the thirty-first as well as the first president of the reorganized academy.

Dr. Moore in his capacity as permanent historian presented verbally the "History of the Arkansas Academy of Science." With no further business the meeting adjourned at 2:30 P.M.

Respectfully submitted,
R. Reece Corey
Secretary
PROGRAM
Friday, April 5

9:00 a.m. to 4:00 p.m. Registration, Trieschmann Fine Arts Building.
10:45 a.m. Business Meeting, Reves Recital Hall
12:00 Noon Lunch
1:00 p.m. to 2:00 p.m. General Session with Junior and Collegiate Academies. Staples Auditorium. Papers by Science Talent Search Winners.
2:15 p.m. to 4:45 p.m. Collegiate Academy, Trieschmann Fine Arts Building.
6:00 p.m. Academy Banquet, Town House Restaurant. Address by Dr. Matt L. Ellis.
6:30 p.m. Collegiate Academy Banquet, Sands Restaurant. Address by Dr. A. E. Sidwell.
7:00 p.m. to 10:00 p.m. Science Fair Exhibits, Grove Gymnasium.

Saturday, April 6
8:30 a.m. to 10:15 a.m. Science Education Section, Staples Auditorium
10:30 a.m. to 11:45 a.m. Section Meetings
12:00 Noon Lunch
1:30 p.m. to 2:30 p.m. Business Meeting, Reves Recital Hall.
2:30 p.m. to 4:00 p.m. Section Meetings

SECTIONAL PROGRAM
Biology and Agriculture
Chairman: J. W. Sears
Harding College

THE DEVELOPMENT OF PLEUROTUS ULMARIUS FR. GROWN IN PURE CULTURE. Delbert Swartz and Jerry D. Collar, University of Arkansas.
FURTHER STUDIES ON AN ANTIBIOTIC SUBSTANCE PRODUCED BY RHIZOPUS NIGRICANS EHRENBerg. Kenneth D. Mace and Delbert Swartz, University of Arkansas.
NOTES ON THE NATURAL HABITAT OF THE
BROWN RECLUSE. Maxine Hite, University of Arkansas.
The Absence of Pasteurella Pestis in the Wildlife of Arkansas. R. Reece Corey, Leo J. Paulissen, and Delbert Swartz, University of Arkansas.
Comparison of Spider Fauna in the Ground Strata of a Pasture and Adjacent Cultivated Field. W. H. Whitcomb, H. Exline, and M. Hite, University of Arkansas, University of Missouri, and University of Arkansas, respectively.

Chemistry

Chairman: Daniel Mathews
Graduate Institute of Technology
University of Arkansas

Incorporation of Thymidine Into DNA During Vitamin E Deficiency of Rabbits. Michael Warrick, University of Arkansas Medical Center.
The Determination of the Stability Constants for the Benzene-Silver Ion Complexes by N.M.R. Spectroscopy. William Trigg, Arkansas Polytechnic College.
Measurement and Use of Substrate and Partition Liquid Selectivities in Gas Chromatography. Junion Johnson, Graduate Institute of Technology, University of Arkansas.
Gas Chromatographic Separations of Amino Acid Derivatives. Earl Riddick, Graduate Institute of Technology, University of Arkansas.
A Device for Measuring Resonant Absorption by Nuclei. Luther Harris, Graduate Institute of Technology, University of Arkansas.
Measurement of the Surface Area of Solids (A Physical Chemistry Experiment?) Buster Slaten, Graduate Institute of Technology, University of Arkansas.
The Glass Electrode and Its Use in Determination of Ionization Constants of Acids. James Carder, Graduate Institute of Technology, University of Arkansas.
A Study of Hydrogen Bonding in the Chloroacetic Acids. Daniel Mathews, Graduate Institute of Technology, University of Arkansas.
Geology
Chairman: John J. Chapman
Southern State College

BOULDERS OF CHERT DERIVED FROM BEDS OF PROBABLE MIDWAY NEAR MALVERN. Richard V. Browne, Arkansas Geological Commission.


HYPOGENE CLAY AND MICA MINERALS ASSOCIATED WITH FAULT ZONES IN THE OUACHITA MOUNTAINS-ARKOMA BASIN AREA, ARKANSAS. C. G. Stone, Arkansas Geological Commission.

SUBSIDENCE STRUCTURES IN NORTHWEST ARKANSAS. James H. Quinn, University of Arkansas.


RELATIONSHIP OF IGNEOUS ACTIVITY TO MINERAL DEPOSITS IN ARKANSAS. C. G. Stone and P. J. Sterling, Arkansas Geological Commission.

A PROPOSED HIGH SCHOOL EARTH SCIENCE SYLLABUS. John J. Chapman, Southern State College.

History and Political Science
Chairman: Keith Petersen
University of Arkansas


THE NORTH AMERICAN LAND AND TIMBER CO., LTD.—SOME NOTES ON ITS BEGINNINGS. Wayne Delavan, Henderson State Teachers College.

ECONOMIC CONTRADICTIONS IN THE PROCESS OF WESTERN EUROPEAN INTEGRATION. Marian L. Piotrowski, Henderson State Teachers College.

Mathematics
Chairman: Glen Haddock
Arkansas College

GAME THEORY, Moorene Newton, Arkansas College.

ALGEBRAIC AND TRANSCENDENTAL NUMBERS. Roy Fuller, University of Arkansas.
EXPONENTIAL MEAN. Marion Brashears, University of Arkansas.
DUALITY. John W. Keesee, University of Arkansas.

Physics
Chairman: Earl R. Williams
John Brown University

ATOMIC AND MOLECULAR DISTRIBUTION IN CC14.
Glen T. Clayton and R. W. Gruebe, University of Arkansas.

X-RAY DIFFRACTION OF LIQUID CC12F2. Glen T.
Clayton and R. E. Graham, University of Arkansas.

PLASMA EXPANSION INTO A VACUUM. Tom Padgett, University of Arkansas.

PROPOSED DEFRACTION OF IONS. Charles Manka, University of Arkansas.

SPECTRA INDUCED BY MOLECULAR HYDROGEN
ION IMPACT ON MOLECULAR HYDROGEN. Lynn Hatfield, University of Arkansas.

A MOSSBAUER STUDY OF Kr88. R. Smith, Arkansas Polytechnic College.

SOLID STATE DIFFUSION OF SILVER INTO GLASS.
J. Scott, Arkansas Polytechnic College.

NUCLEAR QUADRAPOLE IN RESONANCE IN HNX.
Jack G. Dodd, Arkansas Polytechnic College.

Science Education
Chairman: Howard Moore
Arkansas State College

A STUDY OF THE ACHIEVEMENT IN ADVANCED CHEMISTRY COURSES OF A GROUP OF STUDENTS SELECTED FOR GENERAL CHEMISTRY HONORS COURSE.
Wilson J. Broach and Billie G. Broach, Little Rock University.

UTILIZATION OF PRIMARY CHEMICAL LITERATURE SOURCES IN THE UNDERGRADUATE CURRICULUM. Don England, Harding College.

THE UNIVERSITY OF ARKANSAS PHYSICS HONORS PROGRAM. Glen T. Clayton, University of Arkansas.

A THREE SEMESTER HONORS COURSE IN PHYSICS.
Paul Sharrah, University of Arkansas.


THE HENDRIX COLLEGE HONORS PROGRAM. Arthur A. Johnson, Hendrix College.

REPORT OF THE VISITING SCIENTIST PROGRAM. John W. Keesee, University of Arkansas.

THE UNIVERSITY OF ARKANSAS HONORS PROGRAM IN BIOLOGY. Lowell F. Bailey, University of Arkansas.
THE DEVELOPMENT OF
PLEUROTUS ULMARIUS FR.
GROWN IN PURE CULTURE

Delbert Swartz and J. D. Collar
Formerly NDEA Fellow in Botany and Bacteriology
University of Arkansas

INTRODUCTION

Developmental studies of various fleshy fungi have been made by various workers, viz. Atkinson (1,2,3), Beer (4), Blizzard (5), de Bary (6), Douglas (7,8), Fayod (9), Fischer (10), Hartig (12), Hein (13), Johnson (14), Levine (17,18), Sawyer (19), Swartz (21,22), Walker (25), Zeller (26), et al. Ordinarily such studies have been carried out upon fruit bodies collected in their natural habitats. Few, if any, studies of this kind have been made on fruit bodies produced on laboratory media.

MATERIALS AND METHODS

In the fall of 1960, tissue cultures of Pleurotus ulmarius Fr. were obtained from a young specimen collected from a dead elm tree near Fayetteville, Arkansas. Tramal tissue was removed aseptically and placed in flasks of malt extract agar* and allowed to incubate until a relatively large mycelical mat had appeared on the surface of the agar, and fruit body initials began to appear. After inoculation the cultures were kept in a coldroom at 4.4° C. for 24-48 hours prior to removal to the laboratory at room temperature. Cultures placed in the light in a laboratory window showed great acceleration in fruit body formation.**

Fruit bodies at representative stages of development were killed in Flemming's strong solution, washed, dehydrated, and embedded in paraffin in the usual way. Sections were made 7-10 microns in thickness and stained in Heidenhain's Iron-Alum Haematoxylin. (In order to be sure that our specimens were typical, comparative studies were made using sterile segments removed from dead elm branches. Fruit bodies studied from their natural habitat as checks showed no significant variation microscopically or macroscopically.)

*Formula for malt extract agar:
25 gms. malt extract (Difco); 0.5 gms. MgSO4; 0.5 gms. Ca (NO3)2; 0.25 gms. KH2PO4; 0.1 gm. peptone; 25 gms. Agar Agar; 1000 ml. distilled water.

**More than 500 mature fruit bodies were produced in cultures between October 1960 and May 1961.
OBSERVATIONS

Fruit bodies (Figs. 1, 2, 3) showing no external differentiation were selected. The smallest ones studied measured 560 microns by 294 microns wide. In median longitudinal section a mass of interweaving, uniform hyphae was seen. The hyphae exhibited no specific directional growth and stained uniformy.

In slightly older fruit bodies, darkly staining elements scattered randomly through the fruit body were visible (Fig. 3). These darkly staining elements vary in length from 1 to 100 microns, but the average is about 25 microns. They have a uniform thickness, averaging 5 microns. They present a striking contrast with the surrounding mass of interweaving hyphae. These interesting elements disappear as the fruit bodies approach maturity. Similar structures have been reported by Sawyer (19).

Appearance of Primordia of the Stipe and Pileus

As development proceeds the young fruit body gradually becomes somewhat barrel-shaped. Differentiation of the stipe and of the pileus is first noticeable when the hyphae near the apex bend outward and curve downward, thus forming a shallow furrow. At this stage the primordium is an elongate structure having an enlarged base and a narrow blunt apex (Fig. 4). The hyphae usually grow in a direction parallel to the long axis. The staining is relatively uniform at this time, yet the previously mentioned dark staining hyphae are very conspicuous. Marginal hyphae are greatly curved. Despite the characteristic bending outward and downward by the hyphae described above, primordia are not sharply delimited, and the primordium of the pileus is simply an extension to that of the stipe. At this time the appearance of the fruit body is very similar to that described by Douglas (8) in Mycena subcalina Atkinson, Hygrophorus miniatus Fr., H. nitidus B & C, H. borealis Peck, Entoloma flavifolium Pk., E. grayanum Pk., and E. cuspidatum Pk., by Walker (23) in Pleurotus admirabilis Pk., by Blizzard in Omphalia chrysophila Fr., Clitocybe adirondackensis Pk., C. cerussata Fr., and Clitopilus novaboracensis Pk.

Origin of Hymenial Primordium

The hymenial primordium arises in the furrow which was formed by the epinastic growth of the marginal hyphae of the pileus primordium. This area is composed of characteristically crowded hyphae which stain more deeply than the surrounding tissue. The initial cells which compose this layer have acuminated apices and are uneven (Fig. 5). New elements of the hymenial primordia originate near the margin of the pileus.
Pleurotus ulmarius in Pure Culture
As a result the hymenial layer nearest the stipe may be almost mature while those near the margin of the pileus may be in very early stages of development. A cross section through the uppermost portion of the stipe shows the hymenial primordium to be a very darkly staining area around the periphery. (Fig. 6). In a median longitudinal section the hymenial primordium is visible in the annular furrow, and extends below the annular furrow on the stipe for varying distances in different fruit bodies. Prior to the expansion of the pileus there are hyphae which traverse the hymenial primordium, and resemble a partial veil. These hyphae originate in the margin of the pileus and in the periphery of the stipe, just below the hymenial primordium. The relative position of these hyphae varies greatly in different fruit bodies. These hyphae are very variable in length, and interweave conspicuously at the point they come together. These hyphae are loosely connected, appear to be quite fragile, and form a poorly defined thin layer upon the hymenial primordium.

Development of 'Palisade Layer'

It was stated above that the primordial stage of the hymenium consists of an area of densely interwoven, dark-staining hyphae. In this area the hyphal ends appear at different levels on the surface, thus causing a ragged, extremely irregular appearance. During the maturation of the hymenium the free hyphal ends change from acuminate to clavate. Accompanying this change there is a continued projection outward of these component hyphae resulting in the development of a relatively smooth periphery. This growth is the result, in part, of frequent branching and the extension of the branches to the periphery. In addition to the increase in number there is also an increase in diameter. The foregoing happenings result in the formation of a differentiated palisade layer which is made up of relatively even, darkly-staining blunt hyphae. This layer rapidly becomes oriented to a position perpendicular to the long axis of the stipe. Continued centrifugal growth takes place due to the formation of new elements. As this takes place there is less uniformity in the palisade layer. New elements continue to form at the margin of the pileus while gills are forming in the furrow. (Similar development has been reported in a number of agarics: Atkinson (1,2,3), Beer (4), Blizzard (5), Douglas (7,8).

Gill Development

The earliest evidence of gill formation is shown in Fig. 6. In the foregoing section it was mentioned that the palisade lay-
Pleurotus ulmarius in Pure Culture

...er becomes extremely crowded because of the active addition of new elements. The relatively even palisade layer bulges to form radial ridges which are the first indications of the gills. These ridges appear first near the apex of the stipe. Subsequent differentiation results in the extension of the gills to the margin of the pileus. The hyphae which are adjacent to these radial folds extend downward and give rise to the trama of the gills. Tramal hyphae are easily distinguishable because of their failure to take as deep a stain as the surrounding hyphae (Figs. 7, 8, 9). Additional hymenial elements result from continued growth and branching of the tramal hyphae. The change which results during the development of a compact gill layer from the looser tissue composed of newly formed gills is visible in Figs. 8 and 10.

Secondary gills arise frequently between previously formed (primary) gills Figs. 7 and 9. These gills arise apparently in the same manner as the primary ones. Gill development in this species is essentially the same as that reported by other workers for various species.

Formation of Spores

As the 'palisade layer' matures, certain hyphae project outward one to four microns from the surface (Fig. 8). These hyphae are easily identifiable because of their larger size and average 4.5 microns in diameter. The apices become blunt and expanded and give rise to basidia. Four spores are characteristically borne on relatively short sterigmata. No cystidia or setae were observed at any time in the hymenium. Further, no clamp connections were observed during the course of these studies.

DISCUSSION

The Agaricales are divided into six families on the basis of the morphological characters of the hymenophore (15). The present study was concerned with one species of the Agaricaeae, in which the hymenophore is in the form of gills. Again, the Agaricaeae are divided morphologically into two groups depending on the method of gill formation, since the gills may arise either exogenously or endogenously, depending on the species.

The endogenous forms may be divided into two groups depending on the order of differentiation of the pileus and hymenial primordia, i. e. those forms in which the primordium of the hymenium is the first part to appear, and those in which the pileus is differentiated first. The initiation of gills in the endogenous forms are two types, viz. (1) the 'Agaricus' type, in which the gills arise by downward growing radial salients of the hymenophore, accompanied or preceded by a more or less well developed annular prelamellar cavity, and (2) the 'Am-
anita' type in which there is no general annular prelamellar cavity, and the origin of the lamellae is a series of trabeculae extending from the pileus fundament to the stem, and attached to both.

Although the exogenous forms lack many structures found in the endogenous forms, the development is more uniform as a group. In general the following sequences of development occur: the primordium of the fruit body is characterized by a homogenous weft of intertwined hyphae which elongate and the pileus and stipe primordia are initiated by the epinastic growth of the hyphae at or near the apex. The hymenium may be initiated simultaneously as reported by Douglas (8) in Hygrophorus miniatus, H. nitidus, and H. borealis, or the hymenial primordium may take place after that of the pileus and the stipe. The latter type of development is seen in Clitocybe laccatus Scop. (4), C. adirondackensis (5), C. cerussata (5), Clitopilus novaboracensis (5), and Omphalia chrysophylla (5). Douglas also reported the latter type of development for three species of Entoloma.

Further, development of all exogenous forms show striking similarity. The hymenial primordium undergoes maturation and the palisade layer results. Gills are initiated first in or near the annular furrow and extend to the margin of the pileus. The growth of the hymenial primordium, palisade layer and gills is centrifugal.

Pleurotus ulmarius has the exogenous type of development and follows closely the usual sequence in exogenous forms. However two minor deviations were found: (1) Dark staining hyphae are present in the young fruit bodies of this species, but have not been reported elsewhere. Sawyer (19) reports similar hyphae in Pholiota, and states that they were present in all stages of development. In our study we found that these darkly staining hyphae disappeared with the approach of maturity. The significance of these structures and this behaviour has not been determined. (2) Hyphae were found which traversed the hymenial primordium prior to the expansion of the pileus. These hyphae originated in the margin of the pileus, and on the periphery of the stipe below the hymenial primordium. Four different conditions were found in reference to the hyphae which traverse the hymenial primordium: (1) Elements originate in the margin of the pileus and extend down the hymenial primordium. (2) Elements from the pileus margin and stipe traverse the hymenial primordium and intermingle at the point of contact. (3) Elements originate on the stipe and extend upward traversing the hymenial primordium. (4) Elements from both pileus margin and stipe are absent.

In the fruit bodies studied, the development of these hyphae was not sufficient to be called a partial veil. The situa-
tion encountered here is not unlike that reported by Walker (23) in Pluteus admirabilisPk. Here the epinastic growth at the pileus margin "causes the margin of the pileus to roll inward so closely that the edge of the pileus becomes pressed against the loosely interwoven ends of the filaments covering the stem." Hartig (12) reported that in Armillaria mellea Fr. the hymenophore developed exogenously at first, and at a later stage the pileus margin became incurved, and hyphae from the margin of the pileus interwove with the hyphae from the stem covering the annular furrow with a hyphal layer, the veil. Fischer (10) reported in Armillaria mucida Fr. that the hymenophore does not develop exogenously, "the marginal veil is not an aftergrowth, but is formed by the neutral tissue which is present at the beginning." Beer (4) substantiated the work of Fischer in finding that in A. mellea the "hymenium is never exposed in an open furrow. On the contrary, the marginal veil is present from the first, and is never an aftergrowth as Hartig supposed." Fayod (9) studied a great number of agarics and stated that all of them develop endogenously. In P. ulmarius there are many degrees of hyphal development covering the hymenial area. It is possible that the extreme variability found here may be present in other species. If variability is so wide spread it could possibly account for some of the conflicting descriptions of some species.

SUMMARY

1. Fruit bodies of Pleurotus ulmarius were collected and tissue cultures were prepared on sterile malt extract agar.
2. Fruit bodies were produced in culture in such quantity that all stages of development were readily available for study.
3. Fruit bodies produced on a sterile elm stick proved to be identical in development to those grown on agar.
4. All fruit bodies were killed in Fleming's strong solution, washed in tap water, dehydrated in alcohol, transferred to xylene and imbedded in paraffin in the usual way.
5. Sections were cut 7-10 microns in thickness and stained with Heidenhain's iron-alum haematoxylin.
6. The developmental morphology has been studied in a species for which studies had not been made. The sequence of development is very similar to other agarics whose hymenium develops exogenously.
7. The undifferentiated fruit body primordium consists of a mass of generally uniform hyphae which form a conical or hemispherical structure.
8. The first differentiation occurs as dark-staining hyphae which appear scattered at random throughout the young fruit body.
9. The fruit body primordium elongates into a barrel-shaped structure and hyphae at the margin of the apex bend out and downward forming an annular furrow.

10. This epinastic growth marks the first differentiation between pileus and stipe primordia.

11. At a slightly later stage the hymenial primordium appears in the region of the annular furrow at the apex of the stipe. This area is differentiated by the darker staining, pointed hyphae which form a compact, uneven layer.

12. By centrifugal growth the hymenial primordium is extended to the pileus margin.

13. Maturation of the hymenial primordium gives rise to a layer of compact, relatively even hyphae with blunt apices: the palisade layer.

14. Like the hymenial primordium, development of the palisade layer is centrifugal, and the order of its development is from the apex of the stipe to the pileus margin.

15. Gills are initiated as radial folds of the palisade layer at the apex of the stipe and progressive development is centrifugal.


17. Spore development is normal; each basidium bearing four spores on short sterigmata.

18. Cystidia, setae and clamp connections were not found in any of the fruit bodies studied.

BIBLIOGRAPHY


Pleurotus ulmarius in Pure Culture

FURTHER STUDIES ON AN ANTIBIOTIC SUBSTANCE PRODUCED BY RHIZOPUS NIGRICANS EHRENBerg

Kenneth D. Mace and Delbert Swartz
University of Arkansas

INTRODUCTION

The antibiotic actions of fungus extracts have been known for many years. In 1877 Pasteur (4) found that the growth of Bacillus anthracis was inhibited by other bacteria in a contaminated culture. Ward (4) in 1899, proposed the name antibiosis for microbial antagonism. Between 1900 and 1928 the few antibiotics that were isolated were not refined sufficiently to permit tests of their efficiency on humans. Fleming (4) in 1928 made his epochal discovery of penicillin, but it was not thoroughly studied until its potential as a significant treatment for war wounds was realized. The astounding properties of penicillin served to stimulate a wide-spread search for additional substances. Many molds, both common and rare species, were tested.

Broth filtrates of Rhizopus nigricans were reported as having no inhibitory power (7). However, Williams (8), working in this laboratory found that filtrates derived from growing this fungus on especially enriched media yielded an inhibitory substance. His tests showed the inhibition of Bacillus anthracis, Shigella sonnei, Micrococcus aureus, Salmonella typhosa, Salmonella shottmuelleri, and Corynebacterium bovis.

Williams (8) determined that neither lactic, kojic, nor any of the phenolic acids were present in the broth filtrates. The inhibitory substance withstood boiling in air for a period of twenty minutes without appreciable decomposition. Due to lack of time he was unable to examine the details of some of the more interesting chemical and physical properties of the unknown substance.

This work was undertaken to explore further the properties of the substance and to check some of the work reported by Williams.

METHODS

The culture of Rhizopus nigricans used in this study was the same as the one used by Williams, and was provided by Dr. Delbert Swartz of the Department of Botany and Bacteriology, University of Arkansas.

1Graduate Teaching Assistant in Botany and Bacteriology, University of Arkansas.
The fungus was grown on V-8 agar slants at 24°C for six days to obtain spores for inoculation of the flasks of media used in the experiments. One milliliter of spore suspension was placed into the culture medium aliquoted in 125 milliliter Erlenmyer flasks or in one liter Fernbach flasks. These inoculated flasks were incubated at 24°C for seven days, either as stationary surface cultures or as shaken submerged cultures. At the end of this period dry weights of the mats and the submerged mycelial growths were determined. Submerged cultures in 125 milliliter Erlenmyer flasks were agitated on a shaking machine 216 times per minute.

The method of extraction used was similar to that reported by Williams (8), except the metabolized solutions from the broth cultures and the water extracts from the solid media cultures were evaporated in a rotating flask at 60°C. The temperature of the hot ether and hot chloroform extractions was lowered to 40°C. The dried mats were broken up after weighing and extracted with acetone in a Soxhlet apparatus. The extract obtained was then combined with the acetone extract of the evaporated metabolized solutions.

Experimental Procedures and Results

The method of testing solutions for inhibiting ability was a modification of the standard cylinder plate method of assay (5, 6). Controls consisted of uninoculated culture media to determine the possibility that they might contain some substance or substances that would be inhibitory to the test organism Micrococcus aureus. None of the media used in this study exhibited inhibitory activity.

The effect of agitation of broth cultures of Rhizopus nigricans on the growth of the organism as reflected in mat weights and also on the production of the inhibitory substance was explored. Erlenmyer flasks containing 65 milliliters of non-enriched medium 2* or enriched medium 3* were inoculated with a spore suspension of Rhizopus nigricans and incubated at 24°C as submerged cultures and as surface cultures for seven days. At the end of seven days dry weights of the mats were obtained, and the metabolized solution tested for inhibiting ability. Greater mat weights were produced by submerged cultures than those obtained from surface cultures (Table 1). However, the production of inhibitory substance was not increased by agitation (Table 1). Metabolized solutions from aerated cul-

*See Table 6 for formula.
tures of *Rhizopus nigricans* grown at 24°C for seven days in Czapek Dox broth showed greater inhibition of *Micrococcus aureus* than either surface or submerged cultures (Table 1).

**TABLE 1**
Mat Weights and Inhibitory Activity of Metabolized Solutions from Surface, Submerged and Aerated Cultures

<table>
<thead>
<tr>
<th>Type Culture</th>
<th>Average Mat Weight</th>
<th>Test Organism</th>
<th>Diameter of Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 surface</td>
<td>0.189 gm</td>
<td>E. coli</td>
<td>21 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M. aureus</td>
<td>26 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. mycoides</td>
<td>23 mm</td>
</tr>
<tr>
<td>2 surface</td>
<td>0.198 gm</td>
<td>E. coli</td>
<td>22 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M. aureus</td>
<td>26 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. mycoides</td>
<td>24 mm</td>
</tr>
<tr>
<td>3 submerged</td>
<td>0.290 gm</td>
<td>E. coli</td>
<td>17 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M. aureus</td>
<td>27 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. mycoides</td>
<td>24 mm</td>
</tr>
<tr>
<td>4 submerged</td>
<td>0.370 gm</td>
<td>E. coli</td>
<td>17 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M. aureus</td>
<td>27 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B. mycoides</td>
<td>24 mm</td>
</tr>
<tr>
<td>5 aerated</td>
<td>—</td>
<td>M. aureus</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

Cultures 1, 3 and 5 grown in non-enriched medium 2
Cultures 2 and 4 grown in enriched medium 3

The effect of light on the growth of *Rhizopus nigricans*, as reflected in mat weights and in the production of the inhibitory substance, was studied. Clear Erlenmeyer flasks containing 65 milliliters of medium 6 were inoculated with a spore suspension of *Rhizopus nigricans*. Red glass Erlenmeyer flasks containing 65 milliliters of medium 6** were also inoculated with *Rhizopus nigricans*. All of these cultures were incubated seven days at 24°C under a fluorescent lamp. Cultures in clear glass flasks and red glass flasks were wrapped in brown paper and incubated in the dark for seven days at 24°C. Results of these experiments as given in Table 2 show mat weights from cultures grown in the light were less than mat weights from cultures grown in the dark. The same table shows, when tested against *Micrococcus aureus*, zones of inhibition from metabolized solutions taken from cultures grown in the dark were 50% larger than zones of inhibition from metabolized solutions taken from cultures grown in the light. Although the

*Metabolic solution obtained from L. R. Delaney of the Department of Botany and Bacteriology, University of Arkansas.
**See Table 6 for formula.
growth of *Rhizopus nigricans* was slightly inhibited by light after passing through the red glass flask as compared to growth of cultures exposed to light in clear glass flasks. The production of inhibitory substance, as reflected in diameter of zones of inhibition, remained approximately the same.

**TABLE 2**

<table>
<thead>
<tr>
<th>Culture Number</th>
<th>Average Weight</th>
<th>pH of Solution</th>
<th>Diameter of Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.095 gm</td>
<td>2.5</td>
<td>30 mm</td>
</tr>
<tr>
<td>2</td>
<td>1.045 gm</td>
<td>2.5</td>
<td>31 mm</td>
</tr>
<tr>
<td>3</td>
<td>0.341 gm</td>
<td>2.6</td>
<td>20 mm</td>
</tr>
<tr>
<td>4</td>
<td>0.408 gm</td>
<td>2.6</td>
<td>18 mm</td>
</tr>
</tbody>
</table>

*Culture 1—* Clear glass flasks in absence of light.  
*Culture 2—* Red glass flasks in absence of light.  
*Culture 3—* Red glass flasks in presence of light.  
*Culture 4—* Clear glass flasks in presence of light.

Metabolized solutions taken from media used in this paper were tested in order to determine if enriched media would increase the production of the inhibitory substance. The results of this study as given in Table 3 show that enriched medium 6 does increase the production of the inhibitory substance as reflected in the size of the zones of inhibition.

Dialysis of the inhibitory substance was made by placing 100 milliliters of the metabolized solutions from cultures of *Rhizopus nigricans* in a cellophane dialysis bag and suspending the bag with its contents in a cylinder containing 500 milliliters of distilled water. The solutions were kept at room temperature. Tests for inhibiting ability of the solution inside the bag and from the surrounding distilled water were made at 24 hours and 48 hours. At the end of 24 hours no inhibition was obtained from the distilled water surrounding the dialysis bag.

**TABLE 3**

<table>
<thead>
<tr>
<th>Medium Number</th>
<th>Diameter of Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15 mm</td>
</tr>
<tr>
<td>2</td>
<td>27 mm</td>
</tr>
<tr>
<td>3</td>
<td>26 mm</td>
</tr>
<tr>
<td>4</td>
<td>none</td>
</tr>
<tr>
<td>5</td>
<td>20 mm</td>
</tr>
<tr>
<td>6</td>
<td>30 mm</td>
</tr>
<tr>
<td>7</td>
<td>25 mm</td>
</tr>
</tbody>
</table>
However, at the end of 48 hours zones of inhibition averaging 22 mm were obtained from the solution surrounding the dialysis bag showing the inhibitory substance had dialyzed.

The electrical charge of the inhibitory substance was tested by taking 100 milliliter samples of metabolized solutions from cultures of Rhizopus nigricans and passing these through cation resin exchange columns and anion exchange columns. Twenty-five milliliter samples were collected after passing through the columns and evaporated to 10 milliliters and tested for inhibitory ability. The solutions that passed through the cation exchange columns exhibited inhibiting ability, and those that passed through the anion exchange column did not. This indicated the inhibitor substance possessed a negative charge.

The crystals obtained from extracts of metabolized solutions were of two types. The first was crystallized from the cold ether extract of the solutions and was a small rectangular shape with a clear white color, slightly translucent. The second crystal was recovered from the hot chloroform extract and had long needle shapes with yellow coloring.

Metabolized solutions from cultures of Rhizopus nigricans and solutions of crystalline inhibitory substances were adjusted to pH values of 4.0 to 8.0. The results as given in table 4 show no reduction in inhibitory ability over the pH range tested.

Fumaric, indol acetic, oleic, succinic, L-glutamic, alpha-ketoglutaric and malic acids were tested for inhibiting ability. The results showed, that although the pH of the acid solutions tested were similar to those obtained from metabolized and crystalline solutions, there was no inhibition exhibited.

Results of tests as given in table 5 showed the inhibiting substances are unstable as a calcium or sodium salt at pH 7.0 in a physiological saline solution and can not be stored in this form. However, in an aqueous solution with a pH of 2.0 to 3.0, or as a dry calcium or sodium salt the substances can be stored for a period of several weeks without impairing their inhibiting ability. This seems to be a function of the pH of the solutions rather than an effect of the physiological saline.

The inhibiting ability of 0.2% aqueous solutions of the two types of crystals obtained from extracts of metabolized solutions was shown to be equal when tested against Micrococcus aureus (Plates 1,2,3).

The white crystalline substance had a melting point of 94-95°C. The yellow crystalline substance had a melting point of 86-87°C. Both substances, using standard tests (1,2,3), gave negative results for the presence of peptide bonds, presence of a benzene ring, presence of tyrosine, phenylalanine, tryptophane.
Antibiotic Produced by *Rhizopus nigricans*

**Plate No. 1**
Zone of Inhibition Produced by a Metabolized Solution from a Culture of *Rhizopus nigricans*  
(Test Organism - *Micrococcus aureus*)

**Plate No. 2**
Zone of Inhibition Produced by a 0.2% Solution of White Crystalline Substance  
(Test Organism - *Micrococcus aureus*)

**Plate No. 3**
Zone of Inhibition Produced by a 0.2% Solution of Yellow Crystalline Substance  
(Test Organism - *Micrococcus aureus*)
presence of peptides, presence of reducing sugars and the presence of primary and secondary amines. Both substances gave positive tests for carbohydrates and the presence of divalent sulfur.

Both substances were soluble in water, acetone, and hot chloroform. The white crystalline material was also soluble in cold and hot ethyl ether, while the yellow crystalline substance was not soluble in either of these solvents.

Preliminary results indicated that the inhibitory substances were not toxic to animals when administered to living animals in physiological saline solution with the pH adjusted to 7.0.

**SUMMARY and CONCLUSIONS**

The existence of an inhibitory substance produced by *Rhizopus nigricans* Ehrenberg was confirmed. Two inhibiting substances were recovered.

It was shown that an enrichment medium containing an extract of *Maclura pomifera* fruit, 5% dextrose, and neopeptone increased the production of the inhibitory substances to some degree. Agitation of the type used in this paper did not stimulate the production of the inhibitory substances. Light whether from a fluorescent lamp or after passing through red glass of an Erlenmyer flask had an inhibiting effect on the production of the inhibitory substances. At the present time it is not known what action the light has on the cultures to give the adverse effect.

The two inhibitory substances were found to be similar in several ways:

1. Neither substance was colloidal.
2. They both possessed negative valences.
3. The inhibitory activity of the substances was not due to pH.
4. Both gave positive tests for the presence of carbohydrates and SH groups.
5. Both of the substances were soluble in water, acetone, and chloroform.

The substances differed in that the yellow crystalline material was not soluble in ethyl ether.

Preliminary experiments indicate the substances are not toxic to animals, however more work is needed in this area before positive conclusions can be made.
Antibiotic Produced by *Rhizopus nigricans*

TABLE 4
Inhibiting Ability of pH Adjusted Metabolized and Crystalline Solutions

<table>
<thead>
<tr>
<th>Type of Solution</th>
<th>pH</th>
<th>Diameter of Zone of Inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolized* Solution</td>
<td>5.5</td>
<td>20 mm</td>
</tr>
<tr>
<td>Metabolized* Solution</td>
<td>7.0</td>
<td>21 mm</td>
</tr>
<tr>
<td>White Crystals</td>
<td>4.0</td>
<td>25 mm</td>
</tr>
<tr>
<td>Yellow Crystals**</td>
<td>7.0</td>
<td>22 mm</td>
</tr>
<tr>
<td>Mixture of*** Crystals</td>
<td>7.0</td>
<td>31 mm</td>
</tr>
<tr>
<td>Metabolized** Solution</td>
<td>7.1</td>
<td>25 mm</td>
</tr>
<tr>
<td>Metabolized** Solution</td>
<td>7.2</td>
<td>23 mm</td>
</tr>
<tr>
<td>Metabolized** Solution</td>
<td>8.0</td>
<td>24 mm</td>
</tr>
<tr>
<td>Normal Saline</td>
<td>6.9</td>
<td>none</td>
</tr>
</tbody>
</table>

Test organism—Micrococcus aureus

*NaOH used to adjust pH, solution in distilled water.

**Na2CO3 used to adjust pH, solution in normal saline.

***CaCO3 used to adjust pH, solution in normal saline.
TABLE 5
Effect of Storage on Inhibiting Ability of Salt Forms

<table>
<thead>
<tr>
<th>Type of Stored Material</th>
<th>pH of Solution Tested</th>
<th>6 hrs.</th>
<th>12 hrs.</th>
<th>24 hrs.</th>
<th>1 wk.</th>
<th>3 wks.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqueous sol. yellow cryst.</td>
<td>3.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Aqueous sol. white cryst.</td>
<td>2.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Na salt of yellow cryst. in phys. saline</td>
<td>7.0</td>
<td>+</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ca salt of yellow cryst. in phys. saline</td>
<td>7.0</td>
<td>+</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Na salt of white cryst. in phys. saline</td>
<td>7.0</td>
<td>+</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Ca salt of white cryst. in phys. saline</td>
<td>7.0</td>
<td>+</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Yellow cryst. extract (dry)</td>
<td>3.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>White cryst. extract (dry)</td>
<td>2.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Na salt of yellow cryst. (dry)</td>
<td>7.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ca salt of yellow cryst. (dry)</td>
<td>7.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Na salt of white cryst. (dry)</td>
<td>7.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Ca salt of white cryst. (dry)</td>
<td>7.0</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

+: Solution tested exhibited inhibiting ability.
—: Solution tested did not exhibit inhibiting ability.
### TABLE 6
List of Media Used in This Paper

<table>
<thead>
<tr>
<th>Medium Number</th>
<th>pH</th>
<th>Ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.5</td>
<td>Water extract of 200 grams of Bell Pepper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bacto agar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dextrose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>2</td>
<td>7.4</td>
<td>Czapek Dox Broth (Stock)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bacto agar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>3</td>
<td>5.75</td>
<td>Water extract of cortex of Maclura pomifera root</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dextrose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>4</td>
<td>5.5</td>
<td>Water extract of 200 grams of Bell Pepper</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>5</td>
<td>5.5</td>
<td>Water extract of 95 grams of cortex of Maclura pomifera root</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dextrose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>6</td>
<td>4.5</td>
<td>Water extract of 200 grams of Maclura pomifera fruit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neopeptone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dextrose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
<tr>
<td>7</td>
<td>4.5</td>
<td>Neopeptone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dextrose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distilled water</td>
</tr>
</tbody>
</table>
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7. Wilkins, W. H., Harris, G.M.C., Investigations into the Production of Bacteriostatic Substances by Fungi; Preliminary Examination of 100 Fungal Species, Brit. J. Expt. Path., Vol. 23, 1942.
ABSENCE OF PASTEURELLA PESTIS IN THE WILDLIFE OF ARKANSAS

R. Reece Corey, Leo J. Paulissen, and Delbert Swartz
University of Arkansas

It is generally believed that plague first appeared in the United States in 1900 at San Francisco in the form of an initial "murine" phase which led to wild rodent infection and the phase known as sylvatic plague. Since that time, sylvatic plague has spread eastward until now it is reported in the neighboring states of Kansas, Oklahoma, and Texas (1). If migration continues it may be expected to enter Arkansas in the future. To determine if sylvatic plague had reached Arkansas, the isolation of Pasteurella pestis was included in investigations of the incidence of certain diseases in wildlife carried out at the University of Arkansas.

MATERIALS AND METHODS

The methods used for the collection and preparation of the tissue samples was the same as reported previously (2). The medium recommended by Meyer and Batchelder (3) was employed both in liquid and solid form. This medium consists of: Heart Infusion Broth, 25.0 g; Gentian Violet (0.1 per cent solution), 20.0 ml; Na₂SO₃ (10 per cent solution made fresh each time), 2.5 ml; agar (for solid form), 15.0 g; distilled water, 1000 ml. Each tube of broth was inoculated with 1.0 ml of the ground sample suspended in saline. Duplicate tubes were incubated at 30°C; after 4 days, and 10 days incubation, 0.1 ml of broth was spread on the surface of the corresponding agar in duplicate. At the time of inoculation of the broth tubes, 0.1 ml of the original saline suspension was also spread on the surface of agar plates in duplicate. All plates were examined at 2, 4, and 10 days. On this medium colonies of P. pestis are marked by a concentration of dye in the center of the colony. All suspicious colonies were subcultured and checked by slide agglutination with antiserum.

RESULTS AND DISCUSSION

Samples were examined from 1530 mammals of 29 species, 18 reptiles of 6 species, and 24 birds of 11 species. A list of species is given as Table 1. Pasteurella pestis was not found in any of the specimens examined; furthermore, so far as it is known, the plague bacillus has never occurred in the wildlife
of Arkansas. Whether this microorganism can be expected to appear in Arkansas is debatable.

Rat borne plague has appeared in the United States repeatedly: San Francisco, 1900 and 1907; New Orleans, 1914 and 1919; Pensacola, Galveston, and Beaumont, 1920; and Los Angeles, 1924 (5). With the exception of San Francisco, none of these outbreaks have ever shown any tendency to spread or even to persist.

It is generally believed that sylvatic plague has been spreading eastward from an original introduction on the west coast. If such migration continues it may be expected to enter Arkansas in the future. On the other hand, some investigators have explained the occurrence of the disease in North America as due to P. pestis which, they believe, was carried as a population regulator by rodents in their original emigration by the Bering Strait route.

In each of the major wild-rodent foci, the principal reservoirs are burrowing rodents, Sciuridae, which live in subterranean colonies; secondary reservoirs are mainly to be found among the Leporidae, Muridae, or Cricetidae. Such burrowing Sciuridae are found only in the western part of the United States with Kansas, Oklahoma, and Texas forming their eastern boundaries. Whether plague was introduced into the rodent population of the United States in the 1890’s or has been present for a much longer period, its eastern boundary appears to be stabilized at the eastern boundary of the range of these primary reservoirs. Arkansas is, therefore, excluded as the site of a primary reservoir.

Potential secondary reservoirs are found in Arkansas as shown in Table 2. Theoretically, since sylvatic plague is already in Oklahoma, these secondary reservoirs may become infected and bring plague into Arkansas. Such an infection would most likely not be widespread and should not persist as a primary reservoir would be absent. For instance, in Louisiana, where the rodent fauna is essentially the same as Arkansas, plague organisms were found in Oryzomys palustris which had presumably contracted it from the plague infected rats of New Orleans (6). In this case plague was transferred from the commensal to the wild rodents, but in the absence of a primary reservoir, did not persist.

From the above discussion it may be concluded that plague does not appear to be present in Arkansas. Furthermore, while its introduction is not likely the possibility can not be entirely ruled out; in as much as, the general movement of the disease is eastward, secondary reservoirs are available, and the Arkansas and Red Rivers drainage runs from west to east.
Absence of Pasteurella pestis in Arkansas

TABLE 1—Species examined for the presence of Pasteurella pestis.

<table>
<thead>
<tr>
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<th>Total Specimens</th>
<th>Species</th>
<th>Total Specimens</th>
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<td>*Feral specimens</td>
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TABLE 2—Species and genera of mammals occurring in Arkansas that have been found to be infected with P. pestis elsewhere. (After Pollitzer, 5).

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<td>California, Kansas, New Mexico</td>
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<td></td>
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</table>

REFERENCES

COMPARISON OF SPIDER POPULATIONS OF GROUND STRATUM IN ARKANSAS PASTURE AND ADJACENT CULTIVATED FIELD

W. H. Whitcomb\(^2\), Harriet Exline\(^4\), and Maxine Hite\(^5\)

ABSTRACT. Of 64 species of spiders taken from the ground stratum of an Arkansas pasture and adjoining cotton field, only 26 were common to both. Twenty-two were collected only in the cotton field; 16, only in the pasture. Many of the 18 species of lycosids were taken in greater numbers in the cultivated field, especially *Pardosa milvina* and *Lycosa helluo*. Eight species of lycosids were found only in the cotton field; two, only in the pasture. Only *Schizocosa avida*, of the better represented lycosids, appeared to show no preference. Similar relationships are given for dictynids, erigonids, linyphiids, oxyopids, gnaphosids, clubionids, thomisids, and salticids.

No one in North America, as well as can be learned, has compared the spider population of a natural or nearly natural plant community with that of an adjacent cultivated field. Of the numerous recent surveys of particular habitats, many include comparisons of populations of spiders in various strata, and a few deal with faunal changes following plant succession: deciduous forest succession by Smith-Davidson (1932); plant associations, Presque Isle, Lake Erie, by Truman (1942); Chicago area dunes by Lowrie (1948); virgin prairie near Lincoln, Nebraska, by Muma and Muma (1949); and maritime plant communities by Barnes (1953).

A pasture and adjacent cotton field were selected for study, situated on bottom land and river terrace on the south side of the Arkansas River, near Morrilton, Conway County, Arkansas. The pasture undulates and slopes toward the nearly flat cotton field below, its highest point being about 20 feet above the field. The pasture is essentially a Bermuda grass, *Cynodon dactylon* (Linn.), community; but other plants, such as dog fennel, *Anthemis* spp., and bitterweed, *Helenium tenuifolium* Nutt., are present. Cattle graze it, disturbing and destroying some of the spider population, especially that of the herbaceous stratum. The cotton field, once part of the pasture,
has been plowed and planted for two years. It lies fallow during the winter and is thoroughly disked and cultivated. Such cultivation destroys many spiders each winter, so that much of the summer fauna apparently originates in outside sources after each spring planting.

The objective in selecting the ground stratum in these environments was chiefly to investigate the incidence of wolf spiders (Lycosidae) that, in the preliminary surveys of 1960 and 1961, had appeared to be more numerous on cultivated than uncultivated land. The authors hoped to learn, by sampling the ground stratum of adjoining field and pasture, whether certain lycosid species show a distinct preference for one environment or the other.

Methods

Pitfall traps were used, a modification of the type employed by Hensley and associates (1961). Each consists of a buried metal sleeve supporting a quart jar; the jar ring is soldered to a quarter-inch rim, that rests on the sleeve. A metal shield above excludes rain and debris. This construction permits emptying the trap with minor disturbance to the soil and prevents spiders from falling between jar and sleeve. These small traps were used in preference to the larger models of Fichter (1941) and Rhoades (1962), because they could be set in drill rows of the cotton field, without curtailing current farm practices, and in the pasture they were less liable to disturbance by livestock.

Thirty traps were emplaced, 10 in the cotton field and 20 in the pasture, and collections were made weekly from June 10 to September 1, 1962. Jars were filled a quarter to a third their depth with 70 per cent alcohol. When specimens were removed, they were transferred to 95 per cent alcohol for storage.

In computing relative numbers of specimens in collections from the two environments, a base of 10 traps was used. Therefore, actual counts for the 20 traps of the pasture have been divided by two in Table 1.

Results

Sixty-four species of spiders were collected, during the summer of 1962, from the ground stratum in the pasture and adjacent cotton field. Twenty-six were common to both areas: 22 were taken only in the cotton field; and 16, only in the pasture. More wolf spiders (Lycosidae) were taken than members of any other family, and there were more species represented. Distribution of all species is shown in Table 1.
Preference for field or pasture was strikingly demonstrated by most species of lycosids. Only *Schizocosa avida* and *Pardosa saxatilis var. atlantica* were collected in approximately equal numbers in both environments. *Arctosa funerea* and *Lycosa antelucana* were taken only in the pasture. *Pardosa paxillla* and *Lycosa rabida* were taken somewhat more frequently in the pasture. *Lycosa punctulata*, *L. helluo var. annexa*, *Pardosa saxatilis s. s.*, *Pirata minutus*, *P. n. sp. A*, *P. aff. insularis*, and *P. sedentarius*, were collected only in the cotton field. *Pardosa milvina*, *Pirata sylvanus*, *Pirata n. sp. B*, and *Lycosa helluo s.s.* were many times more numerous in traps in the cotton field than in the pasture.

Erigonids appeared to prefer the cultivated field. *Grammonota inornata*, *Erigone autumnalis*, and *Walckenaera vigilax*, represented in both areas, were taken in greater numbers in the cotton field; and *Eperigone aff. tridentata*, *E. tridentata*, *E. maculata*, and *Floricomus* sp. were found only there.

Species of *Dictyna*, which usually build webs high on herbaceous plants, are not ordinarily taken in pitfall traps. *Dictyna segregata*, however, was fairly numerous in samples from the cotton field, although it was not taken in the pasture.

Several more species were far more common in collections from the pasture. The lynx spider, *Oxyopes aff. helius*, is the most unexpected of these, as members of this genus live mostly on foliage of shrubs and are taken by sweeping or plant examination, almost never in pitfall traps. Only very immature specimens of *O. aff. helius* had been taken previously in Arkansas, and then only by sweeping. *Meriola decepta*, a clubionid commonly living in ground litter, was more numerous in the traps in the cotton field, and the gnaphosid, *Drassyllus mephisto*, was more numerous in the traps in the pasture. The atypical linyphiid, *Tennesseellum formicum*, was collected only in the pasture.

Species of several families which might have been expected to give comparative data were useless, because no adults were found, and the immature forms are unidentifiable: *Clubiona*, *agelenids*, and *theridiids*. Identification of several species is tentative because of the poverty of taxonomic literature, limited collections, and incomplete knowledge of the fauna.

**Discussion**

Significant differences in the spider population of the ground stratum of these two concrete and adjacent communities (see Barnes, 1953; Barnes and Barnes, 1955) are apparent. Obviously, the data and collections are too limited to permit generalizations that would apply to similar abstract communities, where populations may be quite different. Also, dif-
frequent results would be likely if the herbaceous, instead of the ground stratum, were examined. Preliminary sampling of the former by sweeping, showed a more numerous spider population in the pasture. In the ground stratum, the population of the cotton field appeared to be considerably larger. Populations of the two strata reflect a difference in their faunas. Sweepings of the herbaceous stratum collect web-builders, as *Tetragnatha laboriosa* Hentz, and hunting spiders living in foliage, including *Oxyopes salticus*, some salticids, thomisids, and clubionids as reported by Whitcomb, Exline, and Hunter (1963). Pitfall trap collections of the ground stratum, in contrast, contain spiders which live in litter, as *Meriola decepta*, and those which hunt most of their prey on the ground, including most lycosids and some gnaphosids. There is some overlapping: litter-inhabiting spiders are sometimes swept from foliage, and spiders of the herbaceous stratum are sometimes collected in pitfall traps.

Some differences noted in the spiders of the ground stratum of the pasture and cotton field may be explained by physical factors. Species of *Pirata* and the erigonids were found in considerably greater numbers in the cotton field, perhaps because the field is lower, and the soil therefore more moist.

The appreciable number of specimens of *Dictyna segre-gata* collected from traps in the cotton field was unusual for this genus. Most species of *Dictyna* live high on herbs and shrubs and are not usually trapped on the ground. However. Whitcomb, Exline, and Hunter (1963) reported that *D. segre-gata* was found close to the ground.

The tremendous quantity of specimens of *Pardosa milvina* collected in the cotton field, 472 specimens per 10 traps, compared to 1.5 specimens in the pasture, is unexplained except in terms of preference or food supply. *Lycosa helluo* also was many times more numerous in the traps in the cultivated field.

An interesting anomaly is noted in the occurrence of *Pardosa saxatilis s. s.* and *P. saxatilis "var. atlantica,"* which usually are not separated taxonomically. *P. saxatilis s. s.* was taken only in the cultivated field; *P. saxatilis "var. atlantica"* was collected in approximately equal numbers in both environments.

**TABLE 1.** Comparison of spiders taken per 10 pitfall traps in ground stratum of pasture and adjacent cotton field near Mor-rilton, Arkansas, 1962.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
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<th>Cultivated Field</th>
</tr>
</thead>
<tbody>
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<td>Dictynidae</td>
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</tr>
<tr>
<td>Species and Genus</td>
<td>Cultivated Field</td>
<td>Pasture</td>
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</tr>
<tr>
<td>---------------------------------------</td>
<td>------------------</td>
<td>---------</td>
<td></td>
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<td>Tennesseellum formicum (Em.)</td>
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### Spider Fauna

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<td>Habronattus sp.</td>
<td>1.0</td>
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<td>Sitticus floridanus Gertsch &amp; Mulaik</td>
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<td>Phidippus carolinensis Peck. &amp; Peck.</td>
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**Literature Cited**


LITERATURE ON THE VEGETATION OF ARKANSAS
Edward E. Dale, Jr.
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A logical first step in making a study of vegetation of any area is to determine the extent and nature of previous work. The purpose of this paper is to bring together a list of publications on the natural vegetation of Arkansas.

The compilation of such a bibliography involves difficult decisions as to what should be included or omitted. In view of this consideration, the list is restricted to published and unpublished material on or directly related to native vegetation. Articles primarily concerned with forestry, agronomy, range management, horticulture or other applied sciences are not listed unless information on native plants likely to be of value to plant ecologists and taxonomists is given. Other studies not listed are those concerned primarily with plant groups lower than the Bryophyta and papers in the field of taxonomy in which the only information on plants of Arkansas is given as citations of herbarium specimens collected in the state. Master's theses on which a published paper is based, and older articles that have been superseded by later papers are also omitted.

The list includes very few papers published before 1925. A bibliography of published papers previous to this date is included in an article by Buchholz and Palmer (1926). The few older articles here included did not appear in their list, or are of particular significance. Also omitted are results of published or unpublished investigations not available through the University of Arkansas library.

This list comprises 102 references arranged alphabetically by author. A comment on the content of each paper accompanies each reference with the exception of papers on which an explanatory note is deemed unnecessary. Each title is followed by the location applicable to the reference, indicated in parentheses. Names of the county or counties are given when possible. If the reference covers a larger area, it is indicated as follows: Ozark Highlands, OZ; Arkansas Valley, AV; Ouachita Mountains, OM; Gulf Coastal Plains, CP; and Mississippi Alluvial Plains and Terraces, MI. These areas coincide in a general way with major physiographic, soil and vegetation regions of the state (Figure 1). References applicable to the entire state are indicated by ST.

Since it is possible that some references may have been overlooked, any additions or corrections for inclusion in a possible future revision will be appreciated.

Grateful acknowledgement is made to Dr. Frank Egler.
Norfolk, Connecticut, for encouraging the author to prepare the bibliography, and for providing material containing many helpful suggestions.

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Literature on Vegetation of Arkansas

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Figure 1. Map of Arkansas showing various regions cited in the bibliography.
GEOLOGY ALONG A PORTION OF HIGHWAY 23,
MADISON COUNTY, ARKANSAS

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Arkansas Geological Commission

ABSTRACT

The Highway 23 area is located in the south-central part of Madison County, Arkansas, between the towns of Huntsville on the north and St. Paul on the south. East-west coverage extends from Highway 23, which is the longitudinal center of the area, in both directions to exposures of Winslow-age rocks, or to a distance necessary for geologic control and interpretation.

Surface rocks are sedimentary strata of the Mississippian and Pennsylvanian Systems. The former is represented by the Fayetteville and Pitkin Formations and the latter by the Hale, Boyd and Winslow Formations. Stratigraphic units were deposited in a near-shore marine environment. Rocks of the Hale and Boyd Formations are variable in composition and appearance reflecting complexities arising from near-shore terrigenous deposits coupled with organic reef development and associated marine detrital deposits.

The Fayetteville Formation is predominantly shale. The Wedington Sandstone Member is not exposed but was penetrated by several exploratory wells. Localized sections of limestone were also penetrated and may represent reef development. The Pitkin Formation is composed entirely of limestone, with the exception of thin discontinuous layers of shale and siltstone. Organic reefs are present and account for some variation in thickness. The Hale Formation is represented by both the Cane Hill and Prairie Grove Members. The Cane Hill Member is made up of siliceous siltstone with interbedded sandstone and limestone. The Prairie Grove Member is predominantly calcareous quartz sandstone but includes thick beds of limestone which contain organic reefs. The Cane Hill and Prairie Grove Members seem to intertongue regionally though they display erosional contacts locally. The Boyd Formation is predominantly limestone with discontinuous lenses of shale, siltstone, and sandstone. Paleontological evidence indicates that the formation is represented by the Brentwood Limestone and Dye Shale Members. The basal unit of the Winslow Formation is the Greenland Sandstone Member which is a massive conglomeratic sandstone. Above the Greenland Sandstone Member the rocks consist of alternating beds of shale, siltstone and sandstone of varying thickness and random occurrence.

The lower shale of the Brentwood Member which may serve as a market bed between the Hale and Boyd Formations
is absent over most of the Highway 23 area. As a result, limestone of the lower Bloyd Formation rests directly on limestone of the upper Hale Formation in places. Where this occurs several general criteria can be used in the field to distinguish the two formations. These are: (1) contacts between lithotypes are gradational in the Hale and abrupt in the Bloyd; (2) distinct lithotypes are traceable over considerable distance in the Hale whereas in the Bloyd they have little horizontal continuity; and (3) distinctive colors of Hale rocks are various shades of brown and those of Bloyd rocks are various shades of gray. In addition, results of laboratory work show that in general the insoluble residues of Hale and Bloyd carbonate rocks within the Highway 23 area are distinguishable. The amount of insoluble material in the Hale ranges from 14 to 40 percent with an average of 26 percent, and those of the Bloyd range from .06 to 18 percent, with an average of 6 percent. The colors of the insoluble material from the Hale are light-tan to brown and those of the Bloyd are light to dark gray. The diameter of the residue is from silt size to 1 mm in the Hale and from silt size to $\frac{1}{2}$ mm in the Bloyd.

A reef complex is exposed along the junction of War Eagle and Jackson Creeks in the northern part of the Highway 23 area. It is made up of a number of intertonguing and overlapping reefs. The reefs have the form of mounds or elliptical masses with maximum widths in excess of twice their height. Individual reefs consist of a reef core composed of dense algal limestone; reef flank strata, composed of bioclastic limestone; and inter-reef deposits of shale, calcareous quartz sandstone and detrital, fossiliferous limestone. Reef development began during late Hale time. It was not determined if reef development culminated at the end of Hale time or if it continued into Bloyd time.

Structures of the Highway 23 area include an east-west trending arch, northeast trending folds, gravity faults and a small collapse structure. The area lies between two major northeast trending anticlines: the Highway 71 anticline and the Highway 23 anticline. Northeast trending folds mapped within the Highway 23 area appear to be subsidiary folds associated with these major structures. A broad east-west trending syncline may be present to the south of the Highway 23 area. Hale and Bloyd age rocks which dip under the Winslow Formation in the southern part of the Highway 23 area are exposed approximately 10 miles to the south. Surface rocks of the intervening area are of Winslow age and the area is topographically lower than the Hale and Bloyd age outcrops.

Seven exploratory wells have been drilled in the Highway 23 area, one of which has penetrated the pre-Cambrian sur-
Two wells tested for gas yielded over 1,000,000 cubic feet of gas per day. Oil shows are reported in six of the wells. The gas shows are restricted to wells located on structural highs, whereas oil shows are found in wells located on both structural highs and lows. There has been no commercial production of gas or oil in the Highway 23 area to date.
RELATIONSHIP OF IGNEOUS ACTIVITY TO MINERAL DEPOSITS IN ARKANSAS

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ABSTRACT

Igneous rock is exposed on less than 0.05% of the surface area of Arkansas. This, however, is no measure of the importance of igneous activity to the origin of ore deposits in the state. The alkalic to ultrabasic intrusives of the Ouachita Mountain areas can be attributed as the source of the bauxite in central Arkansas, the barite near Magnet Cove and the diamond-bearing volcanic neck near Murfreesboro in southwestern Arkansas. These bodies, of probable mid-Cretaceous age, characteristically have a relatively high content of iron, titanium, columbium and vanadium, especially in the Magnet Cove region. Deeper bodies of similar character have been encountered in holes drilled in southeastern Arkansas.

Certain nickel-bearing serpentine and talc bodies of central Arkansas have been described as being derived from igneous bodies of Paleozoic age. Granite and rhyolite of probable Precambrian age have been encountered by deep drilling in northwestern Arkansas, and more recently reported at depth in west-central Arkansas near Fort Smith.

Since the Mesozoic and Paleozoic igneous activity of the state is closely connected to or immediately responsible for much of the known occurrence of metallic minerals in Arkansas, it is logical to examine this background in looking for new mineral deposits.
HYPOGENE CLAY AND MICA MINERALS ASSOCIATED WITH FAULT ZONES IN THE OUACHITA MOUNTAINS-ARKOMA BASIN AREA, ARKANSAS

Charles G. Stone
Arkansas Geological Commission

ABSTRACT

During geologic mapping in the Ouachita Mountains-Arkoma Basin area hypogene clay minerals were found in quartz veins, or along fractures, joints or small slickensided surfaces commonly in or very near fault zones. In the vicinity of Little Rock hypogene micas occur along with the clay and other minerals suggesting an even higher temperature for this part of the region. The clay and mica minerals are: dickite, two varieties of rectorite, muscovite, cookeite (a lithium mica), and chlorite. The presence of these minerals, especially dickite, is useful in determining fault zones in the Ouachita Mountains-Arkoma Basin area. These minerals indicate that fairly high temperature hydrothermal solutions were present throughout this region.
THE AMERICAN NEGRO IN 1901
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Of the many racial and national groups that made up the American scene in 1901, the Negro group constituted the most serious minority problem. Although Negroes had been in the Western Hemisphere since 1512, their number had been greatly increased by an accelerated influx of slaves into the English colonies after 1620. In bondage until the 1860's, a civil war had been fought, partly because the North and South could not agree on the status of the Negro. Immediately after the Civil War, the Negro had gained significantly in his political and social rights, but by 1901 many of these newly acquired rights had been eroded away.

In politics the southern whites drastically reduced Negro voting strength by such devices as the "grandfather" clause, interpretation-of-the-Constitution provisions, residency, literacy, and property requirements, economic pressure, and physical coercion. The justification for Negro disfranchisement and the methods used to accomplish it were best expressed at the turn of the century by Senators Oscar W. Underwood of Alabama, John S. Williams of Mississippi, and Ben Tillman of South Carolina. Underwood stated that the Fourteenth Amendment had been a lamentable mistake, and that the South was not trying to oppress the Negro but rather to protect the homes and property of the whites against misgovernment. At the same time, he said, the South wanted to give this inferior race a chance to grow up and acquire civilization. Williams expressed this same thought in a derisive comparison of whites and Negroes. He said if 10,000 illiterate white Americans were shipwrecked on a desert island, they would have a fairly good government in three weeks. If, on the other hand, 10,000 college-trained Negroes were shipwrecked on a similar island, the results would be the reverse. Within three years, they would have retrograded governamentally, and half of the men would have been murdered and the other half would have two wives apiece. Tillman, who was more for action than for explanations, stated with satisfaction that his state had disfranchised all the colored people it could. "We have done our level best. We have scratched our heads to find out how we could eliminate the last one of them. We stuffed ballot boxes. We shot them (Negroes). We are not ashamed of it."

The poor political position of the Negro was illustrated in 1901 by the departure from office of the last Negro con-
gressman of the Post-Reconstruction era. The number of Negro congressmen had ranged from three in 1869 to a high of eight in 1875 and then down to one by 1891. The last Negro representative was George H. White of North Carolina who had been elected in 1896 and had been returned two years later in spite of the "white supremacy" campaign. North Carolina was overjoyed by White's departure from the House of Representatives in 1901. On March 4 of that year, both houses of the North Carolina legislature noted with speeches of thanksgiving that White's term had ended.¹

Other aspects of the Negro's existence were equally bad. Family life among the Negroes was often haphazard. Sexual immorality and unstable family conditions were common. This situation was caused largely by the Negro's low economic and social position and traditions developed under slavery. The white masters had often been more interested in producing slaves than in promoting stable Negro family relationships. Family instability was further increased by 1901 because many Negro mothers worked and neglected their children. Whereas only three per cent of white married women worked outside the home, twenty-six per cent of Negro married women had outside employment.² Because of their low social and economic position, the Negro death rate was also higher. In Baltimore, Maryland, and Nashville, Tennessee, for example, the death rate of Negroes was about twice that of the whites, and this situation existed generally across the nation.³

The Negro was also at a disadvantage in the labor market. The percentage of Negroes and whites engaged in various occupations in 1900 clearly showed the Negro's disadvantageous position. Agriculture, fishing, and mining had 53.7 per cent of the Negroes and 43.3 per cent of the native whites: manu-

¹Rayford W. Logan, The Negro in American Life and Thought: The Nadir 1877-1901 (New York, 1954), 90-95. With the disfranchisement of the southern Negro, Congressman Martin E. Olmstead of Pennsylvania and Edgar D. Crumpacker of Indiana sought to enforce the second section of the Fourteenth Amendment pertaining to reduction in representation in the House of Representatives. On January 3, 1901, Olmstead introduced a resolution authorizing the appointment of a committee to investigate the alleged abridgement of Negro suffrage in Mississippi, South Carolina, and Louisiana. Four days later Crumpacker tried to put through an amendment to reduce the representation of Mississippi, South Carolina, Louisiana, and North Carolina. This amendment along with Olmstead's resolution were both promptly defeated.


facturing and mechanical industries, 6.9 per cent of the Negroes and 20.3 per cent of the native whites; trade and transportation, 5.2 per cent of the Negroes and 17.3 per cent of the native whites; and professional services, 1.2 per cent of the Negroes and 5.8 per cent of the native whites. Generally, Negroes were not prepared for industry; facilities were not available to train them, and the white industrial world was prejudiced against them. Negroes, even when they lived in areas that were unionized, often were not allowed into the white unions. Out of the 60 unions in existence in 1900, the Negroes had only 32,069 members in nine unions. To illustrate, out of 22,435 colored carpenters, only 1,000 were unionized; out of 5,934 painters, 169 were unionized; and out of 14,457 bricklayers, 200 were unionized. Moreover, the normally strained relations between white and black workers became even worse when unorganized Negroes were used as scab labor.

Negro education revealed similar deplorable conditions. Many of the Negro children were working rather than going to school. Overall, 42.3 per cent of all Negro boys and 30.6 per cent of all Negro girls ages 10 to 15 were engaged in gainful employment, compared to 22.5 per cent and 7 per cent, respectively, for white boys and girls of the same ages. Of the 1,092,020 Negro children 10 to 14, only 54 per cent were in school for limited amounts of time. Although Negro children received money for their education from both philanthropists and local taxes, they still fared badly in educational funds. In a typical example like Atlanta, Georgia, the Negro school population numbered 35 per cent of the whole, and yet they received only 12 per cent of the school funds.

In court the Negro was again at a disadvantage. A white person's word was usually accepted over a black's, and the juries were usually composed of whites. The United States Supreme Court had ruled in somewhat conflicting decisions that a Negro could have a retrial if he could prove that Negroes had been systematically kept off of the jury, but this was difficult to prove. As a result of the Negro's poor legal position, he was often exploited by whites. Negroes on plantations in back-country districts, especially, were held at forced labor at ex-

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4Another revealing statistic on the distaff side on the status of Negroes in the labor market was that out of 665,791 female agricultural laborers in the United States, 509,687 or 76 per cent were Negro.
6Ibid., 26.
7Brawley, Social History, 327-34. These philanthropists, living and dead, included men like John D. Rockefeller, George Peabody, and John F. Slater.
tremely low wages. If a Negro ran away, the sheriff would bring him back on some technicality and his labor would continue.

The Supreme Court had ruled previously in *Plessy v. Ferguson* (1896) that separate but equal accommodations for Negroes and whites were legal and enforceable under the state's police power. The majority of the court said in effect that if one race was inferior to another socially, the Constitution of the United States could not put them on the same plane. In this case, Justice John M. Harlan filed a dissenting opinion. He maintained laws requiring segregation on public carriers were unconstitutional since they interfered with the personal freedom of citizens. Furthermore, such laws fostered ideas of caste and inferiority and would stimulate further aggressions upon the rights of Negroes. Harlan concluded that the United State Constitution was blind and neither knew nor allowed class or color to enter into the civil rights as guaranteed by the supreme law of the land.⁸

The most odious treatment, however, meted out to Negroes, was lynch "law," carried on often with the tacit consent of law enforcement officials. Southern whites felt that such extreme actions were necessary to assure white supremacy. When one considers the population statistics, it becomes clear why the southern whites believed these actions were necessary. In many of the southern states there were nearly as many Negroes as whites and in two states—Mississippi and South Carolina—the Negroes were numerically superior.⁹

Generally, few lynchings took place outside the South. During 1901 there were 130 lynchings in the United States. Of these, 115 were in the South, and Mississippi headed the list with 16. Georgia and Louisiana were tied for second place with fourteen each. Broken down racially, the 130 lynched persons included 103 Negroes, 25 whites, one Indian, and one Chinaman.¹⁰

These lynchings were rather gruesome affairs. On August 12, Joe Washington was burned by a white mob eighteen miles from Savannah, Georgia. He refused to admit that he had assaulted Mrs. J. J. Clark, but she positively identified him as her attacker. Only the charred trunk of his body remained after the burning.¹¹ Eleven days later, Abe Wildner

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⁸Logan, Negro, 112-16.
⁹U. S. Census Office, Twelfth Census, 1900, Population, 1, pt. 1 p. cxii. Table L1. Mississippi had 641,200 whites and 907,630 Negroes. South Carolina had 557,807 whites and 782,321 Negroes. Georgia was almost equally divided, 1,181,294 whites and 1,034,813 Negroes.
met a similar fate at Dallas, Texas. He had allegedly murdered a woman. He was chained to an elm tree, dried sorghum hay applied about his legs, and wood piled to his shoulders. The murdered woman's husband applied the torch. According to eye witnesses, Wildner burned twenty-one minutes before life became extinct. On the last Sunday of October, 1901, a group of Negroes, holding their usual fall camp meeting in a grove at Washington Parish, Louisiana, were attacked by whites and ten Negroes were killed.

On the other hand, there were many southerners who were attempting to abolish lynching law and improve Negro-white relations. On January 20, 1900, Congressman White of North Carolina introduced a bill to make lynching of American citizens a federal crime. But when White delivered his valedictory on January 29, 1901, he lamented that the bill was still "sweetly sleeping in the judiciary committee." Another Negro, Booker T. Washington, was also active in advocating better race relations and the abolition of mob law. On the occasion of President William McKinley's assassination in September 1901, Washington took the opportunity to point out that Leon Czolgosz's deed was the expected manifestation of mob law prevailing especially in the South. He believed lynching to be just as criminal as the shooting of the President. As a positive step to stop lynching, Washington suggested to his race that they work harder to succeed in the community and that they try not to antagonize the white majority. Do not ask for the right to vote, he said. Do not fight for civil liberties or against segregation; go to school; work hard; save money; buy property. Eventually such actions will prove to the whites that Negroes are worthy of equal treatment.

Respectable southern whites were also indignant at Judge Lynch. In Greenville, Mississippi, Reverend Quincy Ewing told his congregation that if the southern states could not stop lynching, the United States Government should. He added that although he was a States-Rights Democrat, the stoppage of mobocracy was important enough to over-ride that consideration. The Atlanta Constitution noted the terrible state of affairs, when the mob burning of a Negro was dismissed by a few lines in some obscure corner of the newspaper.

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12 Ibid., August 23, 1901, p. 1, c. 1.
13 Ibid., September 25, 1901, p. 2, c. 6.
14 Logan, Negro, 317.
15 Ibid., 91.
17 Outlook: A Weekly Newspaper, LXIX (September 7, 1901), 11.
18 Literary Digest, XXIII (September 7, 1901), 272.
Some southerners were acting on these convictions as well as just talking about them. At Wetumpka, Alabama, a white man who helped to lynch a Negro was found guilty by a white jury and sentenced to imprisonment for life. In Carroll County, Georgia, the sheriff killed a member of a mob who was attempting to take Ike Williams, a Negro, out of jail. Williams was accused of murdering Charles Word, a little boy from the county. Williams was not lynched.

In 1900 most of the Negroes lived in the South. Out of the total Negro population of 8,883,994, 89.7 per cent or 7,922,969 lived south of the Mason-Dixon line. Like the southern whites, the great bulk of southern Negroes lived in the country. Of the 7,922,969 Negroes in the South, 6,558,173 or 85.3 per cent lived in the rural areas. However, the Negroes were beginning to move to town at about the same rate as the whites.

Living conditions of southern Negroes in 1901 varied greatly, but they were generally substandard. Some of the most prosperous Negroes lived on farms near Christianburg, Virginia. Here, they owned two-story frame houses, surrounded by gardens and numerous outbuildings. The interiors of these homes were neat and clean, containing pictures, a few books, and adequate furnishings. Nearby, they had a small country school that operated spasmodically for about six months during the year.

A more average Negro community was on the upper reaches of the Alabama River, where 100 Negro families lived on a sandy stretch dotted with giant live oak trees. Their houses were rude huts with two or three rooms and a few outbuildings. Generally, the interiors of the houses were bare, but neat and clean. Vines grew over the porches, and gourds hung from the beams.

The average, annual budget for both rural and urban Negro families was under $600. Of this, around $125 was allotted for food, $75 for clothing, $10 for medical care, $15 for Christmas money, and $5 for church and school. The standard Negro diet in the South was fat pork and cornbread with syrup and greens. Eggs, chicken, fish, wild game, coffee, and tea were sometimes added.

Many southerners felt that the southern Negro's position was pleasant and uplifting. Mrs. Orra Longhorne, of Virginia,
for example, said that in Virginia and in much of the South the great estates were divided into small Negro holdings, where exslaves continued to dwell happily under their own vine, and fig tree on a portion of their old master's land. They lived there, educating their children, holding up their heads, and feeling that the great revolution had borne them to a point that their fathers dared not hope to reach.\(^{23}\)

In contrast, an Alabama resident, Edgar C. Murphy, stated that the Negro had made slow progress in the generation, 1865 to 1901. Of an average twenty-five Negro families he knew, not more than half a dozen were owners of homes, which with some exceptions were mere cabins surrounded with enough land for a small garden. Three-fourths of the Negro farmers were share-croppers or tenants. Most of the great estates had not been divided into small farms; but rather, the huge plantations remained in the hands of single owners who cut them into share-cropper strips that counted as single farms.\(^{24}\)

In general, the Negro's economic, social and political lot in the South was unpleasant. Because of the Civil War and Reconstruction, the Negro was often viewed by southern whites, especially the poorer ones, as a symbol of southern humiliation. Added to this was the southern-white concept of superiority to the black, the struggle between white and black counties for control of state governments, and the competitive labor struggle between white and Negro employees. As a result of these factors, Negroes were lynched, state appropriations for their education were curtailed, they were relegated to menial tasks, their living standards were a bare subsistence, and they were restricted in the exercise of their suffrage.\(^{25}\)

The North, generally, with few Negroes was happy to act as judge of the "unholy" South. William G. Sumner wrote that it was disgraceful in our civilization to put men to death without proof of guilt and in such a painful way. He said that even the burning of a rattlesnake or a mad dog was disgraceful, not because the victim was not bad enough, but because people should be beyond cruelty.\(^{26}\) On September 11, 1901, the Cleveland News and Herald remarked that George Parker, the Negro who seized Czolgosz and attempted to save McKinley's life, was looked upon by a large section of the


country as inferior because he had black skin.\textsuperscript{27} William D. Howells, writing to Henry B. Fuller, said that he had been reading \textit{Morrow of Tradition} by Charles W. Chesnutt, a Negro author. Howells reflected how such a brilliant man must hate the white race with its injustice and its feeling of superiority.\textsuperscript{28} Washington Gladden, president of the American Missionary Association, warned the South that a nation which tried to suppress a weak minority would eventually be overthrown. Gladden said that the southern white wanted to educate the Negro so that he would be helpful but still would not know anything.\textsuperscript{29}

Of course there were people in the North who held the same view as the southern whites on what the position of the Negro should be, and they were not hesitant in stating it. Men as diverse as Senator Albert J. Beveridge, Reverend Josiah Strong, and journalist Poultney Bigelow felt that there were vast differences in capacity between the races and that it was the white man’s mission, his duty, and his right to hold the reins of political power in his own hands for the good of the country and mankind. Bigelow, especially, disliked Negroes generally, and Booker T. Washington in particular. Bigelow attempted to soil the reputation of Washington by alleging that the Negro educator was arrested in upper New York for making an indecent proposal to some man’s wife in a poorly lighted doorway. The journalist concluded that the episode was hushed up, and Washington was quickly gotten out of jail to prevent any scandal that might harm fashionable families and Republican leaders.\textsuperscript{30}

Overall, however, Negroes in the North fared somewhat better than their counterparts in the South. This was due partly to the fact that even though the Negroes had begun to migrate from the South, there were still few in the North. Out of the 8,833,994 Negroes in the United States, only 911,025 or 10.3 per cent lived in the North; and two-thirds of these were in the cities.\textsuperscript{31}

Negro life in the northern cities was far from ideal. Negroes were segregated into slum areas like “San Juan Hill” and Harlem in New York, the Seventh Ward in Philadelphia, State Street in Chicago, the Northwest neighborhood in Washing-

\textsuperscript{27}Cleveland News and Herald, September 11, 1901, p. 4, c. 1.
\textsuperscript{28}William D. Howells to Henry B. Fuller, November 10, 1901, Mildred Howells, ed., \textit{Life in Letters of William Dean Howells} (Garden City, New York, 1928), II, 149.
\textsuperscript{29}Washington Gladden, \textit{Recollections} (New York, 1909), 368-72.
\textsuperscript{31}T. J. Woofter, \textit{Negro Problems in Cities} (New York, 1928), 27.
ton, D. C., and Druid Hill Avenue in Baltimore. The Negro crime rate reflected this slum environment. In fact the northern crime rate for Negroes was about three times what it was in the South. Whereas the South had 220 Negro prisoners per 100,000 Negroes, the North had 765 per 100,000. There were also color-line disturbances in the Northern cities. In Indianapolis, for example, on September 3, a white gang called the "Bungaloos" began a riot at Columbia Avenue and Nineteenth Street. One person was killed and several were seriously injured. Two hundred Negroes and whites were engaged in the affray. This was the third such disorder in two months.

Chicago's State Street section, which had around 30,000 Negroes in 1901, was a good example of a developing urban-Negro community. Chicago was attracting a large percentage of the Negroes referred to as the "talented tenth," who left the South during this period. Among this group were preachers and politicians who had enjoyed political office for a few years after the Civil War, and the restless half-educated who were not content to live on southern farms. This group built a community on the narrow economic base of domestic and personal service and the paternalistic philanthropy of some wealthy Chicago merchants and industrialists. The Negro community life revolved primarily around the lodge and the church. A few Negro business and professional men, politicians, and ambitious servants constituted the social elite, and their wives became the social arbiters. This community was plagued with a red-light district and disturbed relations with native and immigrant whites. Although the Negroes did mix with immigrants, especially the Jews and Italians, they viewed the latter's coming with mixed emotions. The foreign born constituted a potential threat to their jobs as butlers and maids, janitors, and waiters. On the whole, however, the Negroes regarded foreigners with a certain amount of condescension. The foreign born in turn quickly adopted the prevailing stereotypes about Negroes. 'Foreigners learn how to cuss, count, and say 'nigger' as soon as they get here,' grumbled the Negroes.

Jacob A. Riis painted a slightly more pleasant picture of Negro-community life in Harlem. He said the Negroes in New York kept their houses very neat. The poorest Negro housekeeper's room was bright with gaily-colored prints of her beloved "Abe Linkum," General Grant, and President Garfield.

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33 Monroe N. Work, "Negro Criminality in the South," The Negroes' Progress, 75.
35 Drake and Cayton, Black Metropolis, 52-57.
and cheery with flowers and singing birds. In the uptown homes of colored tenants, pianos and parlor furniture were abundant and lent a prosperous air. Riis did note, however, that the Negro community had problems such as disrupted family life, gambling, and a criminal element.  

Compared to the South, the Negro was in somewhat better legal, social, and economic circumstances in the North. There he found less segregation, a wider variety of job opportunities, and more chance of economic advancement. But even in the North, there was a color-line prejudice, and again, there was discrimination. His chance for a job was not equal to that of a white. As for housing, he was compelled to pay a high rent for a home in a prescribed section of the city. And even if the Afro-American remained inobtrusive, there was always a chance that he would be the victim of a riot.  

Generally, North and South, the Negro was treated and viewed as an inferior. In the South, especially, the whites believed that the labor of the Negro existed only for the good of the white man; and if this labor were to be exploited most efficiently, the Negro must not have political power or equal justice in court. In all parts of society, in hospitals, in schools, in places of public accommodation, and even in prison, there developed the idea of inferior service for Negroes. The whites tended to deprive the Negro of many privileges due him, education, economic opportunity, and legal equality. By so doing, the whites brutalized the Negro rather than elevating him. Treated like an animal, he often responded like one.  

Through articles, stories, anecdotes, poems, and cartoons, the Negro in the public mind was made to appear superstitious, dull, imitative, suspicious, improvident, lazy, immoral, criminal, untruthful, and intemperate in his consumption of alcoholic beverages. He used big words which he did not understand. He liked fine clothes and trinkets, chickens, "watermillions," "sweet-tators," and "possum." The inevitable razor-totin' Negro made his appearance. Many comments were made about the Negro's passion for gambling, especially the numbers racket. Preachers and to a lesser degree lawyers were made the frequent butt of jokes. The Negro was portrayed in the plantation tradition as a faithful slave, who had been unable to adapt to his freedom.  

Despite their difficulties, Negroes in the United States were progressing economically and socially. In 1900, of the 8,833,-
994 Negroes in the United States, 3,992,377 over the age of ten were making themselves felt in the economic life of the nation.\textsuperscript{39} In agriculture alone, they operated 746,717 farms which, including buildings, tools, machinery, and livestock, were valued at $499,943,734. The value of the products produced on these farms was $255,751,145.

The Negro was also being educated. In the generation after 1865, Negro illiteracy declined forty-seven per cent. By 1901 there were two-thousand Negroes who had graduated from college, of which 278 were women. At the beginning of the twentieth century, 1,200,000 Negro children were in elementary school, 30,000 were in high schools and trade schools, and two hundred were in northern universities. To aid in the education and improvement of their race, the Negroes privately owned and managed fifty high schools, five law schools, five medical schools, twenty-five theological schools, and $40,000,000 worth of church property.

Therefore, as a result of the desire and facilities for training, Afro-Americans were assuming a role in the professional world. They numbered in their professional ranks thirty-thousand elementary and secondary teachers, hundreds of college professors, fifteen-thousand clergymen, two-thousand lawyers, 1,500 medical doctors, several former United States congressmen, and 4,610 government employees. Negroes had written and published four-hundred books. In addition, they owned and published three-hundred newspapers and twelve magazines. They also had five-hundred patents registered in the United States Patent Office.\textsuperscript{40}

Among the outstanding Negroes in 1901 were W. E. Du Bois, Harvard trained economist; Paul L. Dunbar, Dayton, Ohio, poet; Booker T. Washington, educator; George W. Carver, educator and scientist; Henry O. Tanner, painter; Sissieretta Jones, concert stage artist; Joe Walcott, world welterweight champion; and John Mackey of Philadelphia who died in 1902, leaving an estate of $432,000.\textsuperscript{41}

The New York World, speaking of the achievements of the colored man since his emancipation said: "He owns 137,000 farms and homes worth $725,000,000; he has personal

\textsuperscript{39}Twelfth Census, 1900, Pop., II, pt. 2, p. xviii, Table II: Ibid., Special, p. 230, Table LXII.
\textsuperscript{40}Sinclair, Aftermath of Slavery, 271-85.
\textsuperscript{41}Brawley, Social History, 308-32: Robert E. Park, "Negro Home Life and Standards of Living," The Negroes' Progress, 148.
property to the value of $165,000,000; he has raised $10,000,000 for his own education; and his per capita possessions amount to $72.50.” Considering his status in 1865, these facts indicated that the Negro had made remarkable progress in the thirty-six years since his emancipation. 42

42 Sinclair, Aftermath of Slavery, 280-285; Thomas N. Page, The Negro: The Southerner’s Problem (New York, 1904), 65-66. Of course, some whites viewed this progress darkly. William H. Thomas wrote that the Negro had accumulated about $700,000,000 in property which gave him only $72.50 per capita, or only about $2.50 a year increase since emancipation. William H. Thomas, The American Negro (New York, 1901), 76.
THE NORTH AMERICAN LAND AND TIMBER COMPANY, LIMITED—
SOME NOTES ON ITS BEGINNINGS

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Both C. Van Woodward and Samuel P. Hays consider the North American Land and Timber Company, Limited, as the major southern colonizer of its time and as being responsible for the rise of Louisiana as the major rice producing state within a few years. Rice production on upland prairies allowed the use of machinery adapted from wheat growing thereby increasing ten to twenty times the yield per man.¹

The man responsible for the North American Land and Timber Co. was Jabez Bunting Watkins of Lawrence, Kansas, a farm mortgage broker. Watkins started in the farm mortgage business soon after receiving a law degree from the University of Michigan in 1869. By 1873 he shifted his business to Lawrence, Kansas. By 1876 he opened a branch office in New York. The New York manager, Henry Dickinson, who had contacts for many years with British business interests, pushed for investment funds in Great Britain. Watkins visited England in 1878 for several months and established a branch office in London with H. G. Chalkley as his agent. Watkins had been forced, largely because of drought and the sharp competition of too many mortgage brokers, to restrict his lending for the most part to eastern Kansas and western Missouri, withdrawing from Minnesota, the Dakotas, Iowa, Nebraska, and western Kansas.² Because of this competition, Watkins wanted newer territory and sent Miles Dart, an employee of long standing, to investigate Texas in the fall of 1881. Watkins used the utmost secrecy in this move to enable him "to take up the cream of the business" which resulted in his branch office being opened in Dallas, Texas, a comparatively new field for the loaning business, had a reputation for being a Wild West, and reconstruction disorders had frightened eastern people with

¹C. Van Woodward, Origins of the New South, 1877-1913 (Baton Rouge, 1951), pp. 119-120.
²For a fuller report on the mortgage brokerage business, see Allan G. Bogue, Money at Interest, the Farm Mortgage on the Middle Border (Ithaca, 1955), pp. 79-204.
money to lend. J. B. Watkins was prepared to build confidence in Texas, its soil, crops, business, resources, and people as he did earlier in Kansas and later in Louisiana in order to encourage loans for development.

Watkins, who grew up in Pennsylvania and went to law school in Michigan, knew the timber in those two states. The census of 1880 convinced him that a large block of virgin timber needed to be developed to meet demands. With this in mind, he visited Texas in March, 1882, looking at timber and saw mills, and gathering information.

This and other visits by Watkins, Miles J. Dart, his Dallas manager, and other employees continued to gather information on timber lands of Arkansas, Louisiana, Mississippi, Georgia, Alabama, Virginia, Florida, South Carolina, and North Carolina. Reports were sent to the London office for Watkins concerning laws about alien land ownership, taxes, and transportation facilities. Chalkley, the London manager, had sent out a circular on the pine land scheme in April, 1882. Watkins left for England in late May and returned to the United States in late September, 1882. British investors were putting money into the new scheme that summer. Three members of the House of Commons were in the organization of the new project. Watkins left Lawrence in early October for an extended trip to Dallas and the South in relation to the new project. Evidently Southwest Louisiana had been selected but references to the locality were to be avoided.

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3J. B. Watkins to Henry Dickinson, N. Y., Dec. 5, 1881 (J. B. Watkins Collection, Library of University of Kansas.) Manuscript references will be in this collection for the entire paper.
4T. H. Rudiger to M. J. Dart, Dallas, March 24, 1882.
5J. B. Watkins to Lawrence office, March 27, and May 10, 1882.
Miles Dart to J. B. Watkins, June 28, 30, July 17, 31, and August 10, 1882.
Miles Dart to Registrar, State Land Office, Baton Rouge, La., Dec. 22, 1882.
Miles Dart to Secretary of State, New Orleans, Louisiana, June 23, 1882.
6J. B. Watkins to Lawrence office, June 14, 1882.
Henry Dickinson to M. J. Dart, Dallas, June 17, 1882.
8H. G. Chalkley to Lawrence office, July 7, August 21, Sept. 29, 1882.
9J. B. Watkins to Lawrence office, July 14, 1882.
A John Hayes, an engineer with much experience in Latin America, came from London to New York to visit Watkins and Dart in New Orleans on a trip west, but business in Mexico City took him there first and then back to New Orleans. He left New York on December 7, 1882, but delays and Watkins' sickness while in Cincinnati in November and December kept them from Lake Charles, Louisiana, and Beaumont, Texas, until January. Hayes was to inspect for the new North American Land and Timber Co., Ltd. New circulars on the company were sent out and funds received. In October the registration fee for the company which had been chartered in September had been paid Chalkley in London. Watkins wrote that "It is the vast amount of land that is striking to Englishmen more than money." 12 H. R. Brand, M. P., was chairman of the new company which used the Watkins London office as its address. Watkins was buying shares in the North American Land and Timber Company at 10 pounds each. 13 Many patrons in England apparently were transferring funds from the J. B. Watkins Land Mortgage Company to the North American Land and Timber Company. 14 Watkins opened the Watkins Banking Company, a private bank, in Lake Charles, Louisiana, in order to handle more conveniently his financial matters there. 15 Some of the investors had relatives for whom they wanted positions with the company in Louisiana. 16 Watkins wrote to his London manager and secretary of the Company, "You people on that side may think it somewhat strange that very few, if any, of the persons who have come over here and gone into the employ of the Company have given satisfaction. I have sometimes thought that some of you may conclude that we are prejudiced against Englishmen; but it is a fact that those who have come over so far are almost absolutely worthless, and, as a general thing, are drunken, unreliable charac-

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Lawrence office to M. J. Dart, Dallas, Oct. 9, 1882.
11Henry Dickinson to Lawrence office, Nov. 17, Dec. 2, 9, 12, 1882.
J. B. Watkins to Lawrence office, Nov. 17, 23, 24, Dec. 5, 9, 12, 14, 15, 1882, Jan. 8, 16, 21, 1883.
H. G. Chalkley to Henry Dickinson, N. Y., March 14, 1884.
J. B. Watkins to Prof. A. Thomson, Ames, Iowa, March 14, 1884.
M. J. Dart to Prof. A. Thomson, Lake Charles, La., May 24, 1884.
Henry Dickinson to J. B. Watkins, Feb. 23, March 28, April 12, 24, 1884.
Watkins wrote that anti-alien land laws such as those passed by Illinois, Minnesota, and Wisconsin were "the natural result of the misuse of our land and our poor settlers by foreign ranch owners. No such sentiment will grow up in Louisiana so long as we act towards the people there as we have." He pointed out that the action of Congress in 1887 prohibiting foreign corporations from acquiring and holding land was not to apply to land purchased prior to the act and did not apply, therefore, to the North American Land and Timber Company.  

Watkins had found it good business as well as good advertising for prospective investors to visit Kansas at Watkins' expense. He tried successfully to get editors as well as prospective settlers to come to Southwest Louisiana. Watkins planned to sell some lands in a checkerboard pattern (a quarter section out of each section), give land for roads, etc., in order to improve value of lands remaining in the hands of the Company and to give return on its investment. The demonstration work at Lake Charles was in the hands of his brother-in-law, Professor Alexander Thomson, of Iowa State Agricultural College and of Seaman Knapp, president of that college, who were lured by salary and the imagination of Watkins' enterprise. These men built barges and plow boats for a demonstration of a system of gridiron canals dug by steam dredge to allow plowing, sowing, and harvesting of rice by plowboats and cables. Knapp was in charge of prairie land development where the Arcadian method of rice growing was expanded by use of wheat machinery to large scale production. Land was sold unimproved to settlers; buildings as well as other improvements were to be demonstrations. It was found that home-seekers became discouraged if they talked to natives first instead of seeing actual demonstration farming in action. Seaman Knapp was later to use his experience here and in Iowa to carry on demonstration farming in Mississippi and Texas and for the United States Department of Agriculture that blossomed into the county farm agent of the extension service. He was to found the Rice Association of America and the Rice

18 J. B. Watkins to H. G. Chalkley, Dec. 6, 1887.
Henry Dickinson to Charles Thompson, Manchester, Eng., Nov. 28, 1877.
Henry Dickinson to J. B. Watkins, January 22, Feb. 14, April 11, 1885.
Journal and Gulf Coast Farmer. Too, he and his family kept substantial business interests in southwest Louisiana. One can get some idea of the impression on the Arcadian natives by a quotation from a letter of Watkins in December, 1883: "I now have my machinery nearly through the Custom House * * * for Lake Charles. The machinery from England is over 75 tons. From Chicago about 30 tons. All 105 tons will go west about the same time, ten car loads. We are going to surprise the natives. 16 plows. We have gang [that] will turn 50 acres per day." The New York American was purchased in 1887 to promote the Louisiana project. Both New York and Lake Charles editions were published. Later because of mismanagement, the paper was moved to Lake Charles in 1888 to become the Lake Charles American, an advertising organ of the Watkins enterprises and a family periodical. It had proved too difficult to operate and to manage in New York, a true case of the tail wagging the dog.

J. B. Watkins to A. Thomson, Ames, Iowa, March 14, 1884, March 18, 1887.
For further information on Seaman A. Knapp see Joseph Cannon Baily, Seaman A. Knapp, Schoolmaster of American Agriculture (N. Y., 1945.)
Much promotion work was in rice, oranges, figs, sugar cane, sheep, and cattle. A railroad exhibition car of Louisiana products was sent on tour in the North Central states. The Calcasieu Sugar Company, another English company, was organized in 1891 and operated at a plant costing $150,000 two miles out of Lake Charles on a thirty-acre site to encourage sugar cane growing. Watkins had planned this as far back as 1883, as a possible addition to his Lawrence Canning Company in Kansas.\(^2\) Yellow fever and malaria tended to delay settlement. One project of Watkins was the Telegraph Medicine Company with offices at Lake Charles to manufacture an anti-malaria medicine. This was manufactured and sold at least during 1887 and 1888 and was advertised in every southern state. Nearly every paper in Texas, for example, carried its advertisement.\(^2\)

Much pressure over the years was exerted in Washington, in the North and in the West to bring about dredging and other improvements by the Army Engineers at the Calcasieu Pass, the Calcasieu River, and Lake Calcasieu for a deep water

J. B. Watkins to Editor, Daily Record, Lawrence, Jan. 14, 1890, July 1, 1891.
J. B. Watkins to A. L. Selig, Lawrence, Aug. 4, 1891.
J. B. Watkins to Calcasieu Sugar Co., Lake Charles, June 22, 27, 1891.
J. B. Watkins to A. H. Kellogg, Printer, N. Y., June 25, 1891.
J. B. Watkins to Dr. A. F. McFarland, Gallatin, Mo., Dec. 8, 1892.
J. B. Watkins to James Ellis, Welsh, La., Feb. 25, 1889.
J. B. Watkins, Memo, Sept. 10, 26, 1892.

J. B. Watkins to Mrs. S. A. Knapp, Lake Charles, April 1, 1889.
J. B. Watkins to Prof. Thomson & Knapp, Lake Charles, Nov. 9, 1887, July 17, 24, 1888.
J. B. Watkins to J. M. Houston, Houston, Texas, June 28, July 17, 1888.
J. B. Watkins to Prof. A. Thomson, Lake Charles, July 2, 17, 1888.
J. B. Watkins to Prof. S. A. Knapp, Lake Charles, Nov. 16, Dec. 9, 1887, Mar. 9, April 27, 30, 1888.
J. B. Watkins to Austin, Texas, Statesman, Feb. 24, 1888.
W. F. Presby to Prof. A. Thomson, Lake Charles, March 2, 14, 19, 1888.
outlet for Lake Charles. A harbor was planned on the Gulf to be named Watkins. Watkins thought that the outlet for Mid-America was to be on the Gulf—at New Orleans, or at Calcasieu Pass, or at the Sabine River or at Galveston in Louisiana and Texas. The Sabine route would be of great benefit but the Calcasieu outlet would be a much greater benefit as a deep water port. As early as 1889, Watkins was thinking of a railroad that would connect southwest Louisiana to Kansas City.\(^26\)

Watkins was made unhappy by water rates to Lake Charles from New Orleans and by the monopoly of the Southern Pacific Railroad. The market for cattle from this region particularly was harmed by the expensive freight rates.\(^27\) The contract for grading on the Kansas City, Watkins, and Gulf, which was practically owned by Watkins, was let April 20, 1889. The Railroad, it was hoped, would increase the value of lands in this area and would attract new settlers. Plans were to build up to forty miles the first summer and later connect with new lines to the north, or to build to Kansas City if necessary. A town site company was incorporated for each station location on the Railroad. The Kansas City, Watkins, and Gulf owned and operated 98 miles of line in 1892 going to Alexander, Louisiana. This was merged into the St. Louis, Iron Mountain and Southern Railway Company on September 1, 1909. This is now a part of the Missouri Pacific lines. It did break up the monopoly of the Southern Pacific which had opposed a north-south line eliminating a much longer haul on its lines. Watkins hoped that as a result Minneapolis, for example, would gain economic ties with southwest Louisiana instead of Florida or California! One benefit

\(^{26}\)J. B. Watkins to Rev. Goodnight, Pa., June 11, 1892.
J. B. Watkins to W. B. Morris, Bryan, La., April 19, 1889.
J. B. Watkins to Editor, Daily Record, Lawrence, Kans., Jan. 14, 1890.
J. B. Watkins, Memo, Feb. 27, 1884.

\(^{27}\)Henry Dickinson to J. B. Watkins, May 5, 19, 24, 25, 27, June 3, 15, 1886.
might be the development of a market for oranges from this area in Louisiana.\textsuperscript{28}

The North American Land and Timber Company's original purchase in 1883 was popularly referred to as the "Watkins Syndicate" since Watkins was the resident American manager for the company. Land was bought from time to time until the railroad bought right-of-way land from the state. The final total for all the associated groups approached the size of the state of Delaware. This was purchased from the federal government and from the state government for twelve and a half cents to a dollar and a quarter per acre. Two-thirds was marsh land. The land survey here was quite irregular. Also some of the lands sold by the state had been granted to it by the national government which had not gotten around to actually convey formally the lands to the state. This created a hardship when a deed was to be made to buyers from the Company. It was estimated in 1892 that the North American Land and Timber Company still owned 900,000 acres in Louisiana. Watkins held a fourth of the stock of that com-

J. B. Watkins to James Ellis, Welch, La., April 19, 1889.  
J. B. Watkins to C. P. Huntington, N. Y., Feb. 21, 1888.  
J. B. Watkins to C. C. Jones, Minneapolis, Sept. 10, 1892.  
J. B. Watkins to E. E. Walker, Mt. Vernon, Ohio, April 22, 1889.  
J. B. Watkins to W. J. Patterson, Lawyer, April 9, 1889.  
J. B. Watkins to Prof. P. H. Philbrick, Lake Charles, June 19, 1891.  
J. B. Watkins to The American, Lake Charles, June 22, 1891.  
J. B. Watkins to S. J. Fenton, Welch, La., June 30, 1891.  
J. B. Watkins to J. F. McCoy, Traffic Manager, Lake Charles, July 26, 1892.  
Henry Dickinson to J. B. Watkins, Lawrence, June 15, 1887.
pany. It was not until a visit of H. G. Chalkley to New York in 1885 that he learned by chance that Watkins held over 400,000 acres of land in Louisiana. (This was fact he did not like.) The combine sold no land to the public until 1887. The dividend, its first, paid in 1889 was financed by selling to Watkins, a purchase from the Company of 10,000 acres for $100,000. Also 30,000 acres at $5 an acre were sold to the public.

The influx of settlers, many from the North, plus the dislike of a British company brought another type of difficulty. Politicians did not like the change. Watkins was charged with such things as buying some logs from a native that had been cut on government land; a sheriff refused to prosecute a person for stealing from the Company when stolen goods were found on the person; fence disputes arose; taxes were raised; reports were written to England accusing Watkins of many things; and Watkins was charged with operating a bank without a charter.

One result of these troubles was the creation of the Orange Land Company of Orange, Texas, to hold Watkins' holdings in Louisiana of about 600,000 acres. Louisiana law required

29 Dallas office to J. B. Watkins, May 7, 1883.
  Dallas office to E. G. Richardson, Baton Rouge, La., May 7, 1883.
  M. J. Dart to J. B. Watkins, April 2, 1883, May 24, 1884.
  J. B. Watkins to M. B. Lowrie, Lake City, Minn., Dec. 16, 1887.
  J. B. Watkins to Emil Linburg, N. Y., March 15, 1884.
  J. B. Watkins to A. Thomson, July 11, 1889.
  J. B. Watkins to John S. Lanier, Registrar, State Land Office, Baton Rouge, La., May 18, June 4, 1889.
  J. B. Watkins to H. A. Hoyt, Perry, Iowa, July 5, 1892.
  J. B. Watkins to C. P. Huntington, N. Y., March 15, 1884.


  J. B. Watkins to James Ellis, Welch, La., Feb. 25, 1889, May 14, 1889.
  J. B. Watkins to William Laurents, Cameron, La., April 25, 1889.
  J. B. Watkins to Prof. A. Thomson, Lake Charles, June 28, 1888, March 26, 1889.
a man's estate be put to auction on his death. Watkins' enemies tried to have him declared insane at one time. There were also about eight town site companies as well as the Gulf Land Company.\textsuperscript{32} The Louisiana ventures took much of the liquid assets of the Land Mortgage Company in Kansas and did develop southwest Louisiana.

\textsuperscript{32}J. B. Watkins to A. N. Wichan, Carthage, Mo., May 17, 1892.
J. B. Watkins to H. A. Hoyt, Perry, Iowa, July 3, 13, 1892.
J. B. Watkins to George W. Mitchell, South Britain, Conn., Aug. 8, 1891.
ECONOMIC CONTRADICTIONS
IN THE PROCESS OF
WESTERN EUROPEAN INTEGRATION
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The process of the economic integration of the six countries of Western Europe is probably one of the most outstanding events of the post-war era. Aside from all the political implications of this process, the economic aspect is of the utmost importance to the students of economics. International literature concerning this economic aspect exists in abundance. The process of Western European integration is particularly interesting as an isolated phenomenon which started on a specific day and attempts to continue to previously determined goals. The international treaty signed March, 1957, in Rome set up a permanent Economic Community composed of France, West Germany, Italy, Holland, Belgium, and Luxembourg. We shall consider the influence of some of the institutions created by this treaty particularly dealing with the integration of the agricultural economies of the member countries; we shall not dwell on their creation or structure since these aspects do not specifically concern the present analysis.

The whole process of Western European integration is due to the introduction of specific institutions and regulations. Perhaps this confirms the arguments of the advocates of the institutional approach to the study of economic phenomena. In general, we agree with the assumption that the establishment of the Common Market promoted and will continue to promote the economic growth of the member states. This generalization, to our knowledge, is contested by some isolated voices.

1Arkansas Gazette. January 13, 1963. The economic editor of the Arkansas Gazette, Mr. Leland Duvall, put it this way: "Right now, for example, the part of American exports of farm products that goes to Western Europe does not depend on the willingness of farmers to produce or sell, or on their efficiency. The determining factor will be the decisions reached in the European Economic Community. Only the government of the United States can deal with the problems associated with the Common Market area—which means that politics is at least as important as production in this case."

2Alexander Lamfalussy, "Europe Progress Due to Common Market," Lloyds Bank Review, London (October, 1961). Lamfalussy argues that "there seem to be no obvious figures which would point out a causal relationship between the establishment of the Common Market and the rapid growth of its members. It seems, in fact, quite possible to argue the other way round and to suggest that it is the 'inherently' high rate of growth of Continental Europe which made it possible to set up the Common Market, not vice versa." We think this most pronounced opinion should be taken cum grano salis as it can be considered a voice in the bitter discussion between Great Britain and Common Market.
These voices hold that there is no casual relationship between the establishment of the Common Market and the subsequent rapid growth of the economies of the member countries. But it will be difficult to deny that Western European Economic Community, in the years following their organization of nations, achieved great advances in Gross National Product and in industrial production areas greater than those gained by the United States or the United Kingdom.\(^3\)

The brilliant economic recovery of the Western European Economic Community should not hide to attentive observers two major inherent economic contradictions. These contradictions can hamper Western European development and can make Western European economy in the long future more vulnerable because subjected to internal inflationary pressure and accentuated dependence of external markets. What are these contradictions and what concrete consequences can they bring to bear on European economy?

First, there is an essential discrepancy between the liberal industrial and financial policies of the Common Market and the regulatory character of the agricultural policy.\(^4\) The so-

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\(^{3}\)Data based on OECD statistics and the U. S. Survey of Current Business, September, 1961, as compiled by the European Community Information Service. "A New World Power," Brussels, Luxembourg; September, 1962. In the four years since the Common Market came into force, from January 1958 to December 1961, the Community Gross National Product rose by 21.5\% against 11.6\% in Great Britain and 10\% in the United States. Industrial production in the Community during the four-year plan rose by approximately 29\% compared with 13\% in Britain and just over 18\% in the United States.

\(^{4}\)By liberal industrial policy we mean gradual release of industry, trade, and finances from many regulations, with particular emphasis on the necessity of the healthy competition in internal and external markets. The first Community's Anti Trust Law came into force on February 21, 1961. (European Bulletin Number 53.)

The most important element of this "liberal" approach to industry is tariff cuts in internal trade, the impact of which is so profound on the economy of the member countries. This impact is very well sketched by the Wall Street Journal's correspondent in France.

"Finally, by helping to form the Common Market just before General de Gaulle took office, France subjected its industry to stiff competition from goods coming in from other European nations under tariff cuts the EEC brought about. An EEC study claims such competition since 1958 has forced French factories to slash the price of a typical refrigerator from $160 to $100; a transistor radio from $50 to $20; a set of kitchen kettles from $25 to $14. (The Wall Street Journal, February 1, 1963.)

called Mansholt Plan covers European agriculture of the member countries with protective shields. This Plan has involved the Common Market in tariff disputes with outside nations already; but what is more important is the future effect of this Plan on European industrial development. This regulation of agriculture must result, if not in higher agricultural prices, anyway in the stabilization of the existing prices which are far above the international level. Higher agricultural prices must, of necessity, result in higher industrial prices and create inflationary pressure which is already evident.  

Sico Mansholt, a former Socialist Minister of Agriculture of the Netherlands, now Vice Chairman of the EEC executive body and head of the agricultural section, is the strong man behind the scene in the field of the agricultural policy of the EEC. The proposals embracing the whole series of measures concerning the integration of European agriculture got their name from him and are called, simply, "The Mansholt Plan."  

The Mansholt Plan rigidly controls agricultural production and marketing. This rigidity was criticized when the Plan was presented in November, 1959; this rigidity was again pointed out by many speakers of the European Assembly of the EEC during the spring session of 1960. The Plan involves the fixing of prices for major agricultural products; the creation of an agricultural financial fund to finance the shaping of agriculture to fit the goals of the Plan; the creation of several specialized marketing bureaus to supervise the marketing of products such as wheat, grain, sugar, milk, etc. Should agricultural production exceed consumption, the Plan offers means for reducing production.  

When the Plan was presented to the European Assembly, one of the members of the Assembly said, "This is more than a 'Malthusian' concept of policy; it is a 'Mansholtian' one."  

The Plan has had one prime advantage from the very beginning. It is the only formulated and articulated Plan for the
organization and integration of agriculture within the Europe of Six.  

From the very beginning of the endeavors to create a European Economic Community, it has been obvious that to leave agriculture out of the process of economic integration would be economically and politically impossible in view of the great importance of the farming groups in each individual country as well as in the Community as a whole.

After many discussions concerning the modalities and application of the Mansholt Plan, the Council of Ministers of the Community—during the morning of January 14, 1962—reached an agreement on the first measures of common agricultural policy. The official publication of the EEC commented in the following way on the agreement to agricultural integration and its application. "Effective July 30, (1962) national controls on import quotas, minimum price regulations, and tariffs on grains, eggs, poultry, and pork were replaced by Community controls. Import levies are now applied by the Common Market to those products in both internal and external trade.

"The levies, designed to prevent domestic producers from being undersold, bring prices of imported produce into line with the prices ruling in the particular national market. In order to

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6 In the past there were in Europe many proposals and plans for the European integration of agriculture. In 1950, during the negotiations of the treaty establishing a European Coal and Steel Community, there were endeavors to create the so-called Green Pool. Little came of it. Anyhow, there isn't trace of any challenging program to "Mansholt Plan" on the lines of American suggestions of the Conference for Economic Development "Toward a Realistic Farm Program." (Published in December, 1957, in New York.)

7 According to the Common Market Treaty of 1957, trade on agricultural products was supposed to be subject to the same reductions on duties and quotas as apply to industrial goods. But the farmers in each member country of the Community formed a well organized political power. They were interested primarily in the defense of their immediate interests. Each member country had its own system of protecting the farmers and improving their lot by artificial means. For these reasons, the agricultural problems in the Common Market have simply been ignored till spring, 1960. The protective barriers were maintained despite Rome Treaty provisions—at first tacitly.

But the protests came from the exporters of farm products from Sicily and Holland. Under the pressure exercised by the Dutch government in the spring of 1960, the Rome Treaty provisions concerning the tariffs cut for agricultural goods in internal trade were put in operation and the decision was reached to start to work out the plan for the common agricultural policy, the so-called Mansholt Plan.
provide a measure of Community preference, they are lower in the case of intra-Community trade than for external trade."

We know already the reaction of "outsiders." United States Secretary of Agriculture, Orville L. Freeman, at the ministerial meeting of the Agricultural Committee of the Organization for Economic Cooperation and Development (OECD) in Paris on November 19, 1962, pointed out that the Community's policy would profoundly affect the world agricultural situation. He urged the Community to apply a liberal trade policy in the field of agriculture.

The Mansholt Plan for setting up the whole system of protection is much less flexible than the American pattern of protective measures which can be revised at any time by Congress. The Mansholt Plan is an essential part of the over-all international set-up and will be far more difficult to modify.

This Plan is more a political than an economic solution for European Agriculture. The problems facing agricultural production are similar in Europe to the problems facing the American farmers—but not identical.

"The farm problem has its roots in the small-scale nature of the farm firm, the technological revolution since 1920, the relatively high birth-rate of farm people, and the declining relative demand for farm products. Political measures to solve the problem have only aggravated it, since they have disrupted the normal interaction of economic forces and have dislocated resources. The farm problem is an economic problem; it calls for an economic not a political solution." (Principles of Economics. Chapter 22, "The Farm Problem," by Professors O. W. Cooley, E. E. Heimbach, and S. E. Warren.)

European agriculture is similar to American in the small-scale type of farms, but the second problem is quite different from the U.S.A. situation. The technological advances in Europe are not so pronounced—the prices are very high.

The third problem for both complexes, the high rate of birth in the countryside could be even beneficial for European economy, if properly handled.

As it was recently observed, it is not only the introduction of modern machinery into agricultural production which is detrimental to the small type farms in the U.S.A. but also the marketing of agricultural products.

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*"Processors need large supplies of raw products, therefore they may tend to favor the large producer. The same can be said for the fresh market. Large chains need large quantities of uniform products; therefore they tend to buy from larger producers." Quoted from "Technological Advances Change Farm Marketing" by Ovid A. Martin of the Associated Press. Arkansas Democrat, January 27, 1963.
The Mansholt Plan does not even pretend to solve the essential problems: the distribution of land and the discrepancy between world and European agricultural prices. As an example, let us consider the problem of the price of wheat. Speaking at the Wesleyan University on December 6, 1962, Professor Walter Hallstein, Common Market Commission President, declared: "What already exists is the framework, the instrument for applying the policy, in other words, we have decided that there will be a target price and intervention price for grain, that there will be levies between the member states and at the external frontier, that there will be certain financial measures. The decision as to what is to be made of those instruments will come the moment we decide on the common grain price—that is, the price which is to obtain for the whole Community and toward which the still widely national prices must move."

(United Europe. Challenge and Opportunity.) The first decision on this price was to be determined by the Community's Council of Ministers by April 1, 1963.

In January of this year, the world price for wheat was $64.40 a ton. In France, it was about $98.00 a ton: in West Germany, almost double the world price at $126.00 a ton. When the transition period for the establishment of the unified agricultural market for Western Europe ends in 1970, a uniform price for wheat will be set up for all the six countries of the European Community. Probably this price will be set at the level between the French and German prices as these two countries are the most important members of the Community.

With respect to wheat, Common Market countries face this problem: where to peg the Common Market price.

France now has a price support level of about $2.30 a bushel (as against the $1.82 price support in the U.S.A.): West Germany supports wheat at $3.15 a bushel. The expectation is that President de Gaulle will push for the higher West German price support to make France "Europe's Granary." (The Christian Science Monitor: Farm Export and EEC. March 25, 1963.)

This example of wheat is indicative for other agricultural products. When, on July 30, 1962, the member countries submitted themselves to common farm tariffs, this resulted, for the most part, in increased European tariffs on wheat, feed grain, poultry, some pork products, wine, fruits, and vegetables.

American press and opinion reacted particularly to the increase of import levies on poultry, one of the very important items in American agricultural export to Western Europe.

During the recent negotiations between Great Britain and Common Market, the British press pointed out that unrestrict-
ed, unconditional, and immediate acceptance by Great Britain of the Mansholt Plan will—by 1970—add more than 30 per cent to the market price of wheat and flour in Great Britain. 10

The Mansholt Plan must logically lead in the long run to a general increase in food prices and produce a like effect on industrial prices. We can compare the effect of the Mansholt Plan to the effect of the Corn Laws in England in the 1820's and 30's. This stabilization of agricultural prices on higher levels will not help to resolve the basic structural deficiency of European agriculture which grows out of the distribution of the land. The highly remunerative prices will only stabilize the status quo and put the small submarginal holdings just on the margin of cultivation. 11

The strongest negative impact of the Mansholt Plan, we think, will be felt on the market for industrial manpower: existing policy in the field of agriculture is presently depriving European industry of badly needed labor. The problem of constantly available labor reserve for industry is of primary importance for economic development. This was particularly obvious in the German economic miracle which was brought about by the sudden influx of almost eight million people from East Germany, Poland, and Czechoslovakia. This influx provided West German industry with an available labor force without which the German "Wirtschaftswunder" could not have been so spectacular.

The Mansholt Plan for Western European agriculture, through stabilizing agricultural prices on a level far above the world price level and making the small farm the going concern through price protection—when it is no longer an economically going concern, will not only make the cost of living high but also will influence adversely the normal process of the influx of the rural population into growing industry thus hampering the economic development. The European press for some time has attracted the attention of the public to the prob-


11 The distribution of land in Europe is characterized by small holdings due to shortage of land. In acres, the surface area at the disposition of the farmer is as follows: Germany, 8; Belgium, 12.5; France, 16.7; Italy, 8.1; Luxembourg, 10; Holland, 10.5. (Quoted from L'Agriculture et le Marche Commun par Francois Henri de Virieu Le Monde Diplomatique. Paris, November, 1959.)

In the U.S.A., about 22 million people or 12 per cent of the entire population live from agriculture. They till about 5 million farms embracing more than one billion acres of land. It means that the average surface is 50 acres per farmer; but through purchases and renting many farmers have been steadily increasing the size of their farms. Thus, the average size of the American farm is now 233 acres. (Principles of Economics; "The Farm Problem.")
Economics and Western European Integration

The high prices on agricultural goods together with the labor shortages should inevitably create permanent inflationary pressure, the phenomenon which is already worrying the men responsible for the European economy. "United States tourists have noticed this and wondered whether it is only the outsider who is being charged more. But any tourist who takes the time to stroll through side streets off the tourist route, or to visit small towns where sightseers seldom go, finds that the natives too, are getting a dose of inflation, which invariably affects the ability to compete on the export-import trade. Some of this has not yet shown up on statistics, but firsthand observation has uncovered startling increases that will figure in government reports by mid 1963."  

Now we shall consider the problem of private expenditure. In November, 1962, EEC released the report of the Special Committee of Economic Experts involving the economic forecast for the future. The report presents growth estimates of the major components of the economies of the six countries and of the Community as a whole projected over the decade 1960-1970. According to these estimates, the gross product of the Community will increase by 53-59 per cent from 1960 to 1970; in dollars that increase is from $189 billion to $277 billion.
billion. The Commission expects that personal expenditures will increase by 61-67 per cent as compared with 53-59 per cent for Gross National Product; this means a possible increase from $110 billion to $188 billion. (Bulletin from the Community. Number 59.) According to this expectation, the private expenditure will rise faster than the rise of the GNP but certainly does not indicate that the pattern of European consumption will change radically. Not at all! We must take into consideration that European private expenditure after the Second World War started from a very low level and is far behind the consumption in the United States of America. Particularly is this true in the field of nondurable consumer goods. Some data on 1956 European and American private expenditures for consumer goods will permit enlightening comparison. The consumption of such items as meat, eggs, butter, milk, steel, and energy per capita is much lower in EEC than in the U.S.A. Just to say that in West Germany consumption of meat is 41.6 klg. per capita—in the U.S.A., 82.6 klg.; we say with a great deal of adequacy that American consumption of the above mentioned items (meat, eggs, butter, milk, steel, energy) is double the European.

The anticipated increase in personal expenditure of 61-67 per cent between 1960 and 70 will not greatly vary the pattern of European consumption because this rise must be directly related to the predicted increase in European population. This population increase is expected to reach 8 per cent or 168 to 175 million. We can assume that the average propensity to consume in the EEC Community will be relatively stable.

The consumption of the EEC countries is—and will be—handicapped by the very high prices which the consumer in the Common Market must pay for the food. Just to show this more clearly, let us say it in this way: to pay for 1 klg. of beef sirloin, the American worker must spend 68 minutes of work; French, 317; Belgian, 256; German, 137; and Italian, 353. To buy one klg. of flour, the American worker must

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15Consumption per capita in klg.

<table>
<thead>
<tr>
<th>Country</th>
<th>Meat</th>
<th>Eggs</th>
<th>Butter</th>
<th>Milk</th>
<th>Steel</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>41.6</td>
<td>9.7</td>
<td>5.7</td>
<td>128</td>
<td>417</td>
<td>3,600</td>
</tr>
<tr>
<td>France</td>
<td>74.6</td>
<td>11.0</td>
<td>5.6</td>
<td>88.6</td>
<td>276</td>
<td>2,860</td>
</tr>
<tr>
<td>Italy</td>
<td>19.4</td>
<td>7.4</td>
<td>1.2</td>
<td>52.3</td>
<td>120</td>
<td>1,120</td>
</tr>
<tr>
<td>Belgium</td>
<td>49.3</td>
<td>13.9</td>
<td>9.4</td>
<td>91.6</td>
<td>296</td>
<td>4,340</td>
</tr>
<tr>
<td>Luxembourg</td>
<td></td>
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</tr>
<tr>
<td>Netherlands</td>
<td>37.5</td>
<td>7.6</td>
<td>2.6</td>
<td>199.9</td>
<td>237</td>
<td>2,450</td>
</tr>
<tr>
<td>EEC</td>
<td>45.4</td>
<td>9.5</td>
<td>4.3</td>
<td>97.4</td>
<td>276</td>
<td>2,680</td>
</tr>
<tr>
<td>USA</td>
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<td>21.8</td>
<td>3.2</td>
<td>158</td>
<td>600</td>
<td>8,580</td>
</tr>
</tbody>
</table>
spend 6 minutes; Belgian, 38; French, 33; German, 19; and Italian, 34. A similar gap exists in the case of milk, eggs, and fruits.16

What we must conclude is that the European plan of agricultural integration will result in the petrification of highly artificial level of agricultural prices which in the long run must influence industrial prices.17 The Mansholt Plan will deprive industry of the necessary influx of man power from the rural areas. This dislocation of resources due to the excessive protection will stabilize European propensity to consume. Particularly since European consumption is dictated by customs, a powerful stimulus is needed in the drastic lowering of food prices. The reportages on the spectacular rise in European personal expenditures are misleading. For the most part, these reportages are based on mistaken external signs. The so-called Americanization of European consumption involves the acceptance of modern American procedure but not prices.

Because of the limitation of the internal market the European industry will traditionally look for the foreign markets for their industrial products. The accumulated surplusses will be invested abroad following the traditional pattern of the European economic expansion in 19th century and in the beginning of the 20th century.

17The Common Market, taken all round, provides 87 per cent of its agricultural requirements. With the exception of coarse grain, citrus fruits, fats (except butter) and oils, the Common Market area is self-supporting or more. Quoted from Common Market Commission’s proposals for a common agricultural policy presented to the Economic and Social Committee of the EEC on November 7, 1959.
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