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ARKANSAS ACADEMY OF SCIENCE

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ARKANSAS ACADEMY OF SCIENCE

Forty-eighth Annual Meeting
Arkansas State Teachers College
April 17 - 18, 1964

OFFICERS

President	Dwight M. Moore
President-elect	Lowell F. Bailey
Secretary	R. Reece Corey
Treasurer	Edward E. Dale

AASP

SECRETARY'S REPORT

The first business meeting was called to order by President Moore at 10:45 A. M. with 42 members in attendance. The members were welcomed by Mr. Charles R. Teeter, Director of Development, Arkansas State Teachers College.

As the Secretary's Report was already published in the Proceedings, reading of the report was omitted, and the report was accepted as published. The Treasurer's Report was submitted to the Auditing Committee by Treasurer E. E. Dale.

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The Secretary reported that the Academy had received two grants for the fiscal year 1965 from the National Science Foundation, one in the amount of $7070.00 for the Visiting Scientist Program and the other of $2827.00 for the Junior Academy Program.

The Secretary reported a communication from the Secretary of the University of Arkansas chapter, American Association of University Professors, which suggested that the Academy make it a policy to refrain from meeting on the campuses of institutions on the AAUP list of censure. The Secretary reported that the recommendation of the Executive Committee was: That the proposal not be considered. We do not wish to pass upon the merits of the proposal, but we feel that the proposal is not feasible for the Academy to consider. A motion to sustain the action of the Executive Committee was made by Dr. Brown. The motion was seconded and carried.

The Secretary reported that while the Academy was not in financial difficulties at the present time, such problems could be expected as our expenditures for the Proceedings exceeded our income last year. Possible remedies were listed such as: increased dues, sustaining members, and page charges for excess journal pages. A spirited discussion ensued, in which Dr. Clayton suggested the possibility of an increased reprint charge. A motion was made by Dr. Paulissen and seconded by Dr. Wills that a class of sustaining memberships at $5.00 be established for this year. The motion was passed. A motion was made by Dr. Bailey and seconded that the Secretary be empowered to find a membership chairman to conduct a membership campaign.

Dr. Moore appointed the following **ad hoc** committees.

Nominations:	R. W. Shideler, Chairman I. A. Wills H. L. Bogan
Auditing:	D. Brown, Chairman K. W. Scott
Meeting Place:	A. A. Johnson, Chairman T. J. Paulissen
Resolutions:	W. C. Munn, Chairman O. Myers

Dr. Moore stated that the Collegiate Academy had requested the "Senior" Academy to furnish three judges to evaluate papers presented to the Collegiate Academy. Howard Moore, N. D. Buffaloe, and M. L. Lawson were appointed by Dr. Moore.

There being no further new business the meeting was adjourned at 11:30 A. M.

The second business meeting was called to order by President Moore at 1:30 P. M., April 18, with 36 members present. The minutes of the first business meeting were read.

Committee Reports. The Nominating Committee presented the following slate: President-elect, J. H. Fribourgh.

The motion was made by Dr. Shideler and seconded by Dr. Sears that the slate of officers presented by the Nominating Committee be elected. Dr. Fribourgh was elected by acclamation.

Dr. Brown reported that the Auditing Committee was satisfied that the funds are correct and in order, that the Auditing Committee recommend during the 1964-65 fiscal year that the National Science Foundation grant funds be placed in a separate account.

Dr. Myers reported for the Resolutions Committee.

April 18, 1964

"Be it resolved that the Arkansas Academy of Science in its 48th Annual Meeting at Arkansas State Teachers College, Conway, express its appreciation for the gracious hospitality extended by the administration and faculty of Arkansas State Teachers College in providing the excellent and comfortable facilities for our meetings.

"Secondly, we wish to commend the program and arrangement committees for the smoothly organized programs and services furnished, and in the excellent coordination of the activities of the "Senior," Collegiate, and Junior Academies of Science, along with the Science Fair.

"Be it further resolved that we express our appreciation by a letter written by our secretary to Dr. R. T. Clark for his stimulating lecture.

"We also wish to commend the following for the services faithfully and efficiently rendered: all of the officers of the past year; Dr. James L. Dale for editing of the **Proceedings**; Mr. Robert T. Kirkwood for directing the program of the Arkansas State Science Fair; Mrs. Florence McCormick for sponsoring the Junior Academy; Dr. Wilbur W. Everette and Dr. J. W. Sears for sponsoring the Collegiate Academy."

Respectfully submitted:
Oval Myers, Jr.
W. C. Munn

The list of resolutions was adopted unanimously.

Old business. None

New business. None

It was moved by Dr. Shideler and seconded, that Dr. Lowell F. Bailey be recognized as the new president for the ensuing year. The motion passed unanimously. The gavel was turned over to President Bailey by retiring President Moore. With no further business the meeting was adjourned at 2:15 P. M.

Respectfully submitted,
R. Reece Corey
Secretary

PROGRAM

Friday, April 17

10:45 a. m.	Business Meeting, Student Center Ballroom
12:00 Noon	Lunch, ASTC Cafeteria
1:00 p. m. to 2:00 p. m.	General Session with Junior and Senior Academies, Student Center Ballroom. Papers by Science Talent Search Winners.
2:15 p. m. to 4:30 p. m.	Collegiate Academy, Student Center Ballroom
5:30 p. m.	Academy Banquet, ASTC Cafeteria
6:30 p. m.	Science Fair Awards Program, Student Center Ballroom
8:00 p. m.	Illustrated Lecture, "Health and Fitness in the Modern World." Dr. R. T. Clark, Vice-President in Charge of Research, Harding College.

Saturday, April 18

8:30 a. m. to 10:00 a. m.	Science Education Section, Student Center Ballroom
10:15 a. m. to 11:45 a. m.	Section Meetings
12:00 Noon	Lunch, ASTC Cafeteria
1:30 p. m. to 2:30 p. m.	Business Meeting, Student Center Ballroom
2:30 p. m. to 4:00 p. m.	Section Meetings

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Arkansas State Teachers College

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NOTES ON THE NATURAL HABITAT OF THE BROWN RECLUSE SPIDER[1]

Loxosceles reclusa Gertsch and Mulaik
Maxine Hite

University of Arkansas

Throughout history spiders have been regarded generally as creatures to fear and avoid. Folklore credits all spiders as being quite poisonous. While almost all spiders do have poison glands, only a few are known to be poisonous to man or other mammals. One which is poisonous is the brown recluse (Fig. 1).

During recent years this spider has attracted much attention in this part of the United States because it has been found that its bite is poisonous to man, causing a sloughing of the affected area (Atkins, et al., 1958; Wingo, 1960).

Several proved cases of necrosis resulting from the bite were reported in northwest Arkansas in 1961.

In 1962, a study of its habits, habitat, and life history was initiated.

According to Gertsch (1958), the genus **Loxosceles** is widely distributed in the temperate and tropical zones of the world. He reports that **Loxosceles reclusa** is found in the southeastern and central United States from Tennessee and Alabama westward to Kansas, Oklahoma, and Texas.

Wingo (1960) obtained records to show that it was common in Missouri, south of the Missouri River. In 1959, Baerg stated (p. 33) that "a reasonable conclusion is that the species occurs more or less frequently throughout Arkansas."

I first collected the brown recluse in northwest Arkansas during 1956 and 1957 when collecting spiders for Dr. H. W. Levi. Later when Dr. Gertsch was making his study of **Loxosceles**, he obtained this material, and, in his paper on this genus (1958, p. 10), noted that I had taken "many mature males and females during most of the months of the year."

Speaking of the genus in general, Gertsch states, "They are quite active nocturnal types that live under cover, beneath stones, boards, or other ground objects, in holes in the ground, under the bark of trees, or in crevices in the walls of buildings" (p. 1).

Both Baerg (1959) and Wingo (1960) reported that the brown recluse was most often found about the house and as-

[1]Partially supported by N. I. H. A-1 04950-02.

sociated buildings. Because it has been so frequently found in such places, it is commonly regarded as a "house" spider.

For the first five months after we began collecting these spiders in 1962, all were taken in and about houses: in attics, closets, sinks, bathtubs, boxes of papers, dresser drawers, boxes of toys, front porches, schoolrooms, garages, utility rooms, clothing that had been hanging for some time undisturbed, and in bedrooms beneath beds. However, we believe that their natural habitat is out-of-doors. The specimens collected in 1956 and 1957 for Dr. Levi were found in oak-hickory woods beneath rocks, logs, and loose bark of dead trees. This past winter and early spring, we have found them in large numbers in what we consider could be their primary habitat. This is under dry sandstone bluffs, beneath the flat rocks that have fallen from above.

SUMMARY

The brown recluse spider, poisonous to man, is usually encountered in houses and associated buildings. However, its natural habitat appears to be under dry bluffs, beneath the flat rocks that have fallen from above.

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1. Atkins, A., C. W. Wingo, W. A. Sodeman, and J. E. Flynn. 1958. Necrotic arachnidism. Amer. Jour. Trop. Med. and Hygiene 7 (3): 165-184.
2. Baerg, W. J. 1959. The black widow and five other venomous spiders in the United States. Ark. Agr. Expt. Sta. Bul. 608.
3. Gertsch, W. J. 1958. The spider genus **Loxosceles** in North America, Central America, and the West Indies. Am. Museum of Nat. Hist. No. 1907.
4. Wingo, C. W. 1960. Poisonous spiders. Univ. of Mo. Agr. Expt. Sta. Bull. 738.

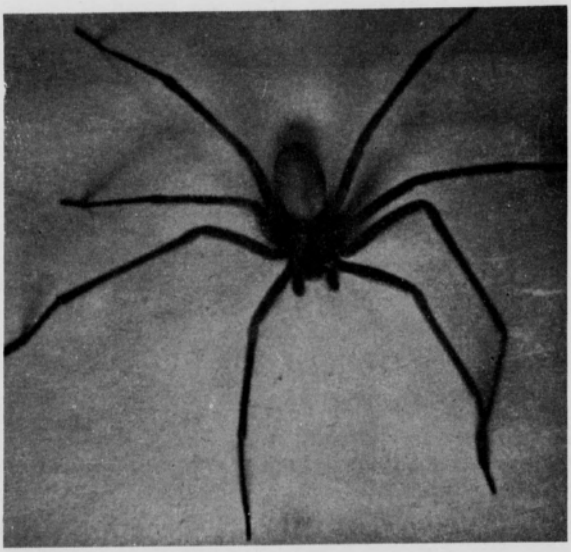


Figure 1. Mature female of the brown recluse spider, **Loxosceles reclusa.**

MATERNAL CARE AS EXHIBITED BY WOLF SPIDERS (LYCOSIDS)[1]

Ruth Robinson Eason
University of Arkansas

Maternal care by wolf spiders (lycosids) appears to be more highly developed than in most other groups of spiders. This phase of the life phenomenon of wolf spiders, however, has received little attention in the United States. Perhaps one deterrent has been the amount of time required for observations. Besides, wolf spiders generally choose the night hours for most of their activity.

Despite these problems, observations have proceeded, and many notes on maternal behavior have been taken. Female spiders were brought into the laboratory and kept in cages so that their activities could be observed. These spiders were **Lycosa carolinensis** Walckenaer, **L. helluo** Walck., **L. punctulata** Hentz, **L. rabida** Walck., **Pardosa** sp., **P. milvina** (Hentz), **Schizocosa avida** (Walck.). From them we found that maternal care exhibited by wolf spiders is divided into several distinct stages which may be classified as follows: construction, care, and perforation of the egg sac; and care of spiderlings after they emerge from the egg sac.

Some species of wolf spiders indicate the approach of egg sac construction the day before the event takes place. Certain **L. helluo**[2] females enclose all or part of their cages with a fine sheet of silk prior to egg sac construction. **L. rabida** females construct a fine sheet web about one-half inch above the cage floor. Females of other species were observed to make a light web over the drinking dish and part of the cage floor.

Actual egg sac construction begins when the female starts spinning a circular mat more or less parallel to the ground but on the web background. Turning her body in alternating clockwise and counterclockwise directions, the female moves her abdomen back and forth, laying the silken foundation with long brushing strokes of the spinnerets. Up and down looping strokes with the tip of the abdomen give the mat depth. To finish the mat, a series of short up and down strokes are employed around its edge until a rim is formed giving the mat a bird's nest shape.

Placing her genital aperture over the center of this mat, the female pauses for three or four minutes. Then the egg mass is deposited along with a liquid material. Another brief period of inactivity precedes covering the egg mass.

[1]Partially supported by N. S. F. G 17564
[2]Spiders identified by Harriet Exline (Mrs. Don Frizzell)

To cover the eggs, the female touches her spinnerets to the edge of the mat, raises her abdomen high, and may or may not touch the egg mass with her spinnerets as she moves her abdomen across to the other side of the mat, and continues back and forth in this manner while turning her body in alternating clockwise and counterclockwise directions. After the eggs are well-covered and additional spinning is done around the edges of the structure, the female frees the mat from the light web to which it is moored. This is accomplished by pulling at the covered egg mass with her palpi while tearing silk strands with her chelicerae. Some females were observed to exert extra "freeing" force by pushing with the legs while pulling with the palpi. Once the sac is free, it is turned with the third and first pairs of legs while the seam is turned down with the chelicerae and palpi.

To complete the first stage of her maternal care, she shapes the egg sac, which at this time resembles a poached egg, by pushing and pulling with palpi and chelicerae while turning it with the third pair of legs until it becomes almost spherical in shape. Then she touches it with her spinnerets. A minute or two later she walks off with the egg sac attached.

Eight observations of **L. punctulata** females show that it takes three or more hours to construct an egg sac. This time is divided as follows: mat construction, more than 40 minutes; pre-egg laying pause, about four minutes; egg laying, four or five minutes; post-egg laying pause, about four minutes; covering the eggs, 20 to 30 minutes; freeing the egg sac, about 25 minutes; turning the seam and shaping the egg sac, some 25 minutes; adding a bluish color to the egg sac and attaching it to the spinnerets, nearly an hour.

Observations of other species indicate that all follow the same basic construction pattern, but the amount of time required may vary. One **L. rabida** female was observed to dispense a blackish drop from the genital aperture, this drop giving her white egg sac a bluish color. Not all species of wolf spiders color their egg sacs.

Care of the egg sac is the second stage of maternal care. A wolf spider "mother" will ferociously defend her egg sac from intruders, as was experienced many times when egg sacs were removed for observation. One "mother" **L. rabida**, upon my returning her egg sac which I had cut beyond repair, scooper her spilled eggs into a mass, held them with her palpi, and tried spinning around them. When that failed, she spun a silk sheet over her eggs and hovered over or near them until they had hatched, molted, and ascended her back.

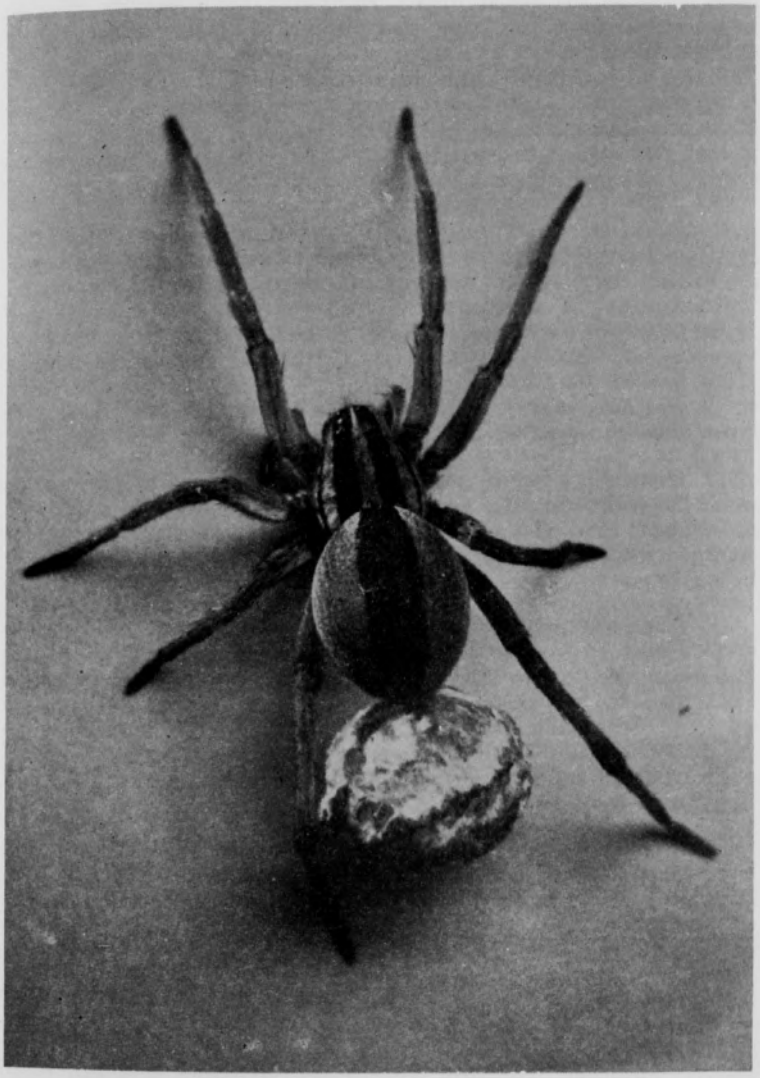


Fig. 1 Female Lycosa punctulata with egg sac.

"Mother" lycosids sun their egg sacs in either natural or artificial sunlight. Some were observed to soak the egg sac a brief time in the water dish. "Mothers" with heavily diseased or parasitized egg sacs have been known to destroy them around the hatching date of the eggs, which hatch within the egg sac. Females with infertile eggs also destroy them at this time if they have not done so following egg sac construction or shortly thereafter. Some females have destroyed their egg sacs for no apparent reasons, or because they may have been lacking some essential in their diet, or may have been distressed.

"Mother" wolf spiders will mend torn or cut places in the egg sacs. This makes it possible to examine an egg sac to determine the stage of its contents, return it to the "mother", and examine the same egg sac again a day or two later — and again a day or two after that, if necessary. This is particularly valuable to the observer since spiderlings remain in the egg sac from one to three weeks after the eggs hatch, and it is difficult to determine actual incubation time without this unwitting help from the "mother" spiders.

When eggs begin hatching, barely perceptible movements made 20 to 30 minutes apart can be seen by removing eggs from the egg sac and using a microscope. These movements become stronger and closer together until the eggs hatch more than six hours later.

Time required for egg incubation varies from species to species and has ranged from six to fourteen days. From the hatching date within the egg sac until emergence, the time ranges from four to 22 days. Total days from egg sac construction until emergence has ranged from 12 to 35 days, the total length of time required for mothers to carry their egg sacs varying according to the species and time of year. **L. rabida** and **carolinensis** females have carried egg sacs the longest.

Number of eggs per egg sac has varied from eight for a **Pardosa** species to 1035 for **L. rabida.** Number of egg sacs constructed per female has varied from one to six, depending mostly on species. Smaller species have tended to be more prolific in number of egg sacs, and larger species in number of eggs.

Maternal care of the spiderlings begins hours before they emerge. The "mother" perforates the egg sac around the seam, either part way or all the way. This double perforation is made by the "mother" rotating the egg sac with her legs and palpi while jerking at the seam with her chelicerae. Thus far no wolf spiderlings have been observed to leave an egg sac without help when the sac is taken away from the "mother" prior to this perforation.

Apparently most spiderlings leave the egg sac during the night. However a number of observations have also been made during the day. The first spiderling to leave the sac pokes its head out of one of the perforated holes somewhat hesitantly, then scrambles out of the hole and up and over the egg sac, and on up over the posterior portion of the "mother's" abdomen. Once on the "mother's" back, it finds an acceptable spot, lowers its body, and clings there. Its siblings follow, sometimes in groups, and sometimes singly. In the species observed the egg sac is usually emptied within 3 hours, and the spiderlings have stacked themselves on top of each other over the "mother's" abdomen, and may be spilling over onto the sides and onto her cephalothorax — which keeps her busy, occasionally, brushing them out of her eyes with her palpi.

Spiderlings remain on a "mother's" back a varying length of time depending on the species and time of year. For **P. milvina** this ranged from four to six days. For the medium-large **L. rabida** the young remained with the "mother" about 50 days. Medium-sized **L. helluo** and **S. avida** "mothers" carried their young from eight to 13 days. Large **L. carolinensis** "mothers" also carried their young from one to two weeks. The time taken for all spiderlings to leave a "mother's" back has ranged from several hours to two days for **P. milvina**, but over three weeks for **L. rabida.**

Mortality rate was higher among spiderlings removed from a "mother's" back than among those allowed to leave naturally.

Maternal care of the young while they are on the "mother's" back includes providing them with water. **L. carolinensis, L. helluo,** and **L. punctulata,** and **L. rabida** spiderlings were observed drinking water with their "mothers".

Experiments were conducted with a typical vagabond wolf spider, **L. rabida,** in order to have more detailed information on water consumption by spiderlings. To make it possible to observe the young drinking without continuous surveillance, water was withheld from the "mothers" from one to three days. Since the response was basically the same in all cases, the description of one observation will suffice.

The thirsty "mother" pawed the dry cotton in her drinking dish with her fore tarsi. The top-most spiderlings began untangling their legs from their siblings, hesitated, and settled again. Water was placed in the drinking dish. Immediately the "mother" moved to the dish, lowered the anterior portion of her body, began to drink, then resumed her usual standing position and placed tarsi of both fore legs and one second leg into the drinking dish.

Following this act, the top-most spiderlings again untangled their legs, walked hurriedly over the backs of their siblings, and continued in the direction of the "mother's" legs which were placed in the water. They climbed down her legs to the drinking dish, and immediately began drinking. The other spiderlings followed in rapid succession, and the "mother" resumed drinking. Upon finishing, the "mother" waited with legs in the water dish until the spiderlings had finished drinking and climbed onto her back. Then she moved away from the water dish.

On only one occasion during all the observations were spiderlings observed to descend a leg not placed in water. Even so, they stopped part way down the "mother's" leg hesitated, climbed up again, and walked across her back and down the legs placed in the water.

Time required for drinking varied from ten to thirty minutes in the observed cases. Age of the spiderlings ranged from newly emerged to a week old.

In one instance a female died the day after her young emerged. When her body was gently shaken her spiderlings began to untangle their legs, hesitated, then settled down again. Even when her body was gently shaken and placed in the water dish they would not leave her back. Those forcibly removed drank thirstily. The others eventually died, apparently of thirst.

Maternal care has been found to extend to the realm of foster "mothers." In an experiment with L. rabida, it was discovered that a "mother" with offspring of her own upon her back would accept offspring of another L. rabida without hesitation, even though her own back was well-covered with young. A "mother" with an egg sac from which spiderlings were due to emerge in several days also accepted a brood of spiderlings although she exhibited some slight leg twitching as they mounted. Several days later it was impossible to tell her spiderlings from the adopted ones.

An unmated female with no egg sac was not so calm about a brood of young ones. She exhibited extreme agitation whenever any tried to mount, and jerked and shook her legs vigorously in an attempt to prevent their mounting. However, she apparently tired of her preventive exercises because, when observed several hours later, all had mounted her back, and she was jerking cotton out of her drinking dish with her chelicerae in the manner of a very distressed spider.

Adoption of a different species by a "mother" has not yet been attempted. In several instances, however, egg sacs were adopted in an interchange between spiders, but more observations are yet needed. One frustrated L. carolinensis female con-

structed an imitation egg sac from cotton in her drinking dish four days after removal of her infertile egg sac. She dropped this substitute about the time fertile eggs would have hatched.

Maternal care ends when the spiderlings leave their "mother's" back and disperse by ballooning.

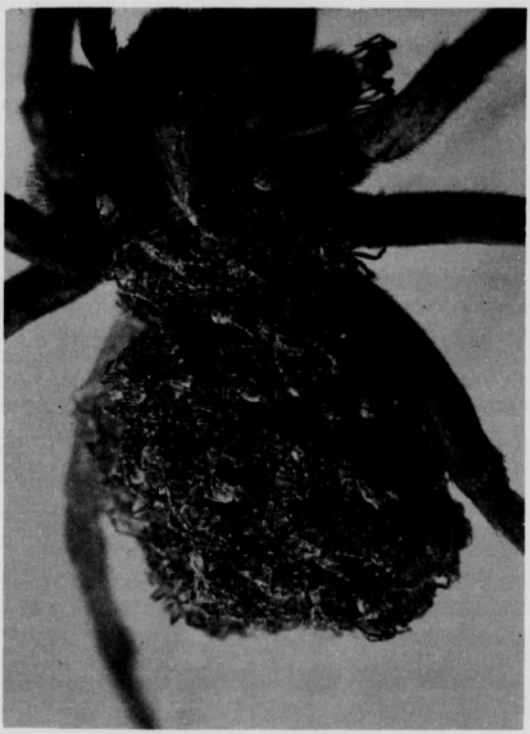


Fig. 2 Female lycosid with young on her back.

THE SEASONAL OCCURRENCES OF ARKANSAS BIRDS

by

Douglas James and Frances C. James
University of Arkansas

The accompanying chart, based on a greater accumulation of information about Arkansas birds than has been compiled previously, shows the seasonal occurrences of the birds that have been recorded from the time the first naturalist visited the state in 1811, through 1963. Not only does it include information from the books on Arkansas birds by Howell (1911), Wheeler (1924), and Baerg (1931, 1951), but it also incorporates data from such other rich sources as the early regional summaries by Black (1935) for the western Boston Mountains, and Deadrick (1938) for the eastern Ouachita Mountains, as well as the more recent studies by Meanley and Neff (1953) on the Grand Prairie, and Mattocks and Shugart (1962) in southern Arkansas. To this was added data found in **Audubon Field Notes** and other statewide analyses (James, 1960, 1964), plus the information obtained from museum specimens in Arkansas collections around the country. The major single source of records, mostly unpublished, came from the nearly thirty thousand entries contained in the files maintained by the Arkansas Audubon Society under the curatorial supervision of the senior author. The bulk of these were obtained from competent field observers since 1955, but past observations made by some individuals who were very active prior to that date were added. These latter, some of which date back to the early part of this century, include the records of M. G. Vaiden, S. H. Weakley, Ben B. Coffey, Jr., Arnold J. Hoiberg, Brooke Meanley, and the senior author.

In spite of the increased coverage, this report is preliminary in the sense that the chart reveals many gaps in the knowledge of the seasonal distribution of the Arkansas avifauna. Therefore, it serves not only as a source of up-to-date information, but also provides an outline to the problems which require further investigation.

Several birds which have been reported in the state are not listed. The Black Skimmer is not included because the single specimen was undated. Birds like the Passenger Pigeon and the Ivory-billed Woodpecker were omitted because they no longer occur in Arkansas. Several species reported in previous publications were omitted because of uncertainties about them. On the other hand, the banded Sooty Tern recovered in Arkansas on September 4, 1950 (Dickinson, 1951) was omitted inadvertently.

THE SEASONAL OCCURRENCES OF ARKANSAS BIRDS

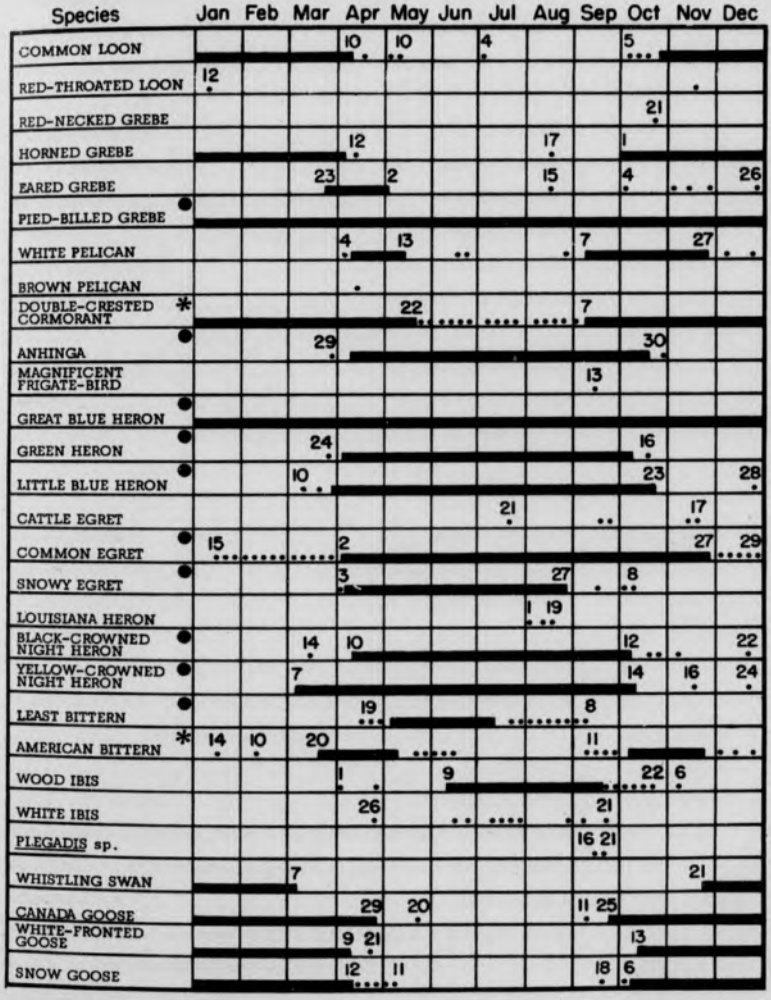
Continuous presence at least locally.

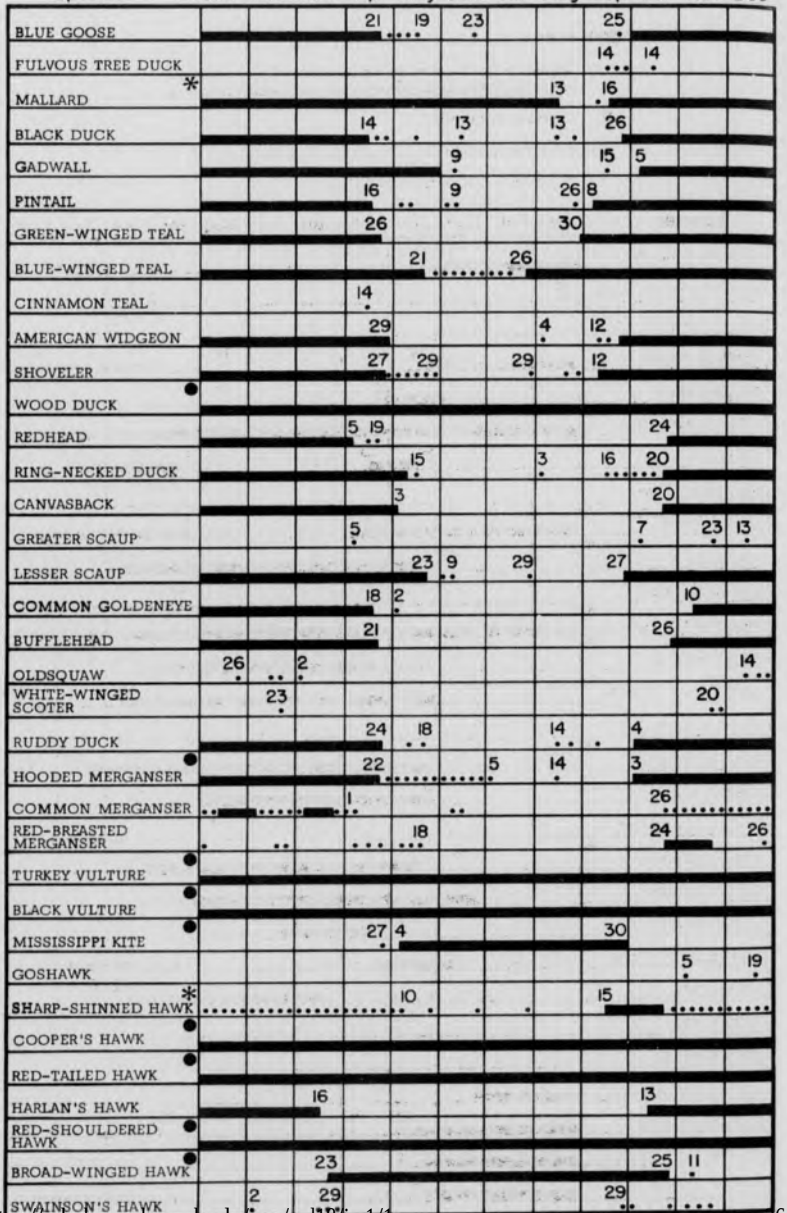
••••• Either isolated occurrences separated by a week or more, or continuous presence in very small numbers.

● Breeding regularly.

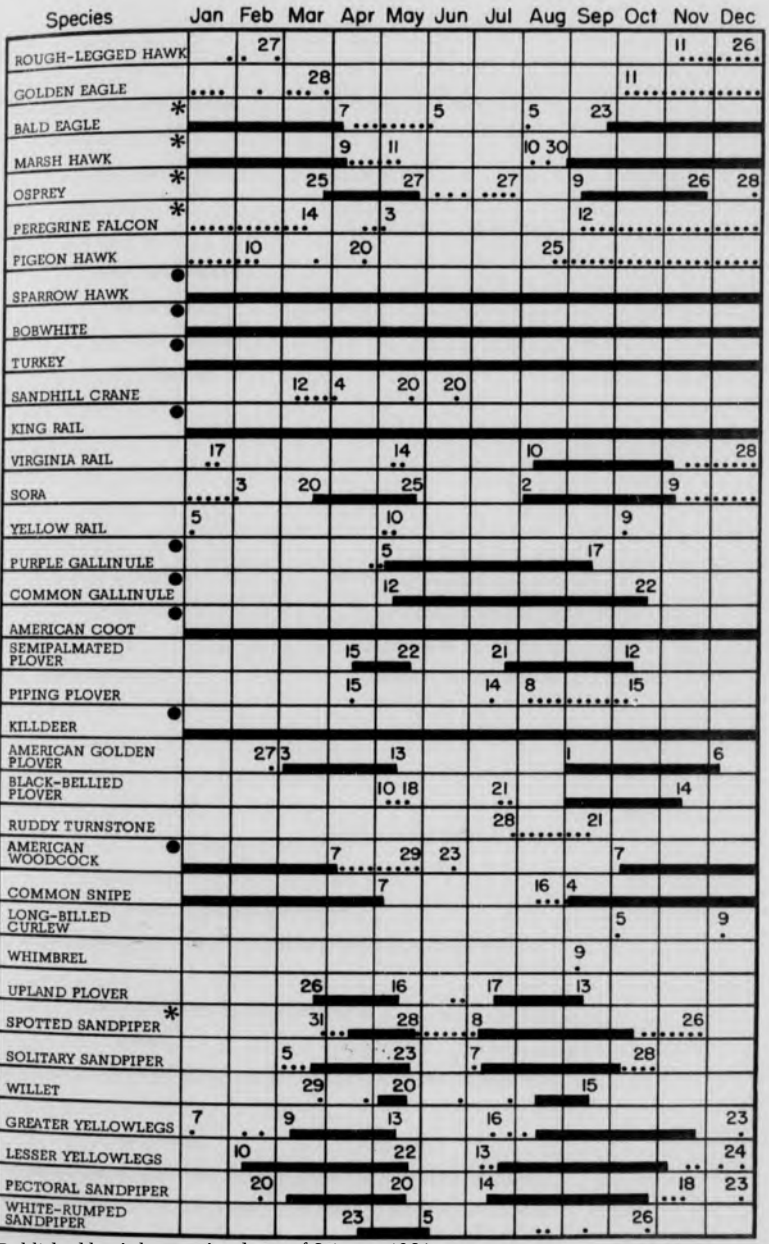
✱ Breeding irregularly or known to have bred.

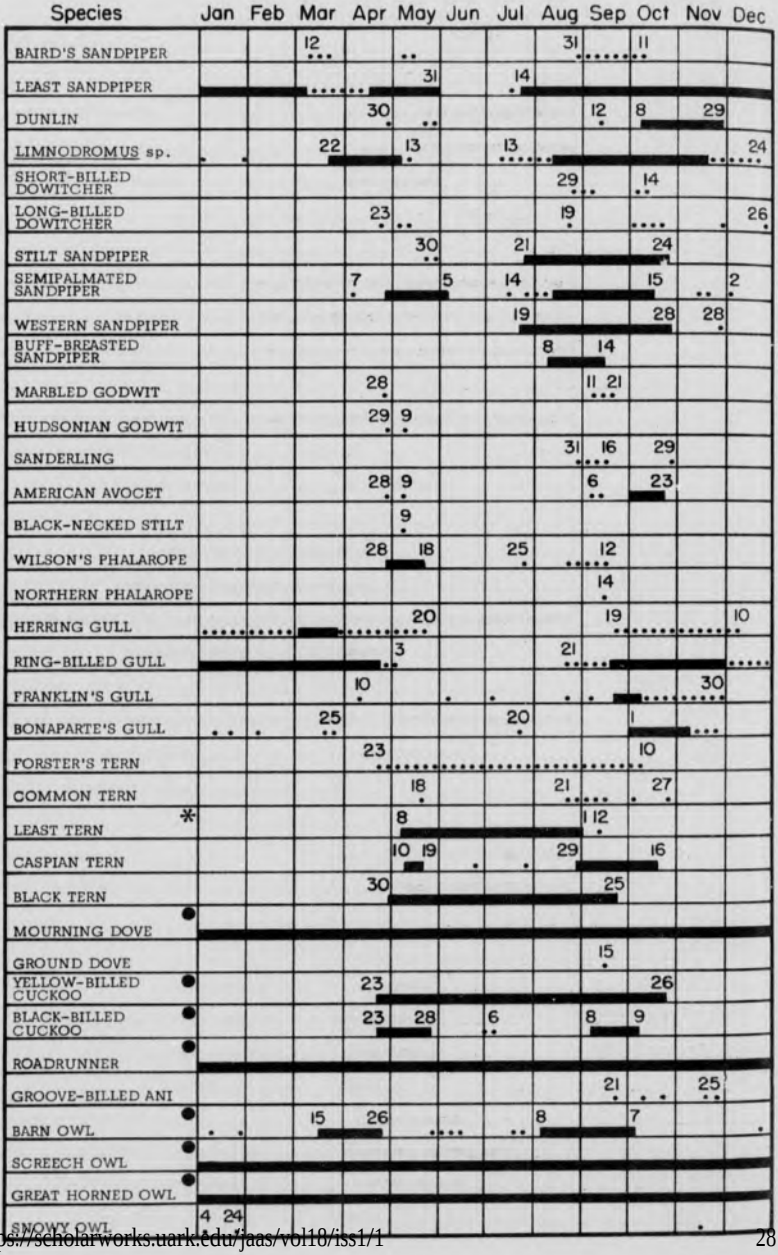
Numbers indicate important dates.



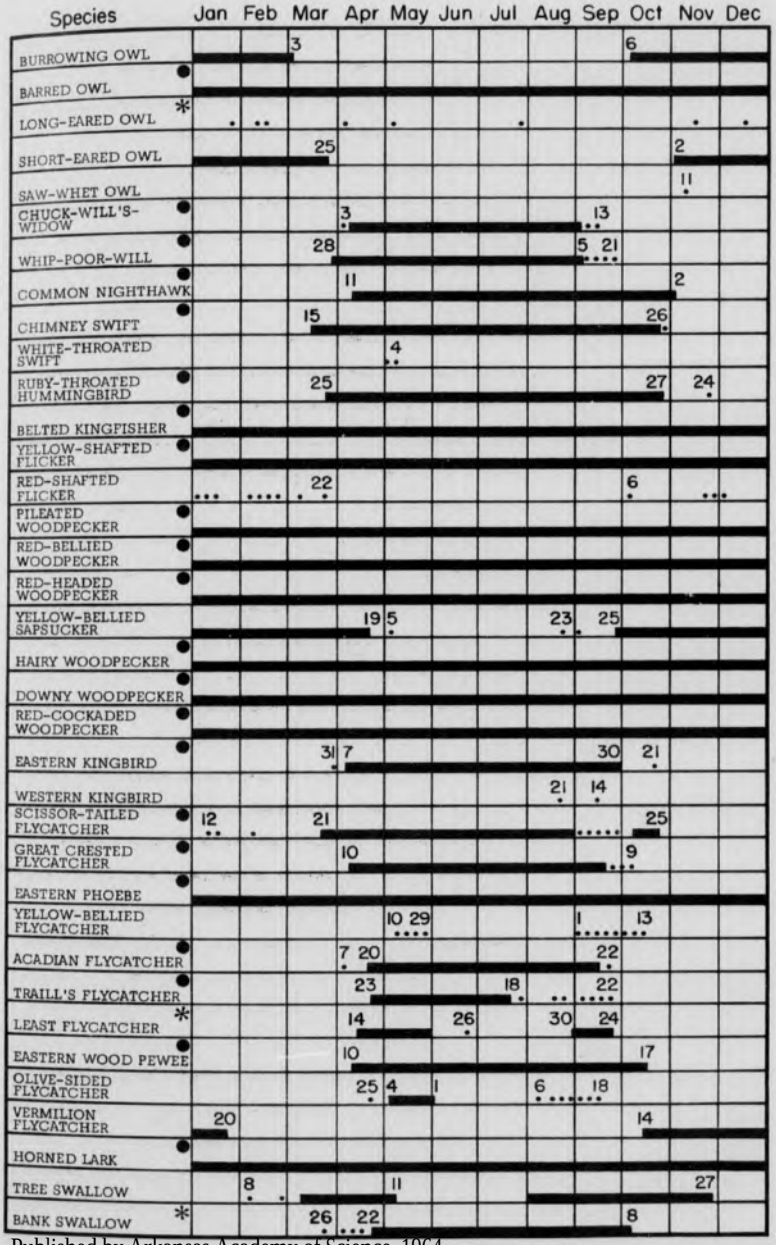

Species
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
BLUE GOOSE
FULVOUS TREE DUCK
MALLARD
BLACK DUCK
GADWALL
PINTAIL
GREEN-WINGED TEAL
BLUE-WINGED TEAL
CINNAMON TEAL
AMERICAN WIDGEON
SHOVELER
WOOD DUCK
REDHEAD
RING-NECKED DUCK
CANVASBACK
GREATER SCAUP
LESSER SCAUP
COMMON GOLDENEYE
BUFFLEHEAD
OLDSQUAW
WHITE-WINGED SCOTER
RUDDY DUCK
HOODED MERGANSER
COMMON MERGANSER
RED-BREASTED MERGANSER
TURKEY VULTURE
BLACK VULTURE
MISSISSIPPI KITE
GOSHAWK
SHARP-SHINNED HAWK
COOPER'S HAWK
RED-TAILED HAWK
HARLAN'S HAWK
RED-SHOULDERED HAWK
BROAD-WINGED HAWK
SWAINSON'S HAWK

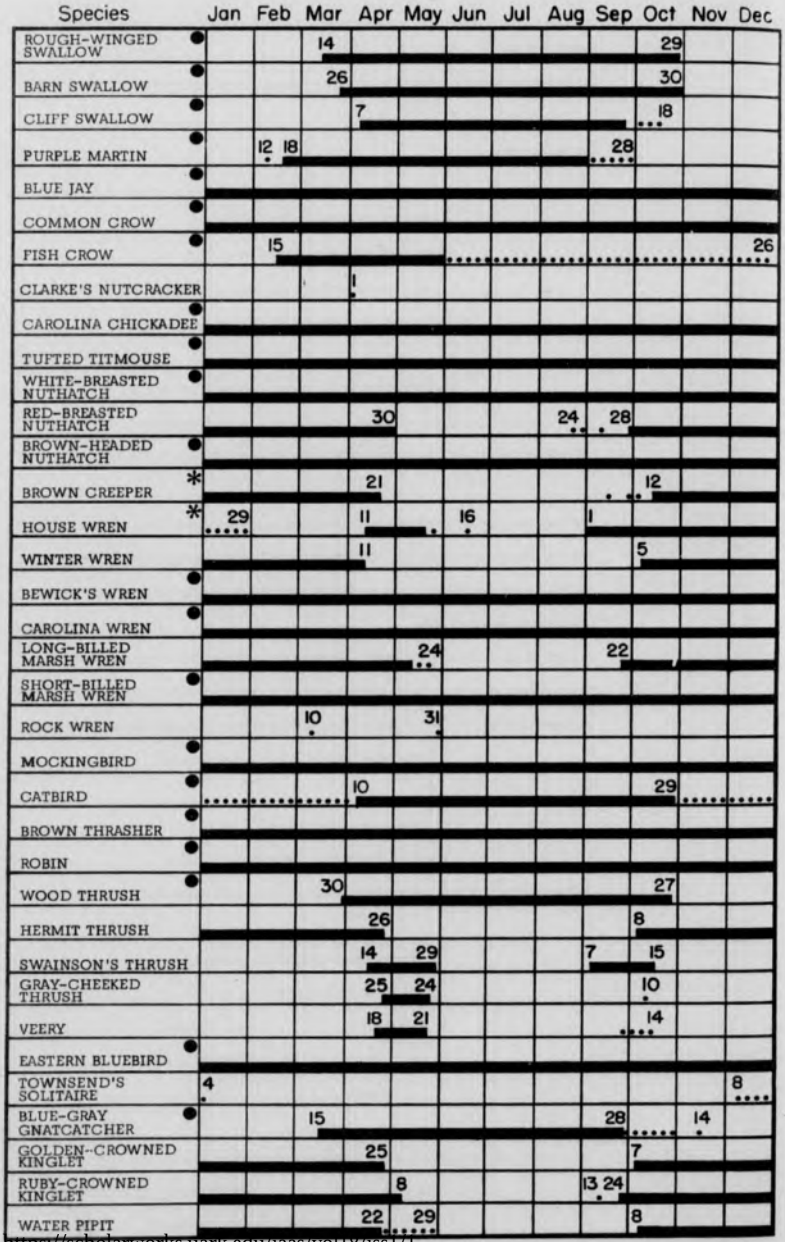
Seasonal Occurrences of Arkansas Birds



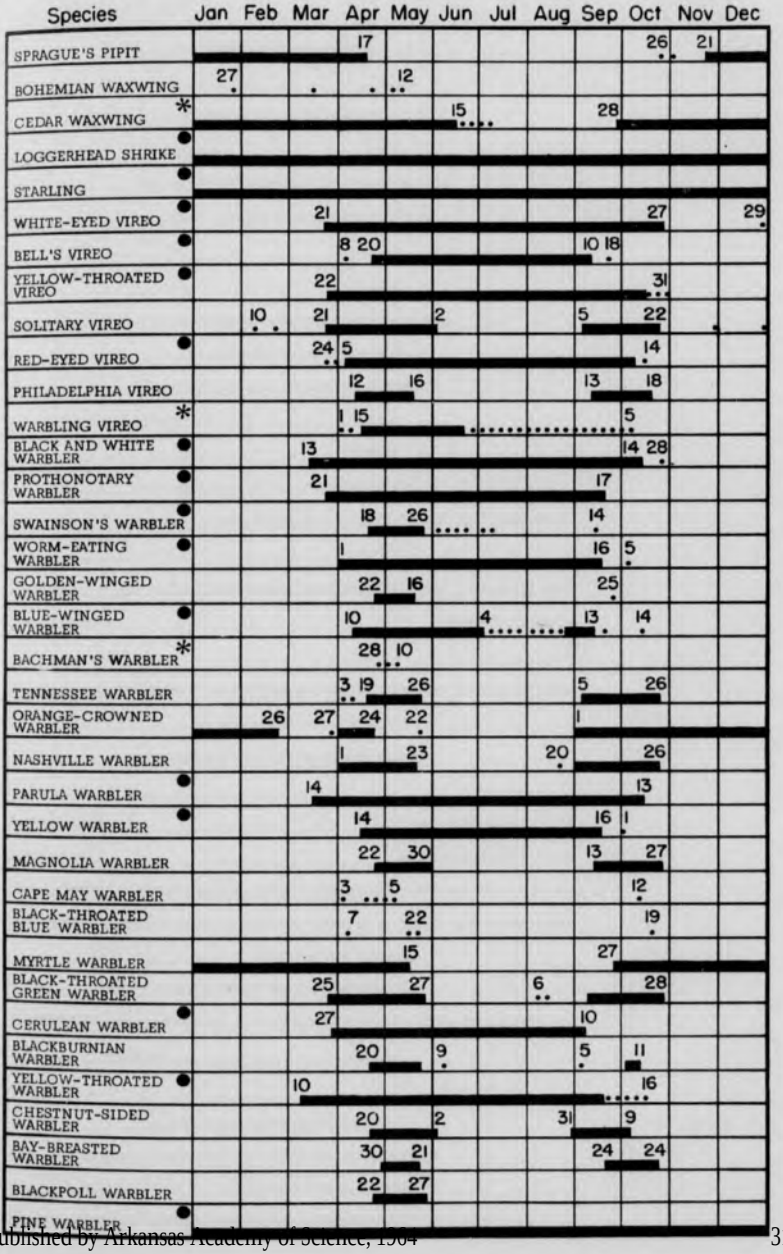

Species
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
BAIRD'S SANDPIPER
LEAST SANDPIPER
DUNLIN
LIMNODROMUS sp.
SHORT-BILLED DOWITCHER
LONG-BILLED DOWITCHER
STILT SANDPIPER
SEMIPALMATED SANDPIPER
WESTERN SANDPIPER
BUFF-BREASTED SANDPIPER
MARBLED GODWIT
HUDSONIAN GODWIT
SANDERLING
AMERICAN AVOCET
BLACK-NECKED STILT
WILSON'S PHALAROPE
NORTHERN PHALAROPE
HERRING GULL
RING-BILLED GULL
FRANKLIN'S GULL
BONAPARTE'S GULL
FORSTER'S TERN
COMMON TERN
LEAST TERN
CASPIAN TERN
BLACK TERN
MOURNING DOVE
GROUND DOVE
YELLOW-BILLED CUCKOO
BLACK-BILLED CUCKOO
ROADRUNNER
GROOVE-BILLED ANI
BARN OWL
SCREECH OWL
GREAT HORNED OWL
SNOWY OWL

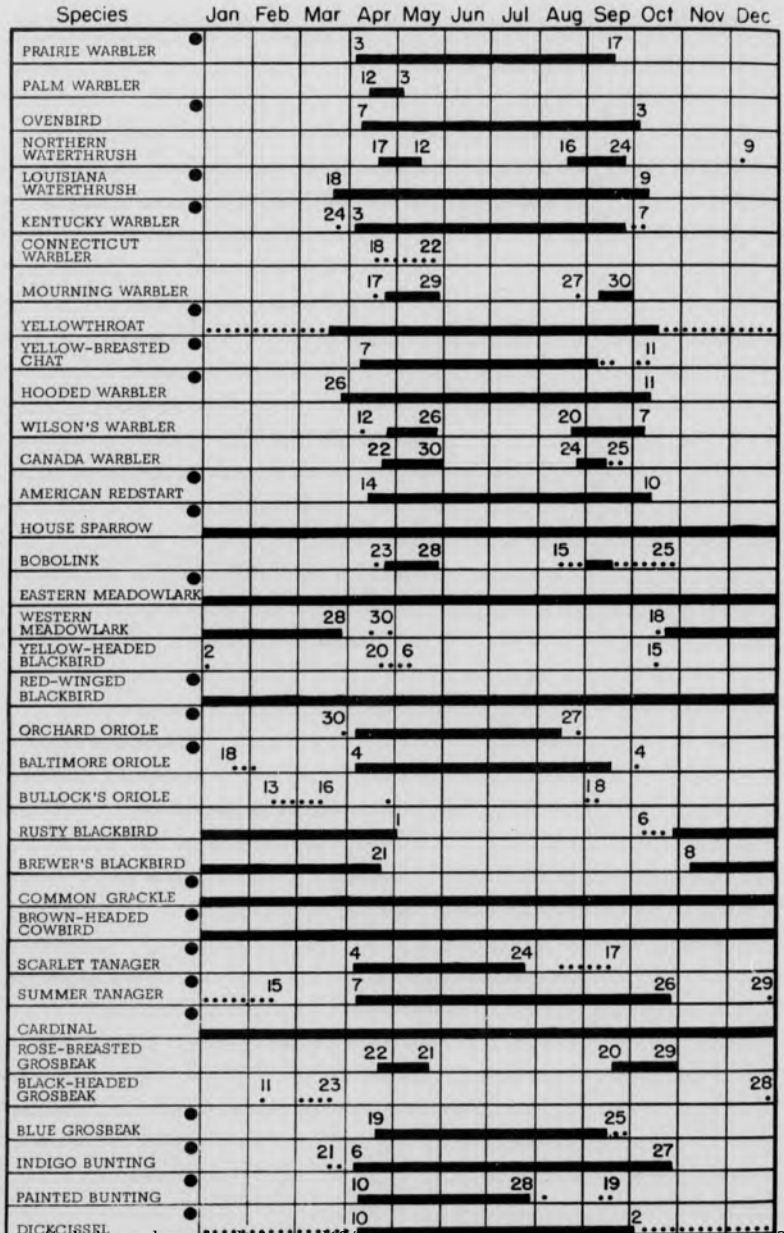
Seasonal Occurrences of Arkansas Birds



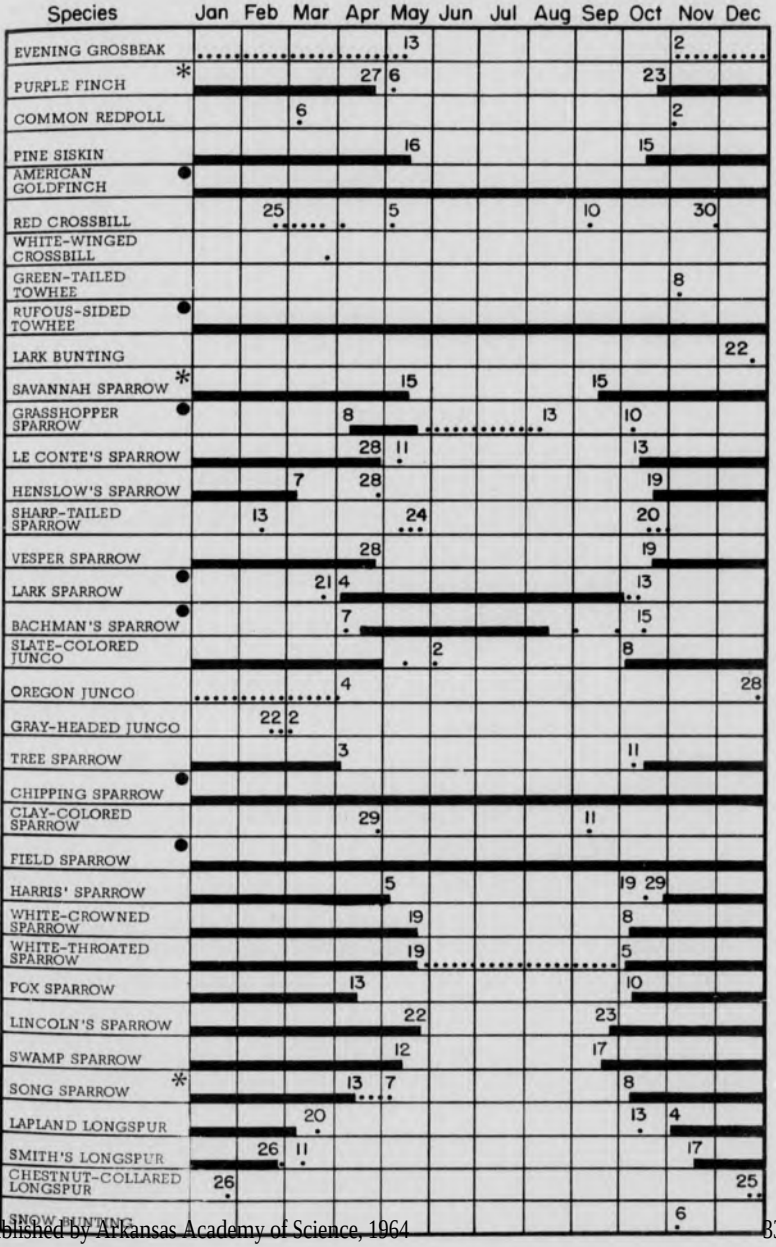

Species
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
ROUGH-WINGED SWALLOW
BARN SWALLOW
CLIFF SWALLOW
PURPLE MARTIN
BLUE JAY
COMMON CROW
FISH CROW
CLARKE'S NUTCRACKER
CAROLINA CHICKADEE
TUFTED TITMOUSE
WHITE-BREASTED NUTHATCH
RED-BREASTED NUTHATCH
BROWN-HEADED NUTHATCH
BROWN CREEPER
HOUSE WREN
WINTER WREN
BEWICK'S WREN
CAROLINA WREN
LONG-BILLED MARSH WREN
SHORT-BILLED MARSH WREN
ROCK WREN
MOCKINGBIRD
CATBIRD
BROWN THRASHER
ROBIN
WOOD THRUSH
HERMIT THRUSH
SWAINSON'S THRUSH
GRAY-CHEEKED THRUSH
VEERY
EASTERN BLUEBIRD
TOWNSEND'S SOLITAIRE
BLUE-GRAY GNATCATCHER
GOLDEN-CROWNED KINGLET
RUBY-CROWNED KINGLET
WATER PIPIT

Seasonal Occurrences of Arkansas Birds




Species
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
PRAIRIE WARBLER
PALM WARBLER
OVENBIRD
NORTHERN WATERTHRUSH
LOUISIANA WATERTHRUSH
KENTUCKY WARBLER
CONNECTICUT WARBLER
MOURNING WARBLER
YELLOWTHROAT
YELLOW-BREASTED CHAT
HOODED WARBLER
WILSON'S WARBLER
CANADA WARBLER
AMERICAN REDSTART
HOUSE SPARROW
BOBOLINK
EASTERN MEADOWLARK
WESTERN MEADOWLARK
YELLOW-HEADED BLACKBIRD
RED-WINGED BLACKBIRD
ORCHARD ORIOLE
BALTIMORE ORIOLE
BULLOCK'S ORIOLE
RUSTY BLACKBIRD
BREWER'S BLACKBIRD
COMMON GRACKLE
BROWN-HEADED COWBIRD
SCARLET TANAGER
SUMMER TANAGER
CARDINAL
ROSE-BREASTED GROSBEAK
BLACK-HEADED GROSBEAK
BLUE GROSBEAK
INDIGO BUNTING
PAINTED BUNTING
DICKCISSEL

Seasonal Occurrences of Arkansas Birds



Funds granted for maintaining the bird files of the Arkansas Audubon Society housed at the University of Arkansas, and for making museum searches for bird specimens collected in Arkansas, were obtained from several sources which are acknowledged gratefully: The Frank M. Chapman Memorial Fund of the American Museum of Natural History, the Louis Aggassiz Fuertes Research Grant of the Wilson Ornithological Society, and research funds from the College of Arts and Sciences at the University of Arkansas. The cost of drafting the printer's copy of the bird chart was paid by the Research Reserve Fund of the Graduate School at the University of Arkansas. Acknowledgment is also due the many contributors to the bird file, and to Charles R. Wallace who assisted in preparing the chart.

The common names of the birds and their order in the chart follow the fifth edition of the "A.O.U. Check-List of North American Birds".

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IDENTIFICATION OF NINHYDRIN POSITIVE COMPONENTS IN ETHANOLIC EXTRACTS OF RICE PANICLES BY PAPER CHROMATOGRAPHY

C. I. Grable[1], J. E. Presley[2], and G. E. Templeton
University of Arkansas

The readily extractable amino acids and amides in rice panicle tissue are being studied to determine their role in the mechanism of physiologic resistance to the kernel smut pathogen, Tilletia barclayana (Bref.) Sacc. and Syd. Paper chromatography, because it is rapid and reliable, is ideally suited for examining amino acid pools from tissue whose resistance has been modified by manipulation of the environment or for following changes in pool composition during growth, either preceding, during, or after infection by this localized parasite in a resistant or susceptible host.

Since the origin of modern paper chromatography by Consden, Gordon and Martin (2), multitudinous modifications for separation and identification of amino acids have been reported (1, 4, 5, 7, 8, 10). This report gives the method selected from these many modifications which has been found to be best suited in our laboratory for extraction, desalting, separation and identification of the 80 percent ethanol soluble, ninhydrin positive components of rice panicles at anthesis by two dimensional descending paper chromatography.

MATERIALS AND METHODS

1. Extraction.

The Bluebonnet 50 rice panicles at anthesis were dried to constant weight at 70° C, ground to pass a 40 mesh seive in a Wiley Mill, and extracted with 80 percent ethanol in an Omnimixer at 8000 R.P.M.. A three gram sample of dried tissue was blended three times for 15 minutes each in 50, 40 and 30 ml portions of ethanol in a stainless steel cup (nominal volume 50 ml) at room temperature. The supernatant from each extraction was decanted and filtered through Whatman No. 1 filter paper and the filtrates were combined.

2. Desalting.

The combined filtrates were desalted with a cation exchange resin according to the procedure of Plaisted (6) in which 100 ml of filtrate was passed through a .9 x 3-5 cm column

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[2]Participant-Undergraduate Research Participation Program in Plant Pathology-NSF 21692.

of acidic Dowex 50 W x 8(100-200) bedded in 80 percent ethanol at a flow rate of 3 ml/min. After elution of the amino acids from the column with ammonium hydroxide, the eluates were taken to dryness in a Rinco rotary evaporator. The residue was taken up in 10 percent isopropanol, made up to 10 ml in a glass stoppered volumetric flask, then stored at room temperature until used for spotting papers for chromatography.

3. Chromatography.

The amino acid solutions were spotted on 18¼ x 22½ inch sheets of Whatman No. 1 filter paper and were separated by two dimensional descending chromatography. The solvent systems used were phenol: water (4:1) or methanol: ethanol: water: urea (45:45:10:0.5) v:v:v:w in the first direction (22½ inch length in the machine direction) and n-butanol: acetic acid: water (4:1:6) (upper layer) in the second direction. A spot, .5 to 1 cm in diameter, containing 100-200 lambda of the amino acid mixture was applied to each paper at the appropriate corner, 3 inches from either edge of the paper with 5 or 10 lambda, self-filling micropipettes. A hair dryer was used intermittently to hasten drying, plastic gloves were used to avoid contamination of the papers with perspiration and a glass plate which supported the papers during spotting was cleaned with acetone after spotting each paper. The pipettes were cleaned in detergent solution, rinsed five times in de-ionized water and dried with acetone.

The spotted papers were folded and developed in an insulated Chromatocab in a descending manner. (Fig. 1). Five to 10 papers were developed at a time with 75 or 100 ml of the solvent per trough for one or two papers respectively. The temperature ranged from 23 to 28° C during the course of this work with temperature variation during one development not exceeding 1° C. Time for development ranged from 15 to 21 hours depending upon solvent, number of papers, temperature, length of paper, etc. Development was begun without an equilibration period and solvents were permitted to travel to within ½ inch of the bottom of the paper before being removed and dried. The folded edge was removed at the antisiphon rod line and the paper was similarly refolded along the edge perpendicular to the machine direction prior to development in the second solvent.

The papers were dried in a forced air oven at 30° C. Papers developed in phenol were dried for 8 hours before developing in the second solvent whereas papers developed in the other two solvents were dried for 2 hours. After completion of drying after the second development, the papers were sprayed or dipped in ninhydrin and heated for color development.

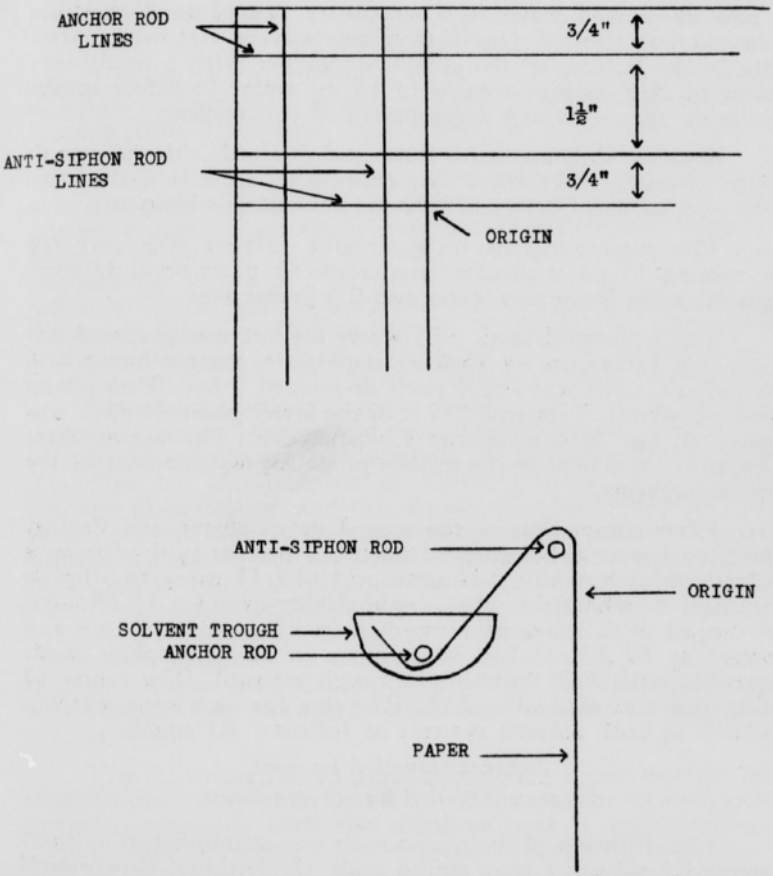


Figure 1. Method of marking and folding paper for two-dimensional descending paper chromatography.

The phenol solvent was prepared immediately before use by shaking together 4 parts liquified phenol (Merck 88%) and 1 part de-ionized water in a separatory funnel until complete solution was affected. One liter of this solvent was used repeatedly in the bottom of the chamber together with a small container of .5 g sodium cyanide in 15 ml water to reduce breakdown of phenol during development in this solvent.

Separate Chromatocabs were used for each solvent system when practical. or cabinets were thoroughly cleaned with detergent and air dried between different solvent developments.

The methanol:ethanol:water:urea solvent was prepared by mixing 45 parts absolute methanol, 45 parts absolute ethanol, 10 parts de-ionized water and 0.5 grams urea.

The n-butanol:acetic acid:water solvent was prepared immediately before use by shaking together 4 parts n-butanol, 1 part glacial acetic acid and 6 parts de-ionized water. Two phases were allowed to form and 100 cc of the lower phase (water) was placed in the bottom of the Chromatocab. The upper phase (butanol) was used as the mobile phase for development of the chromatograms.

After completion of the second development and drying, the papers were either sprayed with 0.2 percent ninhydrin in a solution of n-butanol: 2 N acetic acid (19:1) using an all glass atomizer then heated at 80°C in the drying oven for 15 minutes. or dipped in 0.2 percent ninhydrin in 95 percent ethanol and heated at 65-70° C for 30 minutes in an atmosphere made anerobic with CO^2 bubbling through ethanol. The center of each spot was marked and the Rf value for each spot was calculated in both solvent systems as follows: Rf equals

$$\frac{\text{distance travelled by spot}}{\text{distance travelled by solvent front.}}$$

Identification of the amino acids was accomplished by comparing Rf values of pure amino acids (Nutritional Biochemical Co., Cleveland, Ohio) in the same solvent systems and by cochromatography i. e. adding known amino acid solutions to the spot containing solutions from tissue extracts and chromatographing. In some cases color differences aided in identification.

The chromatograms were preserved by fixing the developed color with copper and coating the paper with plastic. The papers were freed of traces of solvent by washing in equal parts of petroleum ether: acetone (v:v) before treating with ninhydrin. After the ninhydrin treatment and color development the dried chromatogram was dipped in dilute copper nitrate (1 ml of saturated aqueous Cu $(NO^3)^2$ plus 0.2 ml of 10% v/v HNO^3 diluted to 100 ml with ethanol) and exposed momentarily to

ammonia vapor. The paper was then dried at room temperature and sprayed with Krylon crystal clear spray coating No. 1303

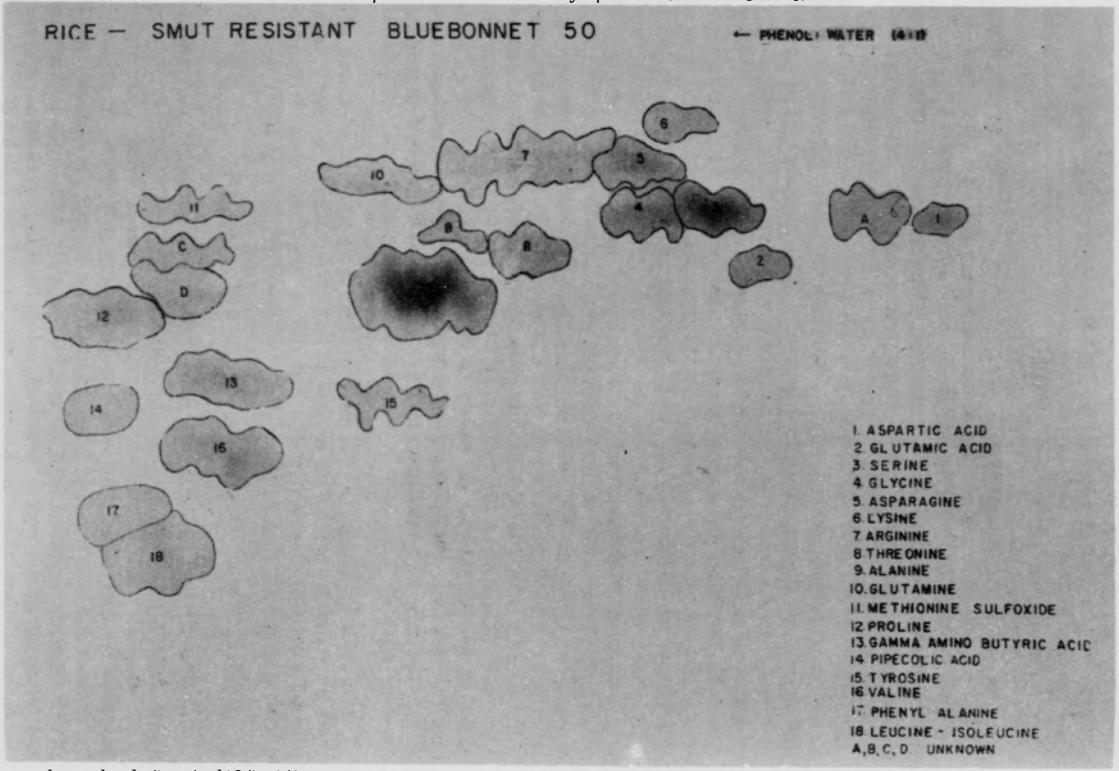
RESULTS

Twenty two ninhydrin positive components were separated by two-dimensional paper chromatography of the ethanolic extracts from Bluebonnet 50 rice panicles at anthesis. Eighteen of these were identified by color, co-chromatography and by comparison of their Rf values in three solvent systems with Rf values of pure amino acids chromatographed in the same three solvent systems. Four spots were not identified and were designated unknowns A, B, C, and D. A two-dimensional chromatogram is shown in Figure 2 with phenol:water in the first direction (from right to left) and butanol:acetic acid:water in the second direction (top to bottom). The number or letter of each spot coincides with the number or letter of the amino acid or unknown listed on the chromatogram. This solvent system does not separate isoleucine from leucine, valine from methionine, alpha amino butyric acid from gamma amino butyric acid and the phenylalanine spot overlaps the isoleucine-leucine spot. Therefore the identification of valine, gamma amino butyric acid and phenylalaine, and the absence of methionine and alpha amino butyric acid on this chromatogram is based on the separation of these in the methanol: ethanol: water:urea solvent. Isoleucine and leucine were not separated in any solvent used. The assumption that both are present is based on the fact that both are ubiquitous in biological material. In addition to the compounds identified in extracts of Bluebonnet 50 rice, methionine sulfone, beta alanine, tryptophane and histidine were identified and two unknowns were found in extracts from other rice varieties.

The Rf values for 40 pure amino compounds in three solvent systems are given in Table I and the number of each compound corresponds with the numbers used in the chromatographic maps in Figures 3 and 4, prepared from this data.

DISCUSSION AND SUMMARY

The degree of separation and identification of the amino acids is deemed adequate for the physiological studies envisioned. The majority of the ninhydrin-positive spots were chromatographically identified and those which were not, were in relatively low concentration. These unknowns might be amino acids previously described (3) but not yet readily available from normal commercial sources, undescribed amino compounds, or small peptides. Unless these unknowns are found to be closely related to some disease reaction of rice it would not seem warranted to go through the laborious procedures necessary for unequivocal identification of these compounds. (11)


RICE — SMUT RESISTANT BLUEBONNET 50
← PHENOL: WATER (4:1)
1. ASPARTIC ACID
2. GLUTAMIC ACID
3. SERINE
4. GLYCINE
5. ASPARAGINE
6. LYSINE
7. ARGININE
8. THREONINE
9. ALANINE
10. GLUTAMINE
11. METHIONINE SULFOXIDE
12. PROLINE
13. GAMMA AMINO BUTYRIC ACID
14. PIPECOLIC ACID
15. TYROSINE
16. VALINE
17. PHENYL ALANINE
18. LEUCINE - ISOLEUCINE
A, B, C, D. UNKNOWN

The absence of some of the common protein amino acids such as cystine, cysteine, methionine, tryptophane is not interpreted as an absence of these amino acids in rice tissue but a lack of their occurrence in detectable quantities using these procedures. In fact, the presence of methionine is strongly suggested since no precautions were taken to prevent its oxidation in these procedures. Likewise no precautions were taken to avoid breakdown of glutamine or asparagine to their respective acids.

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TABLE 1

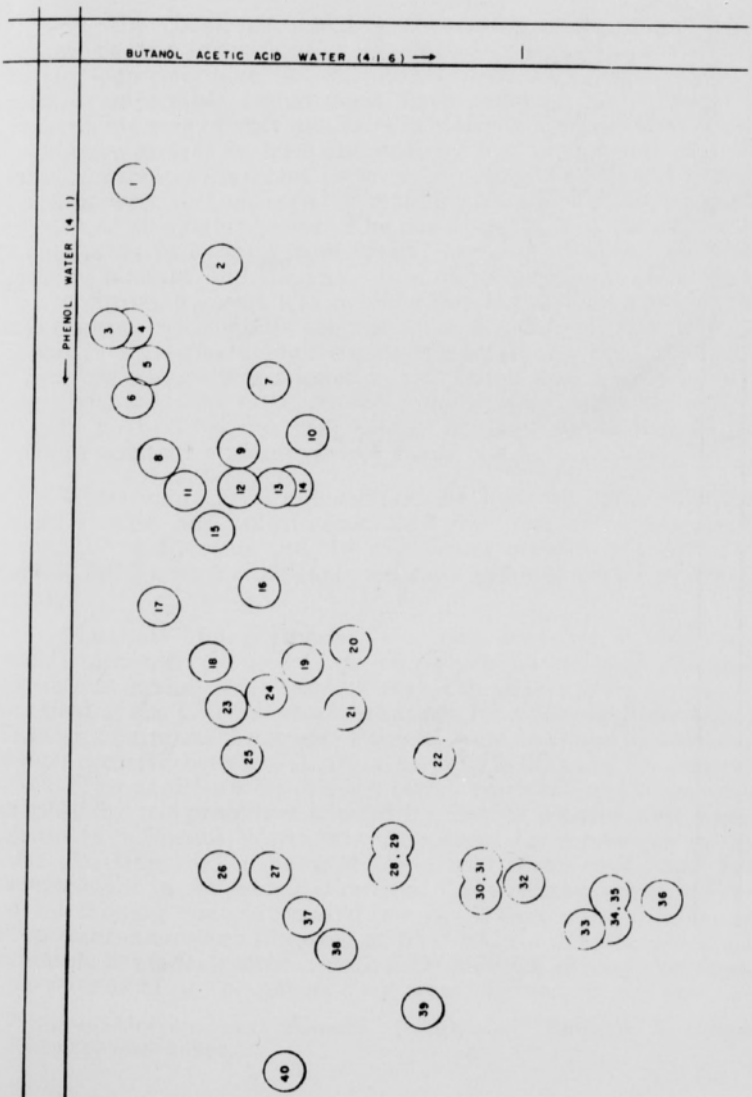
Rf. values of pure amino acids in three solvent systems

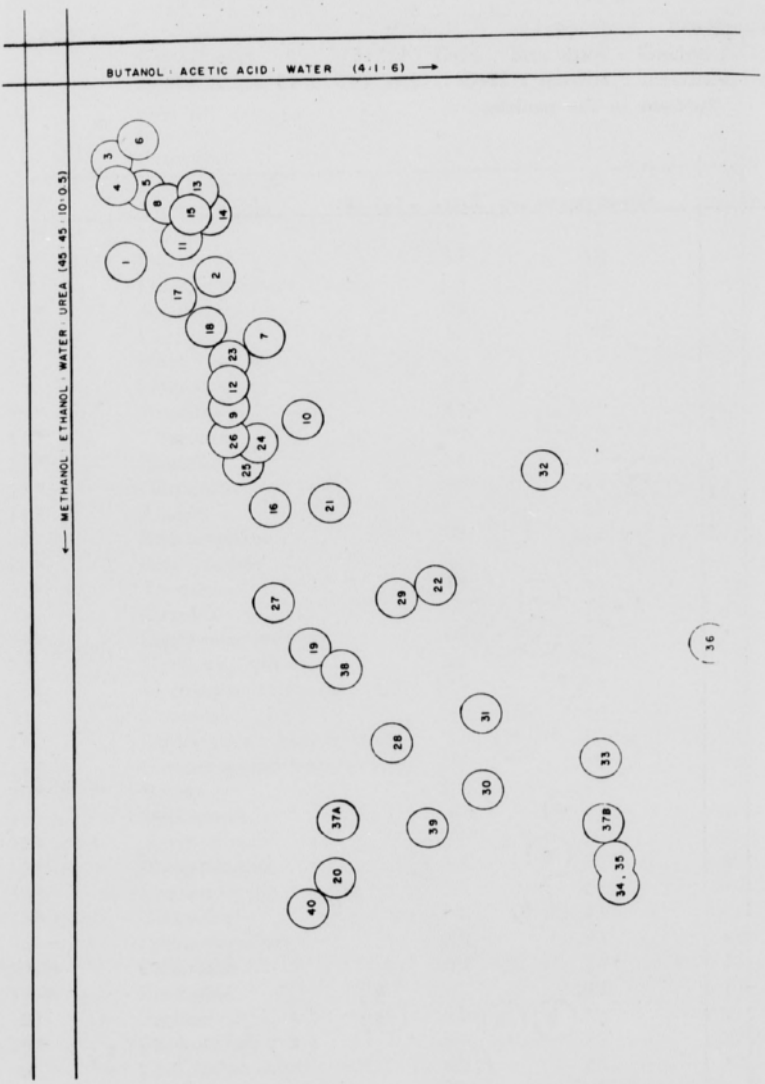
Spot Number	Amino acid	Rf values in Phenol[1]	n-butanol[2]	Methanol[3]
1	Cysteic acid	.11	.07	.17
2*	Aspartic acid	.19	.17	.18
3	Cysteine	.25	.05	.07
4	Cystine	.25	.06	.10
5	Ornithine	.29	.09	.10
6	Djenkolic acid	.32	.08	.05
7*	Glutamic acid	.30	.23	.24
8*	Lysine	.38	.12	.12
9*	Serine	.37	.18	.31
10	Dihydroxyphenylalanine	.35	.27	.32
11*	Asparagine	.40	.13	.15
12*	Glycine	.40	.18	.29
13	Homocystine	.40	.15	.10
14	Homocysteine	.40	.17	.13
15*	Arginine	.44	.14	.13
16*	Threonine	.49	.23	.41
17*	Histidine	.51	.12	.20
18*	Glutamine	.57	.16	.23
19*	Alanine	.57	.28	.54
20	Ethanolamine	.55	.31	.76
21*	Beta alanine	.61	.30	.40
22*	Tyrosine	.65	.43	.48
23	Citrulline	.61	.18	.26
24*	Methionine sulfone	.60	.22	.34
25	Hydroxyproline	.64	.20	.36
26*	Methionine sulfoxide	.76	.18	.34
27	Sarcosine	.76	.24	.50
28	Alpha amino butyric acid	.75	.37	.63
29*	Gamma amino butyric acid	.75	.38	.50
30*	Valine	.77	.48	.68
31	Methionine	.77	.48	.61
32*	Tryptophane	.77	.55	.37
33*	Phenylalanine	.82	.62	.65
34*	Leucine	.79	.64	.76
35*	Isoleucine	.79	.64	.76
36	Diiodotyrosine	.79	.75	.54
37-A	Ethionine	.80	.31	.71
37-B	Ethionine	—	.62	.71
38*	Proline	.83	.31	.56
39*	Pipecolic acid	.89	.41	.71
40	Beta amino butyric acid	.95	.28	.79
A*	Unknown	.25	.16	
B*	Unknown	.58	.18	
C*	Unknown	.39	.20	
D*	Unknown	.39	.24	
E*	Unknown	.29	.13	
F*	Unknown	.32	.09	

Ninhydrin Positive Components in Rice Panicles

(Table 1 continued)

1—phenol : H_2O (4:1)
2—n-butanol : acetic acid : H_2O (4:1:6)
3—Methanol : ethanol : H_2O : Urea (45 : 45 : 10 : 0.5)
*present in rice panicles




BUTANOL : ACETIC ACID : WATER (4 : 1 : 6) →
← METHANOL : ETHANOL : WATER : UREA (45 : 45 : 10 : 0.5)
1
2
3
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32
33
34, 35
36
37A
37B
38
39
40

QUANTITATIVE DIFFERENCES IN ALANINE IN RICE PANICLES OF VARIETIES

Resistant and Susceptible to Kernel Smut

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In the course of selecting chromatographic methods for separation and identification of ninhydrin-positive components in rice panicle tissue, it was noted that the compliments of readily extractable amino acids from resistant and susceptible varieties are remarkably similar qualitatively (1). A few amino acids were present in trace amounts in only one variety but the most apparent differences between varieties of different disease reaction were in the levels of alanine, as indicated by size and density of the alanine spot. The concentrations of several other amino acids also varied from variety to variety but not so strikingly as alanine, and the separation of alanine from other spots on the chromatograms was considerably better than some of the other amino acids whose concentration also varied. Also alanine occurs in a relatively high concentration in rice panicle tissues. Therefore alanine was selected as the amino acid with which to begin the selection of a suitable quantitative paper chromatographic method for determination of levels of the various amino acids in resistant and susceptible rice.

This report gives the method selected for color development, elution and colorimetric determination of alanine from paper chromatograms and the differences between alanine content of field-grown rice plants resistant and susceptible to kernel smut.

Materials and Methods: The two varieties of rice used were Bluebonnet 50 and CI 9446, which are resistant and susceptible to kernel smut respectively. The plants were grown in the field at the University of Arkansas, Rice Branch Experiment Station, Stuttgart, Arkansas. Panicles were collected at anthesis, which occurred between 10:00 a. m. and 2:00 p. m. in August, 1961. The panicles were dried, ground, extracted and chromatographed by the procedure selected by Grable, Presley and Templeton (1). Phenol:Water was the solvent for separation in the first direction and n-butanol:acetic acid:water was used for development in the second direction. Color reaction was achieved by dipping the chromatograms in .2 percent ninhydrin in 95 percent ethanol and heating at 65-70°C for 30 minutes in an atmosphere made anaerobic with CO^2 bubbled through ethanol. After removal of the papers they were allowed to dry for one

[1]Participant-Undergraduate Research Participation Program in Plant Pathology NSF 21692.

hour at room temperature and protected from direct light.

The purplish-blue alanine spots was outlined in pencil and cut out with a razorblade. The removed spots were cut into pieces approximately 1 cm x 1 cm and placed in a test tube. The pieces were washed two times for 1 minute each in five ml aliquots of 50% ethanol. The ethanol was decanted into calibrated colorimeter tubes, made up to 10 ml with 50 percent ethanol and read in the colorimeter at 570 millimicrons. All samples were run in triplicate and a portion of the paper containing no spots was cut out and eluted with ethanol to serve as a blank.

The concentration of alanine was determined by averaging triplicate samples and referring to a standard curve which was prepared from chromatograms of alanine ranging in concentration from 50 to 400 micromoles.

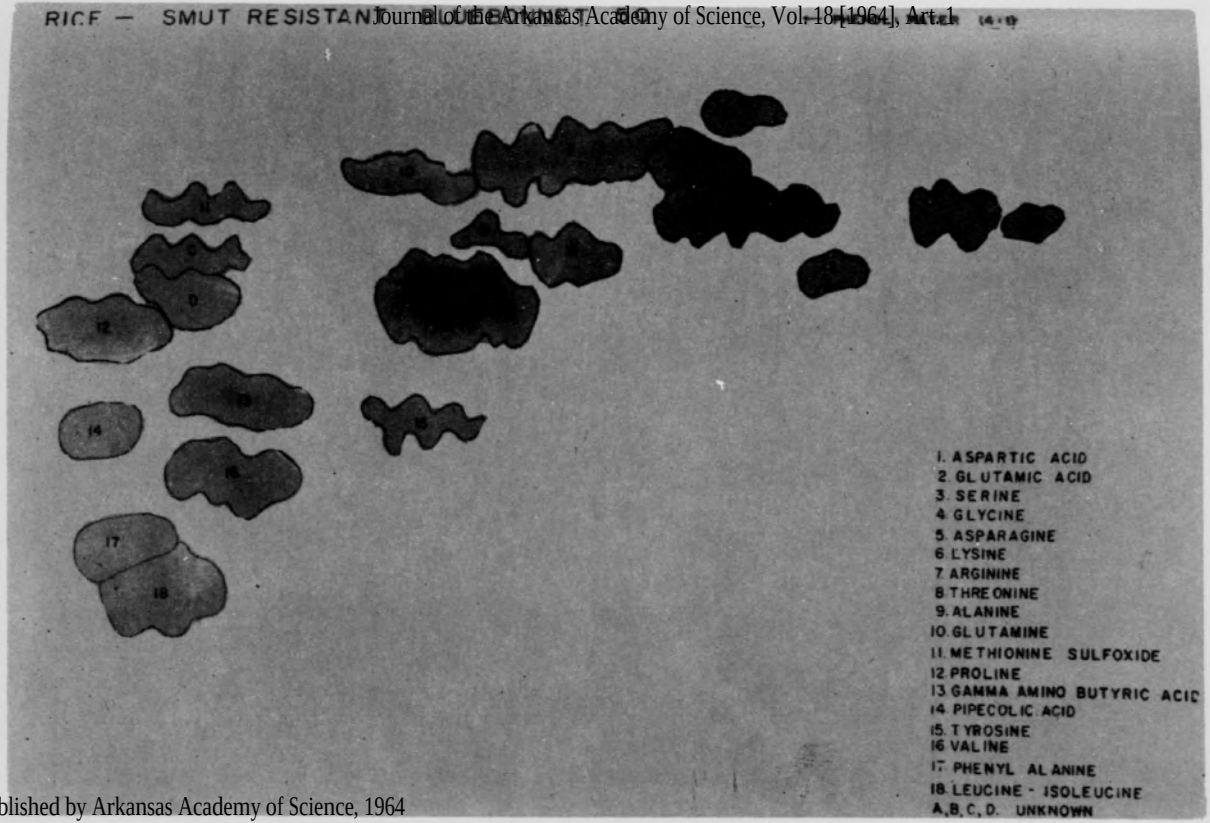
Results:

The chromatograms in Figures 1A and 1B show the relative size and density of the alanine spots from smut resistant and smut susceptible rice panicles. The concentrations of alanine extracted from the two varieties grown at high and low nitrogen fertility levels is in Table 1. The level of alanine in resistant plants was approximately double that in susceptible plants at comparable nitrogen levels. Although there was a consistent increase in alanine in both varieties with increased nitrogen fertilization, this did not prove to be satistically significant. The same results were obtained when data was analyzed with alanine levels expressed as percent of total amino nitrogen.

DISCUSSION, SUMMARY AND CONCLUSION

A suitable colorimetric method was selected for quantitative determination of alanine on paper chromatograms of amino acid mixtures. The method consisted of color development on paper with ninhydrin in an anaerobic atmosphere, elution of the spot from paper with ethanol, and reading absorbance at 570 millimicrons in a colorimeter. The method would be suitable for all amino acids separated on paper, provided that the spots were well separated and account is taken of the fact that color yield per mole for each amino acid is different. Either a standard curve for each amino acid must be made (using 440 millimicron for the yellow proline spot) or adjustment must be made using the experimentally determined color yields as reported by Moore and Stein (2).

The magnitude of the difference between alanine levels in the resistant and susceptible varieties, and the fact that several other of the amino acids in these varieties vary in concentration, suggest that it would be worthwhile to pursue quantitative determination of amino acids in other varieties of plants resistant



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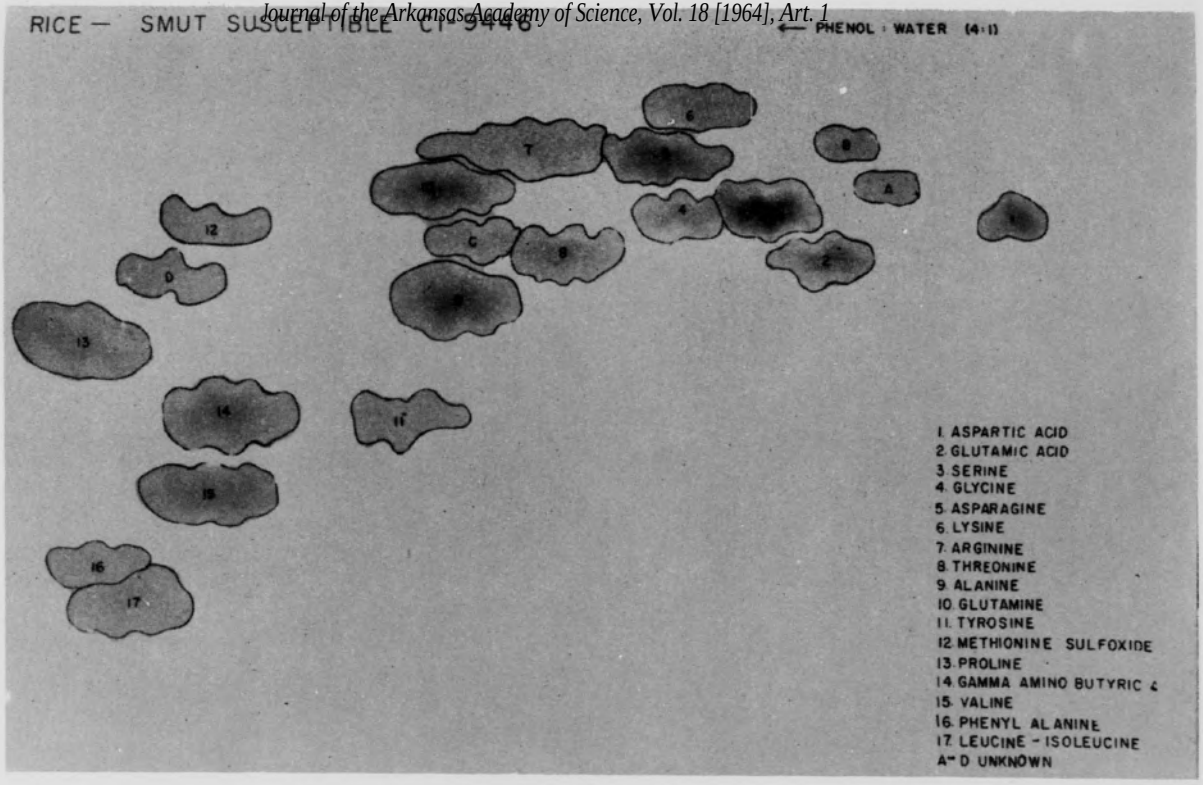
RICE — SMUT SUSCEPTIBLE CI 3446
← PHENOL : WATER (4:1)
1. ASPARTIC ACID
2. GLUTAMIC ACID
3. SERINE
4. GLYCINE
5. ASPARAGINE
6. LYSINE
7. ARGININE
8. THREONINE
9. ALANINE
10. GLUTAMINE
11. TYROSINE
12. METHIONINE SULFOXIDE
13. PROLINE
14. GAMMA AMINO BUTYRIC &
15. VALINE
16. PHENYL ALANINE
17. LEUCINE - ISOLEUCINE
A - D UNKNOWN

and susceptible to this plant pathogen. Since nitrogen fertilization apparently influenced the alanine level and since nitrogen fertilization was reported to influence severity of smut (3), the actual relationship of these factors to disease development must be studied further and under more controlled environmental conditions.

TABLE 1

Alanine in Resistant and Susceptible Rice Panicles Grown at Two Nitrogen Fertility Levels.

Variety	Nitrogen level*	Alanine in Panicles (Millimoles/Gram Dry wt.) Replications A	B	C	D	Ave
Bluebonnet 50 (Res.)	High	6.4	14.3	13.0	8.8	10.6
	Low	8.7	6.6	9.7	8.2	8.3
CI 9446 (Sus.)	High	4.1	6.0	5.3	3.8	4.8
	Low	3.1	4.5	3.0	4.2	3.7

*High—200 lbs. actual Nitrogen per acre.
Low—80 lbs. actual Nitrogen per acre.

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IDENTIFICATION OF THE FREE AMINO ACIDS OF NEMATODE RESISTANT AND SUSCEPTIBLE SOYBEANS

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INTRODUCTION

The search for a chemical basis for disease resistance has followed many patterns. Resistance to diseases caused by nematodes has been studied in relation to mechanical barriers and chemical factors. This is a part of a study in which a chemical basis for resistance to soybean cyst nematode is being sought. Analyses are being made of various chemical components of resistant and susceptible varieties at the site of penetration and at the stage of plant development at which penetration is most readily accomplished. Larvae of the soybean cyst nematode penetrate both resistant and susceptible plants but fail to develop in the resistant plant. This suggested that nutrients, such as amino acids, might be lacking in the resistant plant. The part of the study reported here involves the readily extractable, ninhydrin positive compounds of which amino acids make up the greater part.

The free amino acid pool in the roots of soybeans has been studied previously in relation to the variation with age (2). Comparisons between varieties had not been studied and no information was available on varieties resistant to soybean cyst nematode.

This study was undertaken to determine what free amino acids occur in the roots of selected soybean varieties, including varieties susceptible and resistant to the soybean cyst nematode.

MATERIALS AND METHODS

Soybean varieties and lines used in these studies were Lee, Peking. Arksoy, Harosay, Hood, B1[2], R58-82, R54-168, and P. I. 88788. All are susceptible to soybean cyst nematode except Peking, P. I. 88788, and B1; the latter is a breeding line segregating for resistance.

Plants were grown in sand in the greenhouse until the desired stage of development was attained. Samples were taken when plants were in the cotyledon, unifoliate, first or second trifoliate stages. In one test, half of the plants in the four stages of growth were inoculated with soybean cyst nematode eggs and

[1]Participant-Undergraduate Research Participation Program in Plant Pathology NSF 21692

[2]Lines B1, R58-82 and R54-168 were obtained from Dr. C. E. Caviness, soybean breeder, Agronomy Department, University of Arkansas.

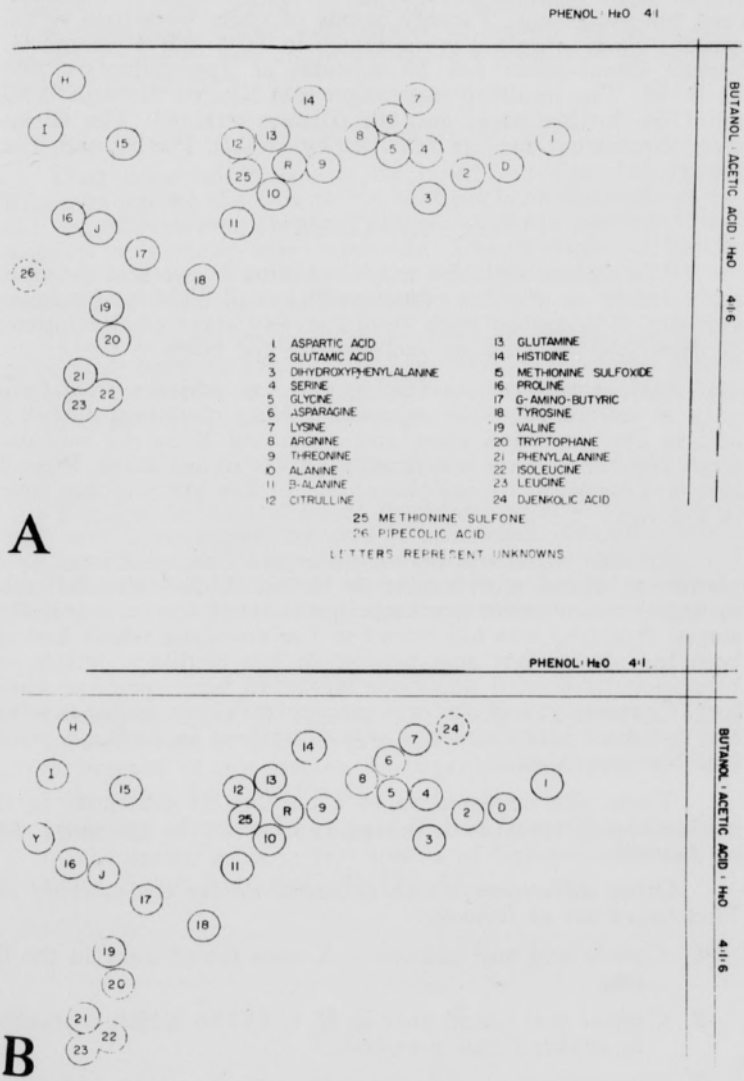

Figure 1. Representative chromatograms of amino acids from: A) Lee, and B) Peking varieties of soybeans.

larvae 48 hrs. prior to harvest for analysis. Roots were washed free of sand, wrapped in paper toweling and taken to the laboratory for processing. Twenty grams of roots were used in each sample. Each sample was macerated in 80% ethyl alcohol in a Servall Omni-mixer for 30 minutes at approximately 8000 R. P. M. The resulting suspension was filtered through Whatman No. 1 filter paper and the filtrates retained. The filtrates were chromatogramed as described by Grable, Presley and Templeton (1).

RESULTS

The chromatographic maps in Figure 1 represent the amino acids found in the Lee (susceptible) and Peking (resistant) varieties. The amino acids found at any stage of development of these two varieties are included on the maps.

Differences between Peking and Lee varieties were found only at certain stages of growth. Peking contained Djenkolic acid in the cotyledon stage and unknown Y in the unifoliate stage. Neither of these was detected in Lee in any stage. Pipecolic acid was found in the trifoliate stage of Lee but was not found in Peking.

Another difference between Lee and Peking showed up in plants inoculated with nematode larvae. This was a difference in arginine content of seedlings in the cotyledon and unifoliate stages. Arginine was not found in Lee seedlings which had not been inoculated, but was present in Lee seedlings which had been inoculated with nematode larvae 48 hours prior to sampling. Conversely, arginine was present in Peking seedlings which had not been inoculated but was not found in seedlings which had been inoculated.

There also appeared to be a buildup of glutamine in inoculated seedlings of both Peking and Lee in the unifoliate stage of growth.

Other differences which occurred among the varieties and lines tested are as follows:

1. Cysteic acid and unknown A were found only in the B1 line.
2. Cystine was found only in P. I. 88788 which is resistant to soybean cyst nematode.
3. Ethanolamine was found only in the line R54-168, a susceptible line.
4. Unknown E was found only in Anderson which is susceptible to soybean cyst but resistant to root knot nematode.

Every variety tested contained alanine, aspartic acid, asparagine, - amino butyric acid, glutamic acid, glutamine, glycine, isoleucine, leucine, serine, threonine, tryptophan, and valine. Tryptophan and valine were absent in certain stages of some varieties. Histidine and unknown H were present in all varieties and lines except R54-168.

DISCUSSION

Data obtained in this study point out some qualitative differences among the free amino acid pools of the various varieties tested. However, these differences were not correlated with resistance to soybean cyst nematode. The explanation for the variation in arginine content of Lee and Peking inoculated and non-oculated plants is not immediately evident.

There is some evidence of quantitative differences in free amino acids between Peking and Lee. Alanine is always present in higher quantities in Lee and other susceptible varieties than in Peking and P. I. 88788 which are resistant.

SUMMARY

The free amino acid pools of various soybean varieties and lines were investigated by two dimensional chromatographic methods. Comparisons were made between soybean cyst nematode resistant and susceptible varieties. No consistent qualitative differences were observed and exact quantitative measurements have not been made yet.

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ARKANSAS AVIFAUNA: SOME SIGNIFICANT FINDINGS, 1960 TO 1964

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This paper continues a practice adopted in an earlier one (James, 1960. **Ark. Acad. Sci. Proc.**, 14:8-13) by describing some of the unusual recent findings about the avifauna of Arkansas. Whenever the previous status of a bird is described without a specific citation, this background information was compiled from a general knowledge of the total ornithological literature of Arkansas supplemented by the data contained in the file of bird observations maintained at the University of Arkansas by the Arkansas Audubon Society. Information from specimens collected in Arkansas and housed at various museums also was helpful in supplying general information about Arkansas birds.

The person(s) responsible for each of the reports of birds included herein is named after each record. Catalogue numbers following specimens and photographs refer to the collections in the Department of Zoology at the University of Arkansas (UADZ). The numbers following sight records designate specific written forms submitted to document unusual sightings (AAS). These standardized forms are required by the Arkansas Audubon Society for all field findings which are extraordinary. The completed forms are kept at the University.

In addition to funds provided by the Arkansas Audubon Society, in recent years assistance in compiling the specimen and field data has come from grants to Frances C. James, who actively has maintained the bird file. These grants were provided by the Frank M. Chapman Memorial Fund of the American Museum of Natural History, and the Louis Aggassiz Fuertes Research Grant of the Wilson Ornithological Society. This help is appreciated.

Gavia stellata. Red-throated Loon. One was seen (AAS 86) at Big Maumelle Lake in Pulaski Co. on January 12, 1963 (H. N. & E. M. Halberg), which was the third record for Arkansas and the first one since 1933.

Podiceps caspicus. Eared Grebe. After being virtually unreported in the state prior to 1956 (James, **loc. cit.**) this species has been reported about every other year since. In 1961, single birds were observed at El Dorado on April 5 and on May 1 and 2 (AAS 62), and again there on August 15 (AAS 65) and November 18 to 26 (P. W. Mattocks, Jr., Hank Shugart, C. R. Amason, **et al.**). In 1963, one was photographed (UADZ 540, AAS 87) at Big Maumelle Lake on March 23 (R. S. & M.

Wilson), and another was found five miles south of Hot Springs on November 28 (H. N. & E. M. Halberg).

Fregata magnificens. Magnificent Frigate-Bird. When the forceful winds of hurricane Carla passed through Arkansas on September 13, 1961, a lone frigate-bird was seen (AAS 71) flying over Horseshoe Lake in southern Crittenden Co. (R. K. Strawn, et al.). It was the first record of this coastal bird in the state. Obviously it had been displaced by the hurricane, which had struck the Gulf Coast of Texas.

Bubulcus ibis. Cattle Egret. The long expected arrival in Arkansas of this newcomer to the Western Hemisphere finally has occurred. The first one was seen near Arkadelphia on November 15 and 17, 1962 (AAS 98; H. N. & E. M. Halberg, W. P. Scarlett, R. L. Jamison). Next, six were found at Lonoke on July 21, 1963 (W. P. & V. B. Scarlett). Later the same year three were observed near Texarkana on September 27 and 28 (Mr. and Mrs. C. L. Gardner, et al.) and another was seen near Booker in Crittenden Co. on November 10 (B. B. Coffey, Jr.).

Branta canadensis maxima. Canada Goose. A male of this large subspecies was collected on January 5, 1964, near Rosedale, Mississippi (Vaiden, 1964, **Occ. Pap. Miss. Nat. Club, v.** 1, n. 8) when it flew over from the Desha Co., Arkansas, side of the Mississippi River. This race once nested throughout the prairies of the Middle West, including Arkansas, but until recently was thought to be extinct.

Aythya marila. Greater Scaup. One seen at El Dorado on December 13, 1961 (AAS 91; P. W. Mattocks, Jr.) was the fifth record for the state.

Clangula hyemalis. Oldsquaw. Previously there were only four records of this duck in Arkansas. Recent reports of single birds were: at Lonoke on January 26 and 27, 1961 (AAS 82; H. N. & E. M. Halberg, W. P. & V. B. Scarlett); near Lake Village, December 14, 1962 (M. G. Vaiden); at El Dorado on December 28, 1963 (W. P. Mattocks, Jr.); and near Pine Bluff, February 16 to 22, 1964 (photographed, UADZ 572; H. S. & J. Stern).

Melanitta deglandi. White-winged Scoter. The first two of these ducks found in the state were caught on February 23, 1958, by commercial fish nets in De Soto Lake, Phillips Co. (M. G. Vaiden, pers. comm.). Another one was found at El Dorado on November 20, 1963, and collected on the 21st (UADZ 634; Mr. & Mrs. H. H. Shugart, T. F. Daniel, Mrs. M. Brown, et al.).

Accipiter gentilis. Goshawk. The first record since 1929, and only the third for the state, was shot by a hunter on Dec-

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ember 19, 1963, at Snow Lake. It was identified by Ben B. Coffey, Jr. (pers. comm.).

Pandion haliaetus. Osprey. The first winter record for the state was a lone bird seen at Calion on December 28, 1963 (Mr. & Mrs. W. L. Goodwin, Mrs. M. Brown).

Coturnicops noveboracensis. Yellow Rail. The recent 5th and 6th records for the state were the only winter occurrences known: one photographed at Booneville on January 5, 1963 (UADZ 432; B. W. Beall, R. M. Armstrong); and another collected in January, 1963, eight miles west of Beebe (B. Smith).

Numenius americanus. Long-billed Curlew. Other than an old record ascribed to Audubon, the reports of this species in the state, both previously unpublished, were two birds at Lonoke, October 5, 1934 (M. G. Vaiden), and more recently a single bird nine miles east of Texarkana, December 9, 1961 (AAS 90; C. L. Gardner).

Erolia melanotos. Pectoral Sandpiper. A lame bird seen at Lonoke on December 23, 1961 (AAS 95; H. N. & E. M. Halberg, W. P. & V. B. Scarlett) was the first December record of this common migrant.

Limosa fedoa. Marbled Godwit. One seen at Big Maumelle Lake in Pulaski Co., April 28, 1963 (AAS 89; R. S. & M. Wilson) was the second record for the state.

Limosa haemastica. Hudsonian Godwit. Two found five miles east of Fayetteville, May 9, 1960 (AAS 47; D. A. & F. C. James) was the second record for the state.

Himantopus mexicanus. Black-necked Stilt. One observed 18 miles northeast of Texarkana, May 9, 1960 (AAS 46; Mrs. B. S. Pagan) was the first record of this species in Arkansas.

Speotyto cunicularia. Burrowing Owl. On October 28, 1962, B. B. Coffey, Jr., discovered a population of this owl in two prairie fields near Lonoke. After that up to three birds were seen there frequently by several observers through March 3, 1963. Three were seen there again from October 6, 1963, through March 1, 1964. Previously, a band recovery was the only documentation of this species in Arkansas (Cooke, 1941. **Bird-Banding**, 12:160). The Lonoke birds were known to be new arrivals in the fields where they were found because these same fields had been investigated several times annually prior to autumn 1962.

Tyrannus verticalis. Western Kingbird. The specimen collected at Eudora on September 14, 1961 (UADZ 408; B.

Meanley) was the first occurrence of this flycatcher ever recorded in Arkansas.

Muscivora forficata. Scissor-tailed Flycatcher. This species breeds regularly in the western half of the state, but it was not found in winter until 1963, when one was seen 18 miles west of El Dorado on January 15 (AAS 101; Mrs. M. Brown), and another was found in southern Hot Spring Co., about 10 miles northeast of Arkadelphia, on February 9 (AAS 102; E. G. Williams).

Salpinctes obsoletus. Rock Wren. One seen March 10 and April 9, 1961, on the rip rap rocks of Cove Lake dam nine miles southeast of Paris (AAS 58; R. M. LaVal, B. W. Beall, W. J. Stewart) was the second record for the state.

Dumetella carolinensis. Catbird. There have been several winter records of this bird recently, a species which previously was not known to overwinter. Single birds were recorded at Texarkana on December 26, 1960 (AAS 77; D. W. Woodard), at El Dorado on several dates in December and January in 1961 and 1963, and from late January to late February, 1963, at Clarksville (I. T. Beach, T. B. & J. O. Wilson).

Myadestes townsendi. Townsend's Solitaire. One found on December 8, 1963 (AAS 109; D. A. James, **et al.**), and seen subsequently on five dates through January 4, 1964, was the first Arkansas record of this species.

Bombycilla garrula. Bohemian Waxwing. Previously there were only two Arkansas records, and none since 1947. One was seen at Clarksville on January 27, 1960 (AAS 42; I. T. Beach), and another was seen in Little Rock on March 16, 1962 (AAS 97; E. M. Halberg).

Dendroica caerulescens. Black-throated Blue Warbler. Only three records were known before 1960 when one was seen at El Dorado on May 17 (Hank Shugart), and a male and female were seen there on May 22 (AAS 55; Hank Shugart).

Xanthocephalus xanthocephalus. Yellow-headed Blackbird. The fifth and sixth state records were: one at Geridge, October 15, 1961 (AAS 72; B. W. Beall, T. H. Johnston, **et al.**); another near Fayetteville, January 2, 1962 (L. Kimbrough).

Icterus bullockii. Bullock's Oriole. A male was photographed during one of its visits to a feeding tray in El Dorado between February 13 and March 16, 1963 (UADZ 635, T. F. Daniel). The only other times this species has been found in the state was late April, 1937, and early September, 1938 (Lincoln, **Auk**, 64: 318-320).

Piranga rubra. Summer Tanager. This breeding bird was

not known to overwinter until one was photographed at Texarkana during its visits to a feeding tray from December 29, 1960, to February 15, 1961 (UADZ 418 & AAS 81; G. Hoffman, Mr. & Mrs. C. L. Gardner), and another was seen at a feeding tray in Fort Smith, January 3 to February 4, 1961 (AAS 80; B. W. Beall, R. M. Armstrong).

Hesperiphona vespertina. Evening Grosbeak. The first recorded statewide invasion performed by this finch occurred in winter 1961-1962. Grosbeaks were seen in 27 cities covering all parts of the state. The first ones were found on December 20, and some were seen as late as May 13. In winter 1963-1964 there was a smaller invasion which began on November 2, and was confined to eight localities in the northern half of the state. The only previous recorded occurrence of Evening Grosbeaks was a group of three birds in Rogers in 1942.

Loxia curvirostra. Red Crossbill. There were four reports of this finch prior to 1935, but none since then until two were seen at Texarkana on September 10, 1963 (AAS 105; Mrs. C. L. Gardner, Mr. & Mrs. Lee Homan, et al.), and 12 were recorded near Rudy, Crawford Co., on November 30, 1963 (B. B. Coffey, Jr., B. W. Beall, et al.).

Junco hyemalis. Slate-colored Junco. The first summer record of this winter resident was reported on June 2, 1961 (AAS 64; W. P. Mattocks, Jr.).

Junco caniceps. Gray-headed Junco. One was photographed at Little Rock during the period it was observed there from February 22 to March 2, 1963 (UADZ 542; E. M. Halberg, W. P. & V. B. Scarlett). This was a new bird for Arkansas.

Spizella pallida. Clay-colored Sparrow. The third record for the state and the first for southern Arkansas was collected at Calion, September 11, 1960 (UADZ 383; Hank Shugart; W. P. Mattocks, Jr.).

Zonotrichia albicollis. White-throated Sparrow. The first prolonged summer records of this winter resident occurred in 1963, when one was noted at Clarksville from June 1 to August 5 (I. T. Beach, T. B. & J. O. Wilson), and another one was seen at Pine Bluff from June 12 to September 25 (AAS 104; G. Hoffman, J. Stern, Mrs. J. Miller). An earlier isolated summer record was recorded on June 2, 1960 (AAS 50; W. P. Mattocks, Jr.).

DICALCIUM SILICATE (BROWN MUD) AS AN AGRICULTURAL LIMING MATERIAL[1]

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Bauxite, Arkansas

INTRODUCTION

"Brown Mud" (sometimes called Brown Lime) is a waste by-product of the alumina industry. The processes involved in aluminum production consist of first digesting bauxite ore with caustic soda (Bayer Process) to extract alumina that is present in bauxite as gibbsite ($Al_2O_3 \cdot 3H_2O$). Also prevalent in Arkansas bauxite is aluminum silicate that is not attacked by the Bayer Process. During the Bayer digestion a desilication product, identified in equation 1 below, is formed. This desilication product and aluminum silicate, collectively called "red mud", are separated from the soluble sodium aluminate solution by settling. The red mud is then treated through the Sinter Process, which involves the addition of limestone, soda ash, and red mud in the necessary proportions to form dicalcium silicate and soluble sodium aluminate. This three-component mixture is ground and mixed in ball mills and fed through kilns where thermal reactions take place. The soluble sodium aluminate is removed by leaching and the insoluble dicalcium silicate is filtered, repugged and pumped to a waste lake. This insoluble "brown mud" has as its main constituent dicalcium silicate, with lesser quantities of iron, aluminum, titanium and sodium oxides; its calcium carbonate equivalent varies from approximately 80 to 90 (pure calcium carbonate—100).

Chemical reactions involved during Sinter Processing are:

$$3Na_2O \cdot 3Al_2O_3 \cdot 5SiO_2 \cdot 5H_2O \text{ plus } 10CoCO_3 \xrightarrow{\text{Approx. } 2400^\circ F} 3Na_2Al_2O_4 \text{ plus } 5Ca_2SiO_4 \text{ plus } 10CO_2 \text{ plus } 5H_2O. \quad (1)$$

$$2Al_2O_3 \cdot 3SiO_2 \text{ plus } 6CaCO_3 \text{ plus } 2Na_2CO_3 \xrightarrow{\text{Approx. } 2400^\circ F} 2Na_2Al_2O_4 \text{ plus } 3Ca_2SiO_4 \text{ plus } 8CO_2. \quad (2)$$

During the last several years an estimated 450,000 tons of brown mud have been produced in Arkansas annually. When this production is compared with Arkansas' annual limestone use of 440,000 tons (in 1962), and with an estimated annual maintenance need of 700,000 to 800,000 tons, it is immediately apparent that brown mud has a tremendous potential value as an agricultural liming material in this state.

[1]Approved by the director of the Arkansas Agricultural Experiment Station.

When dicalcium silicate is added to an acid soil it undergoes the following reactions which result in the neutralization of soil acidity:

$$Ca_2SiO_4 \longrightarrow 2CaO \text{ plus } SiO_2 \quad (3)$$

$$CaO \text{ plus } H_2O \longrightarrow Ca(OH)_2 \quad (4)$$

$$2Ca(OH)_2 \text{ plus } AlH \text{ (soil)} \quad Ca_2 \text{ (soil) plus } H_2O \text{ plus } Al(OH)_3 \quad (5)$$

Whittaker et al. (5), and others (2), have grown and analyzed plants in a greenhouse experiment, using brown mud as an amendment. Volk, Harding and Evans (3), and others (1,4) have reported on the value of the steel industry's blast furnace slag as an agricultural liming material.

The factors that have kept brown mud from having a more immediate value as a soil amendment are:

(a) The alumina industry's main purpose was to produce alumina; in the past they have tended to disregard the value of their waste products.

(b) Technological changes had to be made for further treatment of brown mud before it could be effectively utilized as a soil amendment.

(c) The alumina industries, and hence the suppliers of brown mud, are not decentralized through the agricultural region of Arkansas.

MATERIALS AND METHODS

In the spring of 1963 an experiment was established on an acid Taloka-Parsons-Johnsburg silt loam complex on the University of Arkansas Main Agricultural Experiment Station Agronomy Farm, at Fayetteville, to evaluate brown mud as a liming material. Dolomitic limestone and brown mud were applied and disked into the soil in late March; the experimental design was a randomized block with 5 replications. Hood variety soybeans were seeded on June 6 in the experimental area, but a serious drought negated the yield values. On August 6, eight composite soil cores, to a depth of 6 inches, were taken from each individual plot. The soil samples were dried, crushed, and analyzed for pH and exchangeable cations.

RESULTS AND DISCUSSION

The analysis of brown mud may vary within rather narrow limits from batch to batch. The data in Table 1 encompass the outside limits of most samples of brown mud.

Table 2 gives the quantities of Ca, Mg, and Na applied to the soil as calculated from the analysis of the materials and the rates applied. Table 3 gives the results of the analysis of the ex-

perimental plots five months after the amendments were applied. Because of the nature of field experiments such as this, it would be impossible to quantitatively account for, in Table 3, all the material that was applied as given in Table 2.

A study of the data in Table 3, and a comparison of the data in Tables 2 and 3, will show that the brown mud com-

TABLE 1

Chemical composition of brown mud

Oxide	low	high	typical	Element	typical
CaO	45%	52%	48.5%	Mg	.X-X
SiO_2	24	27	25.5	Mn	.X
Fe_2O_3	6	12	9	S	.X
Al_2O_3	4	6	5	K	.OX
TiO_2	3	5	4	P	.OX
Na_2O	2.5	3.5	3	Li	.OX
				Ga	.OX
				B	.OX-.OOX
$CaCO_3$ equivalent	80	93	86.5	Zn	.OOX-.OOOX
Lost on ignition	2.5	6.0	4.2	Mo	.OOOX
				Others	.OOOX or less each

TABLE 2

Pounds per acre of calcium, magnesium and sodium applied

Treatment	Ca	Mg	Na
1 ton dol. limestone[1]	464	217	0
1 ton brown mud	637	-	40
2 tons brown mud	1274	-	80
4 tons brown mud	2548	-	160

[1]The calcium equivalent of Ca plus Mg in this ton of dolomitic limestone is 826 pounds.

TABLE 3

Effect of dolomitic limestone and brown mud applied in March on the analysis of the soil five months later

			lb/acre of exchangeable		
Treatment	pHw[1]	pHs[2]	Ca	Mg	Na
Check	4.9	4.3	1550	65	160
1 ton dol. lime	5.1	4.7	1710	130	190
1 ton brown mud	5.3	4.8	2030	80	185
2 tons brown mud	5.9	5.6	2430	55	245
4 tons brown mud	6.2	5.9	2650	50	270

[1]pHw is soil pH in a 1:1 soil-water mixture.
[2]pHs is salt pH in a 1 : 1 soil - 0.01 M $CaCl_2$ mixture.

pares very favorably with the limestone. The calcium carbonate

equivalent of the limestone was 103 while that of the brown mud was 80. Yet the brown mud was more effective in decreasing the soil acidity (increasing pH) and in increasing the exchangeable calcium content of the soil than an equivalent tonnage of the limestone. The greater effectiveness of the brown mud can be attributed to the smaller particle size and the increased surface area.

Some of the trace elements in the brown mud could have an extra value for certain crops on some soils; specifically, there may be sufficient Mo, S, Zn, and B present to be a nutritional aid to plants. However, since blanket applications of trace element mixtures are not generally recommended, brown mud should be evaluated on the basis of its liming value only.

It will be noted that brown mud contains more sodium than is contained in agricultural limestone. However, the quantity of sodium applied in an application of brown mud is not high; it is similar to the quantity of sodium applied in normal applications of sodium nitrate fertilizer.

Unreported greenhouse tests by the senior author are in agreement with the field work reported here and have shown that brown mud increased soybean yields when used on an acid soil.

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THE PROBLEM OF HYBRIDIZATION OF THE RED CAVE SALAMANDER, EURYCEA LUCIFUGA (RAF), AND THE LONG-TAILED SALAMANDER, EURYCEA LONGICAUDA MELANOPLEURA (Green)

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During the past six years the author has studied the zones of intergradation of the subspecies of Eurycea **longicauda**, the long-tailed salamander. It was found that although E. **lucifuga**, the red cave salamander, is almost always associated with the subspecies of E. **longicauda**, interbreeding seems to occur very rarely. Mittleman, (**Proc. New Eng. Zool Club**, 21:104-105) reports intergrades of E. **lucifuga** and E. l. **longicauda** from the Cumberland Plateau of Tennessee and Kentucky.

In central and western Tennessee the author found the red cave salamander to be associated with another subspecies of E. **longicauda** - namely E. l. **guttolineata**. This form and the red cave salamander are found together around springs in central and western Tennessee. In Union County, Illinois, the red cave salamander is associated with E. l. **longicauda**. The intergrades involving the above forms are discussed in another paper to be published in the future.

In this paper I am concerned with the problem of hybridization between E. **lucifuga** and E. l. **melanopleura**, both of which are common around springs and in the twilight zones of caves in Northwestern Arkansas, South Central Missouri, and Eastern Oklahoma. Both forms migrate far into caves and lay their eggs in the water of drip pools on the floors of caves. The larvae follow trickles of water out of the caves and larval life is spent on the outside where food is available. On metamorphosing and attaining sexual maturity they again penetrate caves to reproduce.

Over 400 specimens, 200 or more of each species, were collected in Foshee Cave, five miles west of Locust Grove in Independence County, Arkansas. These collections were made monthly throughout 1958 and 1959, and at irregular intervals since then. All specimens, excepting a few used for dissection or given to other herpetologists, were preserved in 60% isopropyl alcohol and stored in the Museum of Biology at Arkansas College in Batesville, Ark.

Although in 1958 and 1959 none of the hybrids collected seemed to be first-generation hybrids, in March, 1960, and October, 1960, hybrids were collected from Foshee Cave which appeared to be F_1 hybrids. In October, 1962, additional F_1 hybrids were collected from Foshee Cave. The female hybrids were tight with eggs. Some of these females and adult males of

melanopleura were placed in a refrigerated aquarium. All were lost subsequently when someone decided to defrost the refrigerator, but excellent color photos of these hybrids are in the hands of the author.

Among the more than 200 specimens of **melanopleura** from Foshee Cave, 7.7% showed some degree of hybridization or genetic influence of **lucifuga**, yet none of the 200 specimens of **lucifuga** collected at about the same time from the same cave showed any evidence of genes from another species. Since hybridization of these species is apparently rare, an effective isolating mechanism must be in operation. It seems likely that the breeding season must be involved in this isolation because a study of the ovarian cycles of both species showed that they had different breeding seasons. **Lucifuga** has a summer breeding season, with all egg laying completed by the end of August, whereas **melanopleura** is an autumn breeder, starting in September and finishing in November.

As soon as females of either species have finished egg laying they leave the cave to seek food outside where they remain until swollen with developing eggs for the next breeding season. They re-enter the cave while the eggs are still relatively immature but remain in the front of the cave in the twilight zone where they probably can obtain aquatic isopods and amphipods for food. As the exhausted females of **lucifuga** leave the cave, egg laden females of **melanopleura** are migrating into the cave.

Males of **lucifuga** apparently enter the cave in greater number than is required as the data shows that males are still present after all females are gone from the cave. Since the males of **lucifuga** remain in the cave much longer than the laying season, they are still there when the first **melanopeura** arrive for egg laying (Table 1). On the other hand, all male **melanopleura** have left the breeding area before the first egg laden **lucifuga** arrive (with mature eggs). Therefore, hybridization would have to involve male **lucifuga** and female **melanopleura**.

The question of the fate of the hybrids was partially answered by the finding of first-generation hybrids in October, 1962, packed with eggs and entering the cave along with dozens of egg laden **melanopleura**. As pointed out earlier, remote hybrids make up a large percentage (7.7%) of the population of **melanopleura** in this cave. The individuals apparently breed with the rest of the species.

It is clear that hybridization has been introgressive as far as **melanopleura** is concerned. It might be supposed that breeding back with **lucifuga** would be likely to occur, but measurements and color pattern do not indicate its occurrence.

That backcrossing and breeding with the melano-

pleura population, it was assumed that they were aberrant specimens of **lucifuga**, since the head and coloration suggested that species. The general color of recent hybrids is silver gray with some red on the dorsal part of the tail; the pattern of **melanopleura** is not evident. More remote hybrids have the pattern of **melanopleura**, but indistinctly so.

Thus, in this one location (Foshee Cave), hybridization occurs between **E. lucifuga** and **E. l. melanopleura**. In most areas the distinct breeding seasons are sufficient to serve as a barrier between the species. It is the lingering of the male **lucifuga** in the breeding area of the **melanopleura** that makes hybridization possible. Why this lingering? It is possible that the cave temperature in the breeding area is a little colder than in other places. The writer and his students have noted many times that this cave seems colder than other caves. Metabolic activities may be retarded, enabling the males to delay their return to the outside.

Since interbreeding does not occur regularly and the species are sympatric, it would not seem wise to regard **E. lucifuga** and **E. l. melanopleura** as conspecific but only as two species that can hybridize under certain conditions.

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TABLE 1

Monthly Time Table of Reproductive Condition in Female Salamanders Collected in the Twilight Zone of Foshee Cave. (N) is the number of specimens collected.

	E. lucifuga	E. l. melanopleura	Total Specimens (Both Species & Sexes)
January	No specimens	No specimens	
February	Eggs medium to small (2) Males (5)	No specimens	7
March	Eggs medium size (8) Males (7)	1 hybrid tight with eggs, balance no eggs (12) inc. males	21
April	Eggs medium size (6) Males (12)	No discernible eggs in body cavity (10)	22
May	Eggs large (15) Males (15)	Very small eggs (12) present Males (0)	42
June	6 packed with eggs 7 exhausted Males (20)	Eggs small (10) Males (0)	43
July	Females tight with eggs (9) Males (9)	Eggs small (7) Males (0)	25
August	A few packed with eggs (3) others exhausted (7) Males (8)	Eggs small (8) Males (3)	29
September	Males only (12)	Eggs medium (14) to large Males (17)	43
October	Males only (10)	Eggs large (12), 1 exhausted female - Males (10)	33
November	Males only (6)	Females tight with eggs (7) Females exhausted (7) Males (12)	32
December	Males only (5)	Males only (10)	15

DIMENSION STONE IN ARKANSAS

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Abstract

Arkansas has several types of natural stone that are used for structural purposes. Sandstone, marble or limestone and occasionally, slate, are produced commercially. Nepheline syenite (granite), dolomite, quartz crystals, onyx, bauxite and cobble stones have been used locally in limited amounts.

Good grade dimension sandstone in colors ranging from brown to light gray and pink, is found in the Hartshorne Sandstone in the central and western part of the Arkansas Valley, and in the Batesville Sandstone near Batesville.

Marble of attractive color variations is quarried and shaped in Independence County near Batesville and in Izard County near Guion. Some production has been recorded in Newton County near Marble Falls.

Slate of commercial grade occurs in Polk County near Big Fork. Predominating colors in the quarries are black and gray, but reds and greens are also found.

A NEW LENTIL IN UPPER FAYETTEVILLE FORMATION

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In the shale above the Wedington Sandstone Member of the Fayetteville Formation and below the Pitkin Formation is a fossiliferous limestone which has been reported (Croneis, 1930, p. 68) in many places in northwestern Arkansas but has not been named and described. A similar fossiliferous limestone of the Fayetteville Formation west of Fort Gibson in Oklahoma was mentioned by Huffman (1958, p. 23[1]); whether or not it is the same as that of Arkansas has not been determined. Because of an abundance of fossils and distinctive rock type, the limestone is capable of becoming useful as a reference horizon. This usefulness requires that the unit be named and it may therefore be called the Koger Limestone Lentil of the Fayetteville Formation. The type locality of the Koger Limestone Lentil is two miles northwest of Elkins, Washington County, Arkansas and 2 miles east of Koger Branch near the center of the north boundary of sec. 3, T. 15 N., R. 29 W. Here the limestone is exposed in a stream bed and is approximately 12 inches thick. It lies 40 feet above the Wedington Member of the Fayetteville Formation and approximately 50 feet below the base of the Pitkin Formation. The name is derived from the nearest named geographical feature, Koger Branch of Middle Fork of White River.

The Koger limestone crops out in many places in the eastern Washington County and western Madison County, Arkansas. In places where the limestone is covered by colluvium, its presence is recognizable in surface fragments.

Besides the type locality, a reference section of the Koger limestone occurs on South Mountain (-Baxter Mountain), south of Fayetteville, Arkansas in NE¼ sec. 28, T. 16 N., R. 30 W. on Country Club road. Along the Frisco Railroad tracks in Fayetteville, Arkansas near Bench Mark 1333 is an exposure which crops out in the drainage ditch. A number of large fragments rest nearby. Here cephalopods were collected in 1961 by Jeff Honderich, a student of the University of Arkansas. The goniatites are **Eumorphoceras plummeri** Miller and Youngquist (1948), **Paracravenoceras ozarkense** Gordon (1960) **Cravenoceras hesperium** Miller and Furnish (1940), and **Tumulitesvarians** McCaleb, Quinn and Furnish (1964). These fossils have not been found above the Fayetteville Formation. A coiled nautiloid, **Stroboceras** Hyatt (1884), was collected at the same place. The catalogue number of these fossils is (L-87-RR), Geology Department, University of Arkansas. Another coiled nautiloid,

Tylonautilus Pringle and Jackson (1928), some gastropods, and trilobite pygidia (L-88-BM) were collected from the limestone on South Mountain. Miller and Furnish (1955, p. 462) reported a large **Tylonautilus** from the Fayetteville Formation at Braggs Mountain in northeastern Oklahoma. Girty (1909, p. 50 & 86) described under the name **Coelonautilus gratiosus** two immature specimens of **Tylonautilus** from the Caney shale of the Arbuckle region in southern Oklahoma. **Tylonautilus** is a guide fossil to the **Eumorphoceras** Zone in England, but in Arkansas it ranges from the Moorefield Formation through beds equivalent in part to the Pitkin Formation. Fossils including brachiopods, some gastropods and numerous trilobite cephala and pygidia referable to **Kaskia** were collected at the type locality northwest of Elkins, Arkansas. **Archimedes**, a bryozoan, is also present in the limestone at the three places mentioned.

The Koger limestone lentil is marine, dark-gray, hard, dense, finely crystalline, and fossiliferous. The lentil is six to fourteen inches thick. The surface of the limestone varies from yellow-brown to red-brown depending on the degree of weathering.

With exception of the trilobites, the fauna of the Koger limestone also occurs in the lower portion of the Fayetteville Formation. Croneis (1930, p. 69) stated that the Fayetteville Formation is Chesterian but its faunal assemblage differs from those typical of Chester age.

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THE POLITICAL PHILOSOPHY OF SUPREME COURT JUSTICE DAVID J. BREWER

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David J. Brewer was born June 20, 1837, in Asia Minor, of missionary parents who returned to America the next year. Brewer later went to Wesleyan University and graduated from Yale with honors in 1856. His father was also a Yale graduate. The young man then studied law in the office of an uncle for a year. He next spent a year at the Albany Law School, graduating in 1858, and was admitted to the New York bar.[1] He spent a few months that fall in Kansas before going out to the Denver region. In June, 1859, he returned to eastern Kansas and settled at Leavenworth, his home until 1890.[2] The uncle under whom he had studied law was David Dudley Field, who was the father of the reformed penal and civil procedural codes in New York; Field also ran afoul of charges of professional misconduct in acting as counsel for Jay Gould and James Fisk in the Erie Railroad affairs in 1869.[3] He was a brother of Cyrus West Field, the businessman of Atlantic Cable fame.[4] All of this meant, no doubt, that the young Brewer was fully aware of the views of businessmen of this time.

Brewer was appointed United States Commissioner in 1861 and was elected judge of the probate and criminal court of Leavenworth County the next year. His election to the judgeship of the first judicial district of Kansas followed in 1864. He was city attorney of Leavenworth, 1869-1870, after leaving the office of district judge. He had been a member of the local school board and president of it, and, for a while, was superintendent of schools in Leavenworth. In 1868 he was the president of the Kansas State Teachers Association. In 1870, at the age of 33, he was elected to the Kansas State Supreme Court and was re-elected twice. After fourteen years there, he was elevated by President Arthur to the Federal Circuit Court for the Eighth Circuit.[5]

Then in 1889 Brewer was named to the United States Supreme Court by President Harrison. Here he was a colleague of his uncle, Justice Stephen J. Field, until 1898. Stephen J. Field was a brother of Brewer's mother as well as a brother of

[1]Allen Johnson and Dumas Malone, eds. Dictionary of American Biography (21 columes, New York: Scribner's, 1928-1937), III, 22.
[2]Ibid.; Hampton Carson, The Supreme Court of the United States: Its History . . . (two parts, Philadelphia: John Y. Huber Co., 1891), II, 538.
[3]DAB, IV, 359-360.
[4]DAB, VI, 357-359.
[5]Carson, op. cit.; DAB, III, 22.

the man under whom Brewer had read law. Field also had visited Turkey as a boy with the parental Brewer family. Another Justice, Henry B. Brown, was a classmate of Brewer at Yale. It is thought that Field tried to lead the new justice, who had a similar political, economic, and legal philosophy, but Brewer refused to follow blindly.[6] However, as one would expect from their similar views, it appears that as time went along he came more nearly to reflect his uncle. While on the Supreme Court bench, Brewer wrote the court opinion in 526 cases, "70 of which involved constitutional problems." In 215 cases, Brewer dissented, writing a separate opinion in 53 of them. Brewer concurred 38 times, and wrote 8 separate concurring opinions.[7] By the time of his death in March, 1910, Brewer ranked third in length of service on the Supreme Court. Justice Harlan outranked him by a dozen years. Incidentally, Harlan was the boon companion of Brewer.[8]

One editorial writer wrote after the death of Justice Brewer that, "Politically, Justice Brewer was a strict constructionist of the Constitution, so far as affected the reserved rights of the States. He feared the increased centralization of power in the hands of the President and Congress."[9] Brewer had been hailed as a "much better states-rights man than his Southern Democratic colleague" when he joined the nation's highest court. This was judged from his decisions as Federal circuit judge. The South was pleased with Brewer's appointment according to the same writer.[10]

Brewer delivered the opinion of the court in Keller v. U. S., 213 U. S. 138. Here, the Federal government was trying to punish the plaintiffs for harboring an alien in a house of prostitution as a violation of federal law regarding immigration of aliens into the United States. Brewer was opposed to allowing the national government a control over aliens that would come under police power, fearing the case might allow Congress to invade state control even more. "We should never forget," wrote Brewer, "the declaration in Texas v. White, ... that 'the Constitution, in all its provisions, looks to an indestructible union, composed of indestructible states'." He also warned that exaggeration of Federal powers and restriction of state power will "tend to substitute one consolidated government for the

[6]DAB, III, 22; Carl Brent Swisher, Stephens J. Fields, Craftsman of the Law (Washington; Brooking Institution, 1930), 438.

[7]DAB, III, 24.

[8]New York Tribune, March 29, 1910, 1 (col. 4).

[9]"The Death of Justice Brewer" (editorial), The Independent, LXVIII (1910), 774.

[10]"The Supreme Court" (editorial), The Nation XLIX (1889), 490.

present Federal system."[11] However, was this protection of an individual stirred by ideas of protection of property rights?

He supported the Federal government against South Carolina's attempt to stop payment of national liquor taxes on liquor sold by the state of South Carolina. That state had state dispensaries with a legal monopoly of wholesale and retail liquor. These had federal permits and had paid federal taxes until April 1901, when South Carolina protested the payment without making any request for a refund of previous payments. Dispensers had no interest nor profits in sales: profits went to the town and county with half going to the state treasury. The federal government had issued 371 stamps in 1901 with only 112 going to the state, and 260 to individuals who had no right to sell liquor. Brewer gave the opinion in South Carolina v. U. S., 199 U. S. 437. Brewer admitted that the federal government could not hinder a state in its governmental function by taxation. However, he felt that if the state engaged in a business that is "of a private nature, that business is not withdrawn from the taxing power of the nation." He noted that South Carolina had a profit of over a half-million dollars from its liquor monopoly in 1901. He feared this profit might cause South Carolina to take over trade in tobacco, oleomargarine, etc. Then other states would follow, delivering a body blow to federal revenue tax collections. He feared that those wanting public ownership of public utilities, including the railroads, would gain by action like that of South Carolina. "Would the State," he asked, "by taking into possession these public utilities lose its republican form of government?" He pointed out that some people even wanted to take over and to manage all business.[12] Interestingly enough, the Justice had been in favor of transportation systems being owned and operated by the government just as was the postoffice.[13]

Justice Brewer was concerned with the centralization of authority in Washington, but he was careful to preserve the national government. A newspaper writer commented that the late Justice Brewer made the greatest impression as a U. S. Supreme Court Justice in helping to bring interstate commerce more directly under national control by interpretation of antitrust and interstate commerce laws. At the same time he tried to preserve the powers of the states that were not "effectively exercised by them."[14] He was not a strict constructionist for he upheld the power of a federal court to issue and enforce an in-

[11]Keller v. U. S., 213 U. S. 138, 139; 143; 148; 149.
[12]South Carolina v. U. S., 199 U. S. 437, 438; 447; 454; 463.
[13]Topeka State Journal, Sept. 6, 1897.
[14]"David J. Brewer" (editorial), New York Tribune, March 30, 1910, p. 6, col. 3.

junction in a labor dispute.[15] But again is this a sense of property rights? He wrote this decision with no regard for a lack of a jury trial or a lack of Congressional legislation to protect such stoppage of interstate commerce.

Brewer on the Kansas Supreme Court had argued that the bill of rights clause in the Kansas Constitution for equal and inalienable natural rights and the statement that all political power is inherent in the people were limitations on legislative grant of power; therefore, legislative action in giving counties the right to issue railroad aid bonds was void in Brewer's opinion.[16] Brewer held that a federal law prohibiting importation and migration of aliens under contract to labor in the United States did not apply to a church in contracting for a British minister to come to New York to be its pastor. Brewer, in the U. S. Supreme Court opinion, held that Congress in the law covering the case had used general terms to prevent loopholes. But he believed this case involving a church was not meant by Congress to be included; therefore, the Supreme Court refused to apply the law to this church in New York. Brewer argued that this was not the substitution of the will of the judge for that of the legislator.[17] No doubt he was right in ruling that Congress only wanted to prohibit the importation of manual laborers. But Brewer did not rest here. Was it the son of a missionary speaking when he wrote that, "But beyond all these matters no purpose of action against religion can be imputed to any legislation, state or national, because this is a religious people."[18] He listed all sorts of religious establishment from the colonial beginnings including the Delaware test oath. This pious view becomes important even if mere dictum.

Brewer wrote in Budd v. New York that:

> The paternal theory of government is to me odious. The utmost possible liberty to the individual, and the fullest possible protection to him and his property, is both the limitation and duty of government. If it may regulate the price of one service, which is not a public service, or the compensation for the use of one kind of property which is not devoted to a public use, why may it not with equal reason regulate the price of all service, and the compensation to be paid for the use of all property? and if so 'Looking Backward' is nearer than a dream.[19]

He felt that the police power may not be used to limit labor hours if the work was "as free from all risk as any ordinary

[15]In Re Debs, 158 U. S. 564, 577; 599-600.
[16]W. F. Dodd, "The Function of a State Constitution," Political Science Quarterly, XXX (1915), 207; State ex. rel. St. Joseph & Denver City R. Co. v. Commissioners of Nemaha Co., 7 Kans. 335 (Dassler).
[17]Church of the Holy Trinity v. U. S., 143 U. S. 457, 457; 459; 472.
[18]Ibid., 465.
[19]Budd v. New York, 143 U. S. 517, 551.

employment."[20] Prohibiting one from using his property by a prohibition of liquor was taking property without compensation in Brewer's views. It was the power to use the property and not mere title that gave the owner value in the property. The legislative power did not cover this lowering of the value of property without compensation; the Fourteenth Amendment prevented the states from doing this. Denial of the use of property must be compensated. His views as a circuit judge were to be over-ruled by the United States Supreme Court in another case.[21] Railroad rates that did not pay the cost of service were not enforceable in the power of the states.[22] The fact that the owners of a business had made it a big one did not give the government more control over it according to Brewer. The public control over a business was not dependent upon the extent to which the public was benefited by the business.[23]

Brewer, who upheld the Kansas prohibition amendment and laws (unanimous court decisions), was opposed to prohibition. "And I have yet to be convinced," he wrote, "that the legislature had the power to prescribe what a citizen shall eat or drink or what medicines he shall take or prevent him from growing or manufacturing that what his judgment approves for his own use as food, drink, or medicine."[24] Brewer dissented from the majority of the Supreme Court and supported a Massachusetts man who refused to be vaccinated for smallpox as required by Massachusetts law, claiming protection of the Fourteenth Amendment for his rights. The man claimed that he had suffered a reaction from a previous vaccination.[25]

What Brewer considered arbitrary denial of personal rights was condemned by the dissenting justice in three cases involving Chinese who had run afoul of Federal immigration authorities. In **Fong Yue Ting v. U. S.**, 149 U. S. 689, Brewer protested that it was not due process to punish one for not having a certificate in his possession when one can get it only by arbitrary and unregulated discretion of any official. He did not think that it was just to take an alien without a certificate before any federal judge without limitation and without provisions for

[20]Ibid., 550; David J. Brewer, "The Legitimate Exercise of the Police Power in the Protection of Health," Charities and the Commons, XXI (1908), 238; 239; 240.

[21]State v. Walruff, 26 Fed. 178, 194; 196; 197; Kansas v. Peter Mugler, 29 Kans. 181 (Dassler), 194.

[22]C. & N. W. Ry. Co. v. Dey, 35 Fed. 866, 880; Chicago, St. P., M. & O. Ry. Co. v. Becker, et. al. 35 Fed. 883, 885; 886.

[23]Budd v. New York, 143 U. S. 517, 550.

[24]Kansas v. Peter Mugler, 29 Kans. 181 (Dassler), 194; Prohibitory Amendment Cases, 24 Kans. 499, 503, 516; Intoxicating Liquor Cases, 25 Kans. 524 (Randolph), 529; 536.

[25]Jacobson v. Massachusetts, 197 U. S. 11, 12; 13; 14; 17; 39.

his getting the white witness he had to have at least to prove his innocence or to be punished by banishment. He feared that this technique as then applied against the widely disliked Chinese might be used later against other classes of people. Also he questioned if it were in line with the principles of Christianity.[26]

In **U. S. v. Sing Tuck**, 194 U. S. 161, Brewer claimed that the Chinese detained when entering the United States from China by way of Canada had been wrongfully held. Five of these gave their names to immigration officials when they attempted to enter and stated that they were American-born. The rest remained silent. The inspector then had ruled against all of them and told them of their right to appeal to the Secretary of Commerce and Labor. No appeal was made. But they asked for a writ of **Habeas Corpus**. Brewer, dissenting, pointed out that these men had no provisions to compel attendance of needed witness—a rule not enforced against Anglo-Saxon American citizens. The worst outlaw, he observed, had this privilege. The Chinese were kept in quarters, not allowed a lawyer to begin with. Finally, after being denied entry, they were allowed to have a lawyer, who could examine but not copy testimony on which the excluding order was based. Written notice of appeal had to come within two days after the decision. In an appeal, no new evidence could be presented. The burden of proof rested upon the Chinese. This harsh and arbitrary treatment, in Brewer's opinion, was destroying traditional Chinese friendship for America.[27]

The last case of these three was **U. S. v. Ju Toy**, 198 U. S. 253. Here also no provision was made for witnesses; the accused, if he had little money, could not afford the transfer to Washington. This was a star chamber proceeding according to Brewer. The Chinese had a court decision stating that he was a free-born American citizen. Therefore, the rules allowed the arrest and deportation of a citizen of the United States by action of an administrative official, thus overriding the court which certified as to his American citizenship. Brewer felt that Congress in giving control over Chinese persons to the immigration authorities meant only citizens of China. He thought the Supreme Court decision in this case made it refer to any Chinese, citizen or alien. This stripped a citizen of all right merely because of his race.[28]

Brewer joined in 1892 with Justices Harlan and Field in **O'Neal v. Vermont**, 144 U. S. 323, in supporting the incorporation theory that the Fourteenth Amendment extended the en-

[26]**Fong Yue Ting v. U. S.**, 149 U. S. 698, 732; 738; 739; 740; 741; 742-743.

[27]**U. S. v. Sing Tuck**, 194 U. S. 161, 166; 170; 177; 178; 182.

[28]**U. S. v. Ju Toy**, 198 U. S. 253; 268; 269; 274; 279; 280.

tire national Bill of Rights against the states. This had never received a majority vote of the Court. But Justice Black agreed in this view in his dissent, supported by three others in 1947.[30]

Brewer in a Kansas case commented that stare decisis is used by many legislatures, executives, and courts, but "accumulating wrong will never be disturbed in its illegally acquired power if stare decisis continues in power." He complained that the Kansas Court had used obiter dictum on which to base stare decisis.[31]

Brewer did not think that judges were placed in office to carry out the popular will—not to reflect the passing will of the masses but to render justice and to determine rights.[32] Neither did he think corporation lawyers would be any less disinterested judges because of their former employments. Cases involving corporations, he said, were usually between corporations; also heads of corporations disliked dishonest judges and had the welfare of the Republic at heart. The best lawyers, according to Justice Brewer, were employed by corporations.[33] He felt that it would be a blessing if half of the lawyers were to quit law; standards should be raised to prevent the unfit from over-crowding the profession.[34] Brewer's ideal lawyer would be honest with the public and with individuals, constantly studious, having both brains and common sense; and he would be one who never forgot his citizenship.[35] He predicted that the lawyer by 800 years would be settling many things in international affairs by law instead of by force as at present; thus the lawyer would be of ever growing importance in our society.[36]

The Supreme Court in Brewer's opinion must be watched and criticized by the citizens. He wrote:

> It is a mistake to suppose that the Supreme Court is either honored or helped by being beyond criticism. On the contrary, the life and character of its justices should be the objects of constant watchfulness by all, and its judgments subject to the freest criticism. The time is past in the history of the world when any living man or body of men can be set on a ped-

[29]O'Neil v. Vermont, 144 U. S. 323, 332; 469.

[30]Adamson v. California, 332 U. S. 46, 71-72.

[31]State ex. re. St. Joseph & Denver City R. Co. v. Commissioners of Nemaha Co., 7 Kans. 335 (Dassler), 339-340.

[32]David J. Brewer, "Organized Wealth and the Judiciary," The Independent, LVII (1904), 302.

[33]Ibid., 303.

[34]Brewer, "Justice Brewer on Training for the Law," The Review of Reviews, XII (1895) 584, 585.

[35]Brewer, "The Ideal Lawyer," The Atlantic Monthly, XCVIII (1906), 598.

[36]Ibid., 597.

estal and decorated with a halo. True, many criticisms may be, like their authors, devoid of good taste, but better all sorts of criticism than no criticism at all. The moving waters are full of life and health; only in the still waters is stagnation and death.[37]

One judicial reform Brewer wished to promote was the elimination of the unrestricted right of appeal which caused delay, allowing the trial court to shift responsibility to the appellate courts which prevented them from working at their best. Also, too many corporations were appealing every case, forcing weaker opponents to compromise what was justly theirs to avoid costly delay. He would have prevented the defeated party from appealing at will: the appellate court would decide whether to entertain an appeal or not. The elimination of this privilege, he believed, would check the habit of lynching.[38]

"The surest quarantee of the permanency of republican institutions," wrote Brewer in August, 1904, "is the stability, the long tenure of judicial office." Election of judges did not reform a man's character or increase his wisdom. He admitted that a high-minded judge did not leave politics behind him when he entered the judgeship; political questions are apt to be labeled as such where appearing in a case and refused judicial support. He approved the tendency of the American people to refuse to transfer one from judicial to political life as wise: he wrote, "I firmly believe in its wisdom, and should not regret even a constitutional amendment forbidding any such transfer."[39] An editorial in the same issue of the magazine in which Brewer's article calling for the elimination of politics from the judiciary appeared admits that Brewer's plan would be practically impossible when judges of lower courts are elected to short terms of office. Also the editorial stated that Brewer wrote against political careers for judges when he knew that Judge Alton B. Parker was apt to obtain (or had already been selected) the Democratic nomination for the Presidency.[40]

Brewer had been mentioned for the United States senatorship in his home state of Kansas, but he had not been willing to try for that honor.[41] Perhaps this principle of separating the political career from the judicial career was the reason? Probably not.

[37]Brewer, "Government by Injunction," National Corporation Reporter, XV, 848.

[38]Brewer, "Right of Appeal," The Independent, LV (1903), 2547, 2548, 2549.

[39]Brewer, "Organized Wealth and the Judiciary," The Independent, LVII (1904), 301, 302.

[40]"Justice Brewer's Suggested Constitutional Amendment," (editorial), The Independent, LVII (1904), 340.

[41]New York Tribune, March 29, 1910, p. 4, col. 7.

Yet Brewer did not hesitate to discuss current problems. Justice Brewer was the best known of the Supreme Court justices,[42] being in almost constant demand as an after-dinner speaker and as a lecturer.[43] He was the only justice who had proof copies of his opinions ready for the press, and he only briefly announced his conclusion in the court session.[44] Brewer must not have shunned the public limelight merely because he was a judge. Furthermore, Brewer was faithful to his religious duties as well as to his civil ones. Deeply interested in Christian missions, he was for years vice-president of the American Missionary Association as well as a loyal church member. He was president of the Associated Charities in the National Capital for five years prior to his death.[45] He was greatly interested in international peace and wrote on international law; he was president of the commission set up by Congress in 1895 to determine the facts in the Venezuela boundary dispute with Great Britain. He was one of the representatives on the arbitral tribunal which made the award in 1898, settling that dispute.[46]

His last years on the bench must have seen a decay of his usefulness. President Taft wrote in a letter that " 'The condition of the Supreme Court is pitiable, and those old fools hold on with a tenacity that is most discouraging.' " He was referring to Justices Fuller, Harlan, and Brewer. He reported that " 'Brewer is so deaf that he can not hear and has got beyond the point of the commonest accuracy in writing his opinion; Brewer and Harlan sleep almost through all the arguments.' " It was " 'most discouraging to the active men on the bench,' " according to Taft.[47] William Allen White reports that Theodore Roosevelt wrote to him in November, 1908, that Brewer was a striking example of a judge entirely unfit to occupy the position.[48] White reports that he knew Brewer as a circuit judge and says Brewer "believed in the divine right of plutocracy to rule. He distrusted the people, and his decisions limited their power whenever the question of their power came before the court."[49] Brewer worked according to White with the methods and morals and

[42] Ibid., March 30, 1910, p. 6, col. 3; "The Death of Justice Brewer" (editoral), The Independent, LXVIII (1910), 773.

[43] New York Tribune, March 29, 1910, p. 1, col. 4.

[44] Ibid.

[45] "The Death of Justice Brewer," loc. cit., 773; DAB, III, 23.

[46] DAB, III, 23.

[47] Henry F. Pringle, The Life and Times of William Howard Taft, a Biography (two volumes, New York: Farrar & Rinehart, 1939), I, 529.

[48] William Allen White, Autobiography (New York: MacMillan, 1946) 440.

[49] Ibid., 159.

manners of his time which leaves something less than desirable.[50] Another writer labeled "Brewer and Peckham, the tough-minded twins of ultra-conservatism."[51]

In summary, Brewer believed strongly that the reserved power of the states must be preserved to prevent a completely centralized government in Washington having full police power. Neither would he approve of state action that could hamstring the national government. Legislative grant of power, he believed, was not unlimited. He believed that the enforcement of law should be based on the spirit of the law rather than the letter of it; if necessary, the judge should consider the intent of the legislature in marginal cases.

His property sense was acute. Title was more important than how one obtained title. He was opposed to governmental regulation of a business which had no governmental privilege granted to it. He felt that if a legislature takes the use of property from its owner, society should repay the economic loss to that owner. Brewer did not believe that a business should be regulated merely because of its size or because of its public service.

Brewer refused to follow majority decisions that took possible rights to a just and fair trial from helpless Chinese by the whims of bureaucrats. Discrimination on account of race or lack of means was not the American way as visualized by Brewer. Also, Brewer insisted that stare decisis was used too often and was freezing bad decisions into a permanent system. The judge was not the mirror of popular will but of justice. Corporation lawyers should not be eliminated from judicial careers for they numbered some of the best lawyers and would not reflect their former employers. Brewer wanted fewer, but more capable and better trained lawyers.

Critics were beneficial to the Supreme Court in Brewer's views. He would have eliminated free use of appeal as too often delaying justice.

The long tenure of judicial office was a safeguard of the nation and justice. There was no place for a political career for the judge. Brewer himself apparently avoided a political career except as a judge. This did not mean that he was not active in civil and religious life.

He seemed to see the religious organizations of Christianity and of the secular government as having a common bond which leads to a question of his attitude towards the separation of church and state.

[50]Fred Rodell, Nine Men, a Political History of the Supreme Court from 1790 to 1955 (New York: Random House, c. 1955), 187.

A COMPARATIVE ANALYSIS OF THADDEUS STEVENS

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High on the list of "Damn Yankees" is the name of Thaddeus Stevens, the most radical of the Radical Republicans who imposed their will upon the prostrate South during the Reconstruction Era. Millions of "Unreconstructed Rebels" nourished their agonizing disappointment and seething fury by concentrating on Stevens as the symbol of everything they hated.

Until recently historians did little to dispel the sulphurous aroma which surrounded the man in death as in life. The concensus of historical opinion is probably best summed up in the words of James Truslow Adams, who called Stevens "the most despicable, malevolent and morally deformed character who has ever risen to high power in America."[1]

It was inevitable that anyone so thoroughly condemned as Stevens would be re-evaluated by later historians, and total condemnation might even be replaced by total commendation among certain ubiquitous revisionists. The latter school of thought reached its zenith in Ralph Korngold's mawkish presentation, **Thaddeus Stevens: A Being Darkly Wise and Rudely Great,**[2] a work which seemed to merit consideration as a scholarly endeavor.

Just as inevitable as the revision was the revision of the revisionists, wherein the same old material would be sifted over and over again in an effort to arrive at a true evaluation of the man who could not possibly be as bad or as good as the extremes represented. Fawn Brodie's **Thaddeus Stevens: Scourge of the South**[3] is the latest and best attempt at honest evaluation.

Recognizing the limitation of a paper of this length, no attempt will be made to discuss and catalog the many biographies of Stevens, for those biographies run from the childishly naive work of Elsie Singmaster[4] to the competent, scholarly work of Richard Current,[5] to whom all subsequent biogra-

[1]**Epic of America** (Boston, 1931), p. 257

[2]New York: Harcourt, Brace and Company, 1955. Hereinafter cited in text by author and page number only.

[3]New York: W. W. Norton and Company, 1959. Hereinafter cited in text by author and page number only.

[4]**I Speak for Thaddeus Stevens** (Boston: Houghton Mifflen Company, 1947).

[5]**Old Thad Stevens: A Story of Ambition** (Madison: University of Wisconsin Press, 1932).

phers are indebted for their Stevens bibliography. A comparison of the Korngold and Brodie works would seem to furnish a firm base for investigation, as both are recent publications, solidly researched. Even though the authors apparently used the same material, their conclusions were so antithetical as to excite curiosity.

Korngold's thesis is that Stevens' disposition can be traced to the fact that he was born lame and sickly, and that as a result of his physical deformity and social rejection he became cynical and defensive while at the same time he became a humanitarian and a natural friend of the downtrodden. Korngold believes that if we accept this thesis all of Stevens' actions become consistent with these characteristics. So far this is the rather standard interpretation of the motivation of Thaddeus Stevens, but Korngold became so enamoured of his subject that he could find no serious fault with him thereafter.

That Korngold is blindly prejudiced in favor of Stevens may be noted in a few illustrations: One of the most damaging blows to the reputation of Thaddeus was the allegation that he murdered a young Negro girl who was pregnant by him. This rumor followed Stevens around for a number of years, and though the weight of evidence seems to clear Stevens of any direct involvement in the crime, there was enough public pressure to warrant a trial. Thaddeus was cleared in court, but because the most damaging evidence was mysteriously withheld, the cloud of suspicion would never be entirely dissipated. On the face of it this whole episode is of critical value in determining the character of "Old Thad," yet Korngold is able to dispose of the circumstances in one innocuous sentence and the disposition of the drama in one page (Korngold, 27), he too omitting the damaging evidence though undoubtedly it was known to him.

Another instance of blind devotion is uncovered in Korngold's treatment of an incident which occurred while Stevens was a student at Dartmouth: Stevens, angered that cows were loosed on the campus, and aggravated at the resulting piles of manure, borrowed an axe and maliciously hacked one of the cows to death. Korngold, in a sentence or two, mentions only that a "prank" which inadvertently resulted in the death of a cow was the cause of Stevens' temporary expulsion from Dartmouth (Korngold, 7).

A third and last incident will suffice to prove the case against the impartiality of Korngold: Stevens' young nephew, Alanson Stevens, whom he had raised and subsequently employed in his Caledonia Iron Works, had taken a common-law wife, and a child, Jennie, was born to the couple. The couple claimed to have married later, but Stevens never forgave them

nor softened toward the child. When Alanson went into the Union army Stevens wrote him letters full of malicious innuendo concerning the girl, whom he continued to address as Mary Primm (Brodie, 100, 101). When Alanson was killed in the war Stevens saw to it that the girl was not allowed the small pension due her as Alanson's widow, despite the fact that Alanson had acknowledged her in writing as his lawful wife (Brodie, 101). Thaddeus, unrelenting as ever, allowed his grandniece, Jennie, to die at the age of eleven, and presumably was gratified to note that Mary Primm, broken in spirit and destitute, began to drift "from one man to another" (Brodie, 102). Korngold, as to be expected, barely mentions this unsavory incident except to say that Stevens considered Alanson's common-law marriage "bad behavior" (Korngold, 123).

If we are to believe Korngold, Stevens was an extremely likable and popular fellow, yet it is a fact that Thaddeus was never invited to join any social organization, was blackballed by Phi Beta Kappa in spite of academic qualification, was disliked by his closest associates in college, was excluded from the Freemasons and the County Bar Association, rose slowly through the Republican ranks, and was never able to gain a Senate chair though this was a constant ambition—at one time he ran third in a three man field vying for a Senatorial chair from Pennsylvania, receiving only seven votes and being soundly beaten by no less a character than Simon Cameron.

Stevens was never popular in the normal sense of the word. Mrs. Brodie, delving into the letters of his contemporaries, has uncovered a wealth of information bearing out the fact that Stevens was "the most unpopular man on the floor," and was considered "unfit to lead any party" (Brodie, 259). Stevens certainly had friends and admirers, but there seems little reason to doubt that they were in the minority, and that Stevens was deserving of the unpopular reputation with which he has been saddled for so long. Richard Current, in speaking of Thaddeus, said that "bewigged, clubfooted, sarcastic Old Thad Stevens was the imperious kind of man whom few could love but to whom none could be indifferent or lukewarm."[6]

Political power, then, did not stem from an engaging personality, yet there is no question about the actual authority which Thaddeus enjoyed in the House. The evidence of that leadership is concrete and incontrovertible, and one might well question the source of such control.

Mrs. Brodie tells us that part of Stevens' political success was attributable to his indifference to public opinion; having no fear of public reaction he would have no compunction about using any means possible to achieve any goal. His "religion of

[6]Ibid., p. iii.

antislavery" (Brodie, 86) was not a popular one, but it was one which had vociferous and growing support in the 1850's, and when the Republician party finally made slavery an issue Thaddeus was already ensconced as the leading opponent of slavery. At the conclusion of the war he kept his party in a particularly uncomfortable position, for he insisted on the stern application of the principles the party was supposed to represent, at a time when they would rather have modified their program to gain more popular support.

Since success is the art of compromise it behooves us to note that Stevens, in spite of his relentless pursuit of certain goals, was not above accepting temporary compromises along the way. In those particular programs where he would accept no compromises, as in the confiscation and redistribution of Southern plantation lands, and the impeachment of President Johnson, he invariably met with defeat. It seems that at times his Puritan morality demanded punishment above all else, and this intense preoccupation with punishment (Brodie, 306) would place unnecessary impediments before his legislative objectives.

A complete listing of the many factors which contributed to his political prowess would be tedious and trite, for much of his power was derived from the usual sources; seniority, Chairmanship of the Ways and Means Committee, legislative reciprocation, etc. To this writer, the first gear of Stevens' political drive was that he was by nature an antagonist, most happy when he was in the minority—when he felt that he was directly or indirectly persecuted or oppressed. The very consistency of his political orientation would add greatly to his success as a legislative leader. That his personal life might run contrary to his political principles did not bother him in the least.

> His reputation remains many-sided partly because his character and history were full of paradoxes and contradictions. He was a humanitarian lacking in humanity; a man of boundless charities and vindictive hates; a Calvinist convinced that all men are vile who nevertheless cherished a vision of the Promised Land where all men should be equal before the law; a revolutionary who would carve up the estates of the "bloated aristocrats" of the South, but in the same breath offer to defend Jefferson Davis in his trial for treason. He was an equalitarian who would pinion the Southerner for his racial bigotry and caste prejudices, but who for twenty years would live with a colored woman as his mistress, apparently content with a relationship common in the Southern aristocracy, and one that Northern abolitionists generally pointed to with horror. (Brodie, 20)

Putting his personal life aside, Stevens was a politician first and foremost. Furthermore, he was a political tiger who would not be caged—a tiger who was determined to devour his enemies. Is it strange that few of his constituents were anxious to anta-

gonize this hungry, uncaged tiger? His biting sarcasm could demolish the most worthy opponent, and his claws remained sharp from constant battle with his enemies.

Stevens' basic strength also stemmed from the righteousness of his cause, a fact about which he was absolutely certain, and a fact that his enemies found hard to circumvent. Before the war he saw the slave as a hunted animal, and he centered his life around trying to help this hunted animal escape forever to a life of freedom equal to that of his tormentor, the Southern Planter. During the war—the period which saw him rise to political heights in the national legislature—he consistently strove to gain freedom for the slave, threatening and trying to push President Lincoln to terminal acts which Lincoln did not think politically advisable at the time—acts concerning slavery, for the most part: As the war dragged on Thaddeus came to believe that the strength of the South and the reason for its ability to defend itself so well was the control which the planter class exercised over its human property. The most effective weapon against the Confederacy, therefore, was to destroy that strength by emancipation, but Lincoln believed that the Union could be saved only if the border states would not secede; he felt that emancipation would throw them into the arms of the South and perhaps lead to the permanent destruction of the Union. Lincoln philosophied that "by general law life and limb must be protected; yet often a limb must be amputated to save a life; but a life is never wisely given to save a limb" (Korngold, xi).

During the period of Reconstruction the South itself, by its intransigence, allowed Stevens to play the role of the distraught parent who was forced to deal harshly with his obstreperous child. This fortuitious circumstance was augmented by the similar intransigence of President Johnson, another "child" who would not recognize the authority of its "parent." Stevens saw himself playing the role of the indulgent parent when he offered ratification of the Fourteenth Amendment as the sole price of readmittance to statehood, and he was again playing the role of the indulgent parent when he offered President Johnson his advice. The rejection of these offers probably pleased Stevens, as it added to his righteous indignation and opened the door to any action necessary to bring these children under control.

In conclusion, perhaps the physical deformity of Stevens did contribute to his bellicose, defensive nature. Perhaps his quarrelsome attitude did stem from self-hatred. Perhaps he did represent the minority as a matter of self-association. The end is the same. Thaddeus Stevens pursued a lonely, thankless path, casting weeds and seeds as he passed. The weeds survive, but so

do the seeds—emancipation, universal suffrage, free schools, tolerance. If these seeds ever blossom to outgrow the weeds of sectional animosity, they may one day provide a touch of beauty to the ugliness that was Thaddeus Stevens.

SOCIAL HISTORY AND STRATIFICATION IN THE ANTE-BELLUM SOUTH

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This is an essay in historical criticism. It concerns some sociological concepts as factors operating in historical inquiry in a specific body of historical writing, revisionist social history of the ante-bellum American South. The following discussion seeks to examine the problem of reinterpretation which faces the contemporary historian with respect to a narrowly defined subject matter, namely the social stratification of the ante-bellum South. It trys to isolate some of the existing conceptual difficulties and show how the lack of a consistently applied conceptual framework leads to descriptive confusion and questionable interpretations of data.

Myths, in MacIver's phrase, those ". . . value impregnated beliefs and notions that men hold, that they live by or live for"[1] seem universal. Some myths are of slight importance, encompassing only a portion of a single isolated individual's conception of how things are, or should be, or were, while others become linked in vast networks, accepted as the dominant modes of thought for whole societies. Necessary in fact for their existence.

The American South has long been the subject of myths both popular and scholarly by which its way of life, social structure, and peculiar institutions have been sustained, explained, and justified. The network of myths surrounding the South have changed surprisingly little since their institutionalization in the context of the war between the states. In the popular imagination the earlier visions still persist and are mixed with present truths in the beliefs Northerners and Southerners still hold concerning one another.[2] Historians, too, have not broken free of the biases of the originators in spite of the fact that myths are subject to change. MacIver implies that the process of change is inevitable: " . . . it is important to observe that the myth sustaining a [social] relationship is often different from the myth that bore it. Once the track is pioneered many men follow it. The original myth may be forgotten, and if it endures it changes."[3] Why then have the Southern myths persisted? It becomes more understandable when we consider that myths

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[1] R. M. MacIver, **The Web of Government** (New York: The Macmillan Co., 1947), p. 4.

[2] Howard Zinn, "The Southern Mystique," **The American Scholar**, 33:49-56, Winter, 1963-64.

[3] MacIver, **op. cit.**, p. 5-6.

are not necessarily true or false. Falsity and fact are compounded in the alchemy of myth making and, while scientific objectivity as a characteristic of historical inquiry demands that the elements be refined out of the compound, it has not been easy to ask the necessary questions. Gradually, however, the focus of historical inquiry has been changing. Articulate Southerners of our generation have been questioning the older historical tradition in two ways—first, by examination of old concerns, and second by concern for new frames of reference within which subject-matter can be considered.[4] One such new frame of reference is the writing of social history.

Social historians plead that history is incomplete until the society of a region during a particular period is described. Such a description once begun, we would suggest, is incomplete until studies of social structure and social stratification are made.

Ante-bellum Southern society was an early subject for myth making by patriots both Northern and Southern. Their pronouncements make clear that the moral justifications for engagement in war and historical tasks are incompatible. The valuing process and the determination of historical facts and causality are even in the same mind clearly antithetical, but still historians are conditioned no less than are other men by the culture in which they live and are thereby predisposed to reconstruct the past in light of their learned perspectives. And so it was that an older generation of historians had a tendency to see the most striking and uniquely different aspects of Southern patterns of life. Their work came to be relied upon in such a manner that subsequent writings, according to Owsley, "further simplified the picture of Southern society,"[5] so that until recent times no real understanding of the complexity of Southern life could be derived from existing historical works. The reasons for these distortions lie in the pressing needs of our historical forerunners—after all they had a war to explain. It was easy to be trapped by the pseudo-sociology of regional partisans who stressed social and cultural differences between the regions to the exclusion of difference within the regions themselves. In its extreme form the North became " . . . a conglomeration of greasy mechanics, filthy operatives, small-fisted farmers, and moon struck theorists . . .," while the South perpetuated the fondest of its self images, the well-bred Southern gentlemen.[6]

[4]See A. J. N. Den Hollander, "The Tradition of the Poor White" in W. T. Couch (ed.), **Culture in the South** (Chapel Hill, 1934), 403, 415, for a criticism of the traditional view of society in the ante-bellum South.

[5]Frank Lawrence Owsley, **Plain Folk of the Old South** (Baton Rouge: Louisiana State University Press, 1949), p. 3.

[6]Muscogee, Georgia, **Herald**, quoted in **New York Tribune** (September 10, 1856), cited by Kenneth M. Stampp, **The Causes of the Civil War** (Englewood Cliffs, New Jersey: Prentice-Hall, 1959), p. 180.

Much of the fault to be found in these earlier studies lies in the fact that they were based on ". . . the idea of explaining the common [or universal] aspects of its society."[7] Lewis E. Atherton describes the situation in this way:

> Planters, slaves, plantations, staple crops, and factors characterized the South in this version and were pictured as dominating the section. Contemporary observers and historians might call attention to exceptions, but this conception became too deeply entrenched to be shaken. It was recognized, of course, that some southerners did not own slaves, that some areas did not produce the common staples, and that parts of the South did not fit a stereotyped pattern.[8]

The crux of the difficulty lies in the fact that the reappraisal of Southern history is a comparatively recent undertaking, which only now is revealing that vast quantities of data concerning the structure of society in the ante-bellum South were either nonexistent or had not been used in the kind of systematic appraisal necessary for an adequate description of the social structure.

Actually what the historian is faced with now, is the failure of the earlier students of Southern history, mainly untrained, to record the testimony of older generations of Southerners, who could have filled the gaps in our present materials.[9]

Because of this, in order to bring the specific nature of social structure into more realistic perspective, it has been necessary to abandon the sectional approach for a more specific analysis of regional areas. These studies depend on the existence, not of "private papers and business accounts," but rather, according to Owsley, on:

> . . . church records, wills, administration of estates, county-court minutes, marriage licenses, inventory of estates, trial records, mortgage books, deed books, county tax books, and the manuscript returns of the Federal censuses

not to mention:

> . . . county and town histories, biographies, autobiographies, and recollections of men and women of only local importance—preachers, lawyers, doctors, county newspaper editors, and the like . . .[10]

One course many of the newer studies take is to study the land tenure and economic stratification of the region under ex-

[7]Lewis E. Atherton, The Southern Country Store, 1800-1860 (Baton Rouge: Louisiana State University Press, 1949), p. 2.
[8]Ibid.
[9]Owsley, op. cit., p. 6.
[10]Ibid.

amination in an effort to bring into sharper relief the nature of the small planter and non-slaveholding, free, white farmer group.[11] Out of a population of some 6,000,000 Southerners in the 1850's, this segment of society numbered more than 5,750,000 and comprised by far the largest portion of the white population of the southern states.[12] This is not to say that this group had, by any means, the social, political, or economic significance warranted by its numerical strength, but rather illustrates that the simple two-fold division of the society previously relied upon gave far too much emphasis to the elites in a many-faceted, complex structure.[13]

Besides the very rich, owning 50 slaves and upwards, that populated the rich cotton and sugar lands of the "black belt," this area was interspersed with small planters and farmers who hardly ". . . had sufficient money to support the type of life which has sometimes been pictured as typical of the South."[14] Shugg characterizes their status by saying:

> Over half the slaveholders in the country probably lived in less comfort. They were the yeomen farmers who owned from one to nine Negroes, besides their land, and might well be called common people "on the make." With a family of five slaves . . . a yeoman was lucky to earn $150 a year from the cotton he could raise.[15]

In the highlands and the piney woods region where the rich alluvial soils are widely scattered or non-existent, thus making the plantation system uneconomic, the population was almost entirely comprised of "corn 'n tater" farmers, cattlemen, and lumbermen.[16] These people were partially geographically segregated and rarely had contact with their more prosperous kind located on the richer lands.[17]

Historians have in general tried to make a much greater distinction between the various members of the group previously known as "poor white trash," or just "poor whites." The really poor or "trashy" components of the society are said to

[11]Jackson Turner Main, "The Distribution of Property in Post-Revolutionary Virginia," **The Mississippi Valley Historical Review**, 41:241-58, September, 1954; James C. Bonner, "Profile of a Late Ante-Bellum Community," **American Historical Review**, 49:663-80, July, 1944; Herbert Weaver, **Mississippi Farmer, 1850-1860** (Nashville: The Vanderbilt University Press, 1945); Owsley, **loc. cit.**

[12]Atherton, **loc. cit.**

[13]Owsley, **op. cit.**, p. 7.

[14]Atherton, **loc. cit.**

[15]Roger W. Shugg, **Origins of Class Struggle in Louisiana** (Baton Rouge: Louisiana State University Press, 1939), p. 26.

[16]**Ibid.**, p. 97.

[17]**Ibid.**, p. 31.

have comprised at least in the agricultural region a relatively small number of the total population if not of the middle and lower economic group as well.[18] This places the emphasis then on what some historians call the "yeoman farmer" as the stalwart of Southern agricultural society.

At this juncture, perhaps it would be well to discuss the term "yeoman farmer" to see what contribution, if any, it makes to our clarification of the social stratification of the Old South. This term was introduced into the historical literature for the reason that, according to Shugg:

> Any appellation like "poor whites," compounded of snobbish prejudice and used without discrimination, has little value to the presumably impartial historian. It explains nothing about the people it slanders, and even fails to classify them precisely.[19]

Granted that the term "poor white trash" should be replaced should it be superseded with a term to which no slander attaches but which does little in the way of contributing to a more precise classification of the subgroups which are subsumed under the term "yeoman farmer"? The real danger it wou'd seem is not so much that it fails to classify adequately, but rather that its use tends to retard the development of more specific outlines and the descriptive terminology to accompany them for these subgroups within the larger category itself.

When we include the term "class" in our discussion of the yeoman farmer, we introduce more serious heuristic difficulties. The term "class" in one accepted sense is used to describe a group ". . . demarcated by economic factors: by income, economic function, or relation to a system of production."[20] This, however, is not the only sense in which the term "class" has meaning to the sociologist. The attitudinal principles of group consciousness, cohesion, and exclusiveness are of primary importance to the concept of "class" in the sociological sense and should not be overlooked as a contributing or ultimate criterion of stratification.[21] This duality of content, that is, being both socio-economic and socio-psychological, makes "class" difficult for the historian to use, particularly when associated with an already obscuring term like "yeoman farmer." An illustration of this difficulty can be derived from Herbert Weaver's discussion of the yeoman farmers in his Mississippi Farmers, 1850-1860. He says:

[18]Weaver, op. cit., pp. 61-62.

[19]Shugg, op. cit., p. 22.

[20]Charles H. Page, "Social Class and American Sociology," Class, Status, and Power, Reinhard Bendix and Seymour Martin Lipset, editors (Glencoe: The Free Press, 1953), p. 47.

[21]Ibid., p. 48.

> Economically the yeomen might today be termed lower class, but socially and economically in the late ante-bellum period they were middle class or lower middle class. Many owned a small number of slaves, and the majority owned at least a small amount of land. They were not wealthy, but neither were they poverty-stricken. From this class had come some who by 1860 were wealthy planters. Others were acquiring property at a rate which indicated that they, too, eventually would move into a higher economic stratum.[22]

Notice that here Weaver is discussing primarily the economic elements in his class distinction but introduces the term "socially" which seems to imply presence of attitudinal group factors. He goes on, saying:

> In the older delta counties these people were fewer than in the more recently settled areas, and their social status was somewhat different. Overshadowed by a large number of planters, they were sometimes considered low caste. Even those who owned a few slaves moved in different social circles from the planters. Slaves of wealthy men looked down upon whites who owned no slaves, or who owned fewer than their own masters, frequently referring to them as "poor white trash." Some travelers apparently accepted this characterization uncritically, without attempting to ascertain what manner of men they actually [sic] were. Available records fail to bear out the implications of this characterization. Census figures show that production per acre of major crops among the small farmers compared favorably with that of the planter, a clear indication that they were not lazy and shiftless. The steady increase in property owned implies a thriftiness not generally ascribed to "trash."[23]

Here Weaver abandons his economic definition of class, describing a segment of the group's "social status" as being low in the socio-psychological sense. The term "caste" is here misused and should be discarded. Then he returns to his economic definition of class which from his own perspective defines what the people "actually" were. The critic must suggest that Weaver is defending from his own point of view presuppositions he has already made about the nature of the yeomen farmers. Obviously the yeomen farmers, living in different geographical areas, were not socially stratified by the members of their own society in the same way.

If, then, the yeoman farmer was not socially stratified the same throughout the areas of the South under scrutiny, how was he stratified? Except in a few cases we are left with the problem of inferring the social stratification from our knowledge of the economic stratification. Using this economic base as a reference point, it should be possible to trace the outlines of the class

[22]Weaver, op. cit., p. 56.
[23]Ibid., p. 56-57.

structure in the sociological sense on a regional basis. Roger W. Shugg attempts this in his **Origins of the Class Struggle in Louisiana** and relies on what might be described as peripheral social activities to indicate the social layering of society in Louisiana. For an example of this we might point to his description of the political history of Louisiana in which the play of socio-economic factors comes through quite clearly.[24] What really is indicated in all this is that we should not rely exclusively on either economic or social stratification for our picture of society and, above all, should not confuse the two as being synonymous.

One important category in our sociological description of the Old South, namely, the social mobility of the inhabitants, has largely been neglected. This is due in part to our failure, discussed above, to make the necessary delineation of the class levels within the small planter-free white farmer group. The degree of vertical mobility seems to have been in some areas at least very high, making the development of a clearly defined set of influences contributing to this mobility difficult. The picture is further broken up by the fact that fluctuating, economic influences resulted in similar fluctuations in the degree of mobility exhibited by the regional social units.[25]

Some disagreement over the degree to which an open class system with its accompanying relative mobility existed in the ante-bellum South is apparent in the writings of at least four historians. Owsley claims that the yeomen farmers were not class conscious and did not regard the elites as socially oppressive, and that upward social mobility except in the older states of Virginia and the Carolinas was considered a common occurrence.[26] Shugg holds, however, that as time went on and the " . . . ranks of the yeomen and middle classes thinned out, the proportion of common people enlarged; and the aristocracy . . . became more select and more class conscious," the degree of mobility and openness of class lines became a public issue.[27] Weaver, holds that, in general, the farmers were fully as prosperous as the planters, that upward social mobility was common, and that social hierarchy was little recognized.[28] By contrast Bonner maintains that a superficial view does not tell the real story of the farmers in the lower economic group, which comprised almost 35 per cent of the total white community and whose economic position became progressively worse as the 1850's wore on. He further holds that the means to increase

[24]Shugg, op. cit., pp. 121 ff.
[25]Ibid., p. 23.
[26]Owsley, op. cit., pp. 133-34.
[27]Shugg, op. cit., pp. 33-34.
[28]Weaver, op. cit., pp. 124-25.

ones social status became harder to come by and that as time went on, the class cleavages became more apparent and realized by the populace.[29]

One is forced to the conclusion that few generalizations about the nature of mobility and the relative openness or closure of class in the South as a whole can be made from existing interpretations.

A far more serious fault of the historical studies so far discussed is their exclusion of the underlying Negro society, both free and slave, from their study of ante-bellum social structure. What kind of skewed picture of society results from paying attention only to the white segment of a much larger society? It is perhaps not too far amiss to suggest that in the attempt to "correct" a traditional over-emphasis on the aristocratic slave-holding tone of ante-bellum Southern society, these historians have shied away from an inclusion of Negro slave society in their description of Southern social structure.

This avoidance, even if justified in terms of a division of labor, leaves the historian open to charges of making deliberate distortions and perhaps what is more significant, affects his own analysis adversely. This adverse affect may be enough to offset any gains made towards the reinterpretation which is desired.

Why should this be so? It is clear that social stratification depends in large part on the existence of value symbols which are interpreted in the social situation as validation of social statuses. In the case of the ante-bellum South, we know that the percentage of Negroes in the total population varied widely from place to place and that the percentage of slave-holders varied as well.[30] And further, we are aware that the existence of a slave caste with its own internal class distinction as well as a thin strata of free men of color are value symbols that collectively, vitally affect the relative class distinctions which are made within the upper caste white society. Is it, therefore, not more cogently reasoned that by inclusion of both Negro and white castes and their classes in our description of social structure we will do more justice to those areas where slaves and slave-holders do not predominate? By stressing the diversity of types and degrees of stratification, we additionally strengthen rather than weaken the brief that the earlier over-simplified myths are perpetuating a distorted picture of Southern society. At the same time we will not be laying grounds for new myths.

The successful writing of social history depends in large

[29]Bonner, op. cit., pp. 666 ff.

[30]Kenneth M. Stampp, The Peculiar Institution (New York: Knopf, 1956), pp. 30-32.

part on the availability of historical materials that have sufficient breadth and depth to enable us to describe the social stratification of a given society both in time and in geographically distinct areas. So far, the historical materials relating to the social stratification of the ante-bellum South have not been collected in any kind of systematic whole to enable us to make an adequate judgment about the feasibility of such studies. Evidence on a regional basis suggests that it will be possible to write adequate descriptions of social stratification only by the dint of much hard labor expended in a thorough examination of existing sources. It also seems indicated that the South, at least in the stratification sense of the term, is a fiction, which if true will make studies using this concept useless for any serious socio-historical consideration. If this proves upon further examination to be true, the idea of a "South" should be discarded in favor of one which will do justice to the regions involved, as well as the historians who are engaged in writing histories of them.

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