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OBSERVATIONS OF IMPORTED FIRE ANT PREDATION ON NESTLING COTTONTAILS[1]

By EDWARD P. HILL III[2]

ABSTRACT

During a five year study of cottontail reproduction in Alabama, frequent observations were made of activities and mortality of nestling cottontail rabbits in five 50′ x 50′ pens, in six 200′ x 200′ pens, and in five large enclosures ranging from 6 to 40 acres in size. During this study 371 cottontail nests were found in which 231 litters were born. Evidence, some of which is circumstantial, indicates that 68 whole litters and parts of two other litters were destroyed by fire ants. From these observations it appears that significant fire ant disturbances to cottontail nesting can be expected in pens and enclosures where fire ant populations are of medium to high density. This is not meant to imply that fire ant predation would seriously alter cottontail populations in an unrestricted natural environment containing fire ant populations.

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Where fire ant populations are considered to be of medium to high density, the data indicates that predation on cottontail nests is not related to proximity of the nest to active fire ant mounds. No fire ant predation was observed in nesting cottontails older than seven days. Field tests in which fire ants were introduced into cottontail nests and into simulated nests of white rats indicated that cottontails reaching pelage development characteristic of approximately four days of age were relatively free from fire ant disturbances. The guard hairs on the back, neck, and head prevented the fire ants from inserting their stingers into these critical areas. Nest construction, particularly the amount and distribution of the fur lining in the nest, appeared significant in preventing mortalities in nestling cottontails. With the possible exception of intensity managed rabbit enclosures, fire ant control measures are not recommended. No indications of fire ant predation were found in 7 active litters and in 18 old nests of cotton-rats located incidental to the study.

Ant predation on various species of wildlife and fish has been a subject of interest and concern to many writers. Numerous studies (Stoddard, 1931:139, Travis 1938:705-708, Moore 1940:37-42, Schillinger and Morley 1942:31, Emlen and Glading 1945:45-46, and Lehmann 1946: 111-123) have resulted in reports of ant disturbances to bird nesting activities. The ants usually involved belonged to the genus *Solenopsis*, and there were conflicting opinions regarding the damage these ants caused.

With the introduction of the imported fire ant (*Solenopsis saevissima* V. Richteri Ford) and its spread through the Southeast in the 1940's and 1950's, questions arose concerning the detrimental effects this ant might have on wildlife. Many workers feared the bobwhite quail, *Colinus virginianus*, because of its ground nesting habits would be among the species most vulnerable to fire ant depredation. Johnson (1961:105), after a series of studies including observations of bobwhite quail nests in areas heavily infested with imported fire ants, concluded that imported fire ants rarely attack and kill normally hatching quail chicks. Recognizing the need for further work on wildlife having altricial young he noted that meadowlarks, (*Sturnella magna argutula*) and cottontail rabbits (*Sylvilagus floridanus mallurus*) appeared vulnerable to fire ant predation.

Much of the life history of the cottontail is known. Little work, however, has been done to determine factors affecting survival of nestling cottontails. A search of literature revealed only one referenc on cottontail nesting studies (Bruna, 1952) from Southeastern states, and no fire ant-cottontail relationship studies.

The purpose of this paper is to report nest disturbances by fire ants that occurred during a study of the cottontail in Alabama. The study was designed to determine: (1) the number of litters per year, (2) the average litter size, and (3) the success of nesting attempts. While the study was not specifically designed to investigate fire ant-cottontail relationships incidental findings were of such significance as to warrant reporting.

The study was conducted using penned cottontails during a five-year period from 1963 to 1967. Facilities consisted of five 50′ x 50′ pens, six 200′ x 200′ pens, and five large enclosures from 6 to 40 acres in size.

Procedures, 50′ x 50′ Pens

Five 50′ x 50′ pens were constructed on private land one mile southeast of Prattville, Alabama. The sides of the pens were five feet high, and the top of each pen was covered with chicken wire to exclude avian predators. A brush pile six feet in diameter was placed in each pen.

In January or February of each year, 1964-1967, one male and two female cottontails were put in each pen. In 1963 three females were put in two of the pens. Commercial rabbit feed was provided throughout the

study period. During the winter months, other supplemental foods were provided twice weekly. Among these were waste cabbage, lettuce, apples, carrots, pears, ear corn, and sweet-potatoes. Fall plantings of ryegrass *(Lolium sp.)*, crimson clover *(Trifolium incarnatum)*, oats, *(Avena sp.)* and winter wheat (*Agropyron* sp.) were made in each pen. Summer plantings of millet (*Setaria sp.*) and cowpeas (*Vigna sinensis*) were made. During periods of drought, water was provided in each pen.

Beginning with the first signs of breeding, pens were searched frequently for litters. Brush piles were not disturbed in 1963, but were searched carefully thereafter. Beule (1940a) mentioned indicators (arrangement of plant material covering the nest and excavated dirt) that aided in locating nests.

Parturition usually occurred at 26 to 28 day intervals. Knowledge of the gestation period and the time of first parturition provided a means of forecasting (within 2 to 3 days) subsequent parturitions. After littering sequences were established for each doe in each pen, intensive searches were made for nests at the time of each expected parturition.

Nests were marked with plastic flagging tied through the chicken wire above the nest. Dates that litters were born and found were recorded.

During the 1963 and 1964 seasons, litters were normally examined daily, but in 1965 and 1966 were checked less frequently. Observations were usually made early in the morning and an attempt was made to check each litter after heavy rains. Nests containing litters were often checked a second time in the late afternoon or after darkness.

Procedures, 200′ x 200′ Pens

Six 200′ x 200′ adjoining pens were built on the State Game Farm in Prattville, Alabama. The pens were made of 1½″ hexagonal mesh wire 5′ high which was set in the ground at a depth of twelve inches. The posts were 4″ x 8′ creosoted pine set at a depth of three feet and spaced at intervals of twelve feet. An electrical shock wire and a single strand of barbed wire were placed one inch and four inches, respectively, above the top of the netting on the perimeter fence.

In each pen a large doughnut-shaped brush pile was provided for clover, and a pole trap was provided to minimize the effect of avian predators. Food strips approximately ¼ acre in size were planted in fall and early summer. During the winter months, ear corn, commercial rabbit pellets, and waste produce such as lettuce, cabbage, apples, and sweet potatoes were provided as supplemental foods.

In February 1965, each of the pens was stocked with ten female and five male cottontails. With the commencement of the breeding season, each pen was systematically searched each week to locate nests. Nests were marked with plastic flagging tied through a loop bend in a short piece of wire which was pushed in the ground approximately five feet from the nest. Nests were classified as recently built but unused, recently destroyed, active, or successful. Unused and active nests were re-examined frequently to determine further developments.

If cottontail nestlings were found dead in the nest, estimates were made of the time since death and their age at death. Clues which aided in estimating the time since death were the extent of decay, the development of fly larvae in the decaying material, and the amount of tissue removed from the nestlings by ants. If recently dead litters were covered with fire ants and if no recent rains had occurred or no other cause of death could be found, they were categorized as probably killed by fire ants. In these cases, the nest was remarked with yellow plastic flagging, and the distance to the nearest fire ant mound was measured. Litters judged to have been dead more than five days were not considered.

Dates of birth were estimated for all live litters. Nests that were known to contain young were checked frequently until the young were

seven days old: they were also checked after each heavy rain, and when the young were tagged at 10 to 12 days of age.

Rabbits were removed from the pens in mid-August. The vegetation was burned and counts were made of the ant mounds in October. The mounds were disturbed and classified (depending on the presence of ants) as inhabited or uninhabited.

Procedures During Observations in Large Enclosures

One state-owned and four private rabbit enclosures located within seven miles of Prattville, were available for study. Except for fertilized food plots, perimeter fences, and rabbit population densities of approximately 0.5 to 2 rabbits per acre, these enclosures were generally representative of surrounding habitat.

Systematic searches were made of likely nesting areas to locate nests. Most of these searches were made during March or early April before vegetation began to obstruct visibility of the ground. Most of the nests found were therefore, built prior to the second parturition of the season. Procedures used in reconstructing nest histories were the same as those used in 200′ x 200 pens except that the distance from nests to fire ant mounds was not measured.

Procedures During Field Experiments

During 1967 experiments were conducted during which fire ants from disturbed mounds were transferred on a stick and shaken into five nests of cottontails ranging in age from two to six days and observations were made of the events that followed. Similar experiments were conducted in two simulated nests of 3 and 7 day old rats which were donated to the study by Southern Animal Farms at Prattville, Alabama.

Results, 50′ x 50′ Pens

Through the breeding seasons (1963-1967), 131 cottontail nests were found in the 50′ x 50′ pens. Forty-five nests were unused and 101 litters were born in the remaining 86 nests. Thirteen nests used twice and one was used three times. Table 1 contains a summation of events that occurred in the 131 nests.

Table 1. Summation of observations of cottontail nests in five 50′ x 50′ pens during four breeding seasons from 1963-1967

Stage or event	*Number*
Nest cavities found	131
Nest cavities unused	45
Litters observed	101 [1]
Successful litters (young left the nest)	71 [2]
Litters probably destroyed by fire ants	16 + 1/4 + 1/3 [3]
Litters drowned during heavy rains	2 + 2/3 [3]
Litters died of exposure after heavy rains	1
Litters randomly scattered in pen	3
Litters died of malnutrition	1
Litters killed or eaten by other predators	4
Litters abandoned	2

In addition to the 101 litters observed, omissions in the littering sequences and young rabbits from untagged litters indicated that seven other litters were born during 1963. I believe these litters were born in nests located under the brush piles which were not searched during 1963. Since brush piles were searched during the other years and no young rabbits from unobserved litters were found, it is thought that all, or nearly all, nests and litters were detected in 1964, 1965, and 1966.

1 Fifteen of these litters were born in previously used nests.
2 Two litters in this group had been stung by fire ants.
3 Fractional numbers are parts of litters.

Fire ant activities resulting in litter destruction occurred primarily at night or on overcast days. Of the 16 litters thought desroyed by fire ants, nine were observed alive the previous day or were born during the night before they were found. Two litters were observed in normal condition 48 hours before being found dead, and three litters were less than 48 hours old when found dead. Four of the litters probably killed by fire ants were born in shallow, poorly constructed nests. These were either half above ground or lacked the normal amount of fur lining. The other nests appeared normal.

Two of three nestlings of a 1963 litter were dead and had several small spots on the skin when found. This condition and the pustules that usually developed at sting sites were initially thought to be caused by dermal fungus and bacterial infections. Subsequent observations, however, revealed that fire ant stings caused the small raised spots that later become inflamed and formed small pustules.

Two other litters that had numerous sting pustules survived, indicating that nesting cottontails can occasionally withstand several stings. A litter of three nestlings was found dead a day after it had been observed in good condition. Pustules were scattered over the bodies of each nestling, however, there were no ants in the nest. Two of the nestlings had been dead only a short time, but had lived long enough after the initial stings for large pustules to form at several of the sting sites. This suggests that ants occasionally discontinue an attack or are unable to overcome litters.

It is also noteworthy that four litters killed by causes other than fire ants were not being utilized as food by the ants when the litters were found. Also, I discovered a dead nestling, which had apparently crawled out of its nest; it was being eaten by fire ants, but its litter mates in the nest were unharmed. These incidences suggest that fire ant discovery and predation of cottontail nestlings may be a chance occurrence that is probably influenced by the extent of ant foraging activities.

One litter, scattered approximately one foot away from the nest and being fed on by fire ants, was born during the night or late the previous day before being found. The slightly opened, fur-lined nest contained fire ants. These young could have crawled from the nest after being attacked. However, they may have been removed by the female particularly if an ant attack came while she was attempting to nurse them.

A litter lost due to malnutrition probably died as a result of termination of lactation in the doe during a period of drought.

Of the four litters killed by predators, one was probably eaten by an opposum which I killed in the pens the following night. The three others were killed but not eaten by other rabbits or rodents. This was indicated by tooth marks on the nestlings' heads and bodies. If she were stung around the nipple while nursing the nestlings or if the nestlings jumped and emitted loud cries when they were stung, it is possible that a nursing female killed the nestlings by biting them.

Within a two-day period, nine other juvenile cottontails in three litters were killed shortly after leaving their nests. These mortalities were attributed to spotted skunks, two of which were caught in steel traps outside the perimeter fence shortly thereafter.

During a re-examination of dead nestlings, the discovery of large, robust fly larvae in the decaying tissues suggested another possible cause of mortality. Beule (1940) reported that the larvae of the flesh fly *(Wholfahrtia vigil)* caused myiasis which destroyed two cottontail nests. It was suspected that this was occurring in these studies and that fire ants, coming upon the situation, were feeding on the nestlings that had been killed by fly larvae. I observed a fly larviposit six larvae on the back of a two-day-old nestling that had drowned. The fly departed, the larvae crawled a short distance and penetrated the skin. Larvae taken from this specimen and several other nests were identified as genus *Sarcophaga*. Subsequent daily examinations of the litters failed

to reveal symptoms characteristic of *Wohlfahrtia* parasitism; consequently *Wohlfahrtia vigil* was eliminated as a possible cause of the mortalities.

Results, 200′ x 200′ Pens

Because of the large number of females and the fact that the size of the pens made daily searches impractical, littering sequences were not positively established for the ten females in each of the six pens. The conceptions were somewhat sychronized and I was able to concentrate searches during periods when several litters were expected. I was also unable to follow subsequent events at each nest to the degree followed in the 50′ x 50′ pens.

During the 1965 breeding season, 169 nests that provided usable data were located in the six 200′ x 200′ pens. Eighty-eight of these were unused and litters were born in the remaining 81 nests. Twenty-seven complete litters and parts of two litters successfully departed from the nest. Fire ants probably were responsible for the loss of 41 litters and one nestling of another litter. Table 2 contains a summation of the events following the discovery of the nests.

Table 2. Summation of observations of cottontail rabbit nests in six 200′ x 200′ pens from February through August, 1965

Stage or event	Number
Nest cavities found	169
Nests unused	88
Litters observed	81
Successful (litters)	27 [1] + parts of 2
Litters probably destroyed by fire ants	41 1/3
Litters drowned	4 2/3
Litters destroyed by unknown predator	1
Litters died of abandonment (starvation)	1
Litters died of exposure	1
Litters died of unknown causes	4

Only a few litters of live rabbits with pustules were found and the only litter found under attack by fire ants was pinpointed through the cries of the two-day-old nestlings. Less than ten fire ants were in the nest. They were removed, and the nest was rebuilt with fur from an old nest. The following day several pustules, typical of those caused by fire ant stings, were found on the nestlings. Although none of this litter was recovered when the pens were cleaned out in mid-August, they survived until they were tagged and had left the nest.

Fire ant populations, as indicated by the density of the mounds, might normally be expected to reflect the extent of predation. The mound density in the pens compares with the number (40 to 50 mounds per acre) considered by Hays (1959) as a stable population in good habitat. The mounds counted in each pen are shown in Table 3.

Table 3. Counts of inhabited and uninhabited fire ant mounds in six 200′ x 200′ pens during October, 1965, on the State Game Farm in Prattville, Alabama.

Pen Number	Inhabited Mounds	Uninhabited Mounds	Total Mounds	Cottontail litters Probably Destroyed By Fire Ants
1	40	13	53	16 (64%)
2	33	20	53	6 (75%)
3	22	6	28	2 (33.3%)
4	37	12	49	4 (30.7%)
5	46	20	66	5 1/3 (33.3%)
6	30	13	43	8 (57.1%)

[1] One litter was saved from fire ants.

There appears to be no correlation between mound density and the number of litters thought destroyed in each pen, however this relationship is complicated by overlap of ant foraging areas into adjacent pens.

The measurement of distances from the nests of twenty-nine dead litters to nearby fire ant mounds revealed little that related nest destruction to proximity of ant mounds. The average distance to the nearest mound was 39.6 feet. Three dead litters were found where the closest mounds were 100 plus, 90, and 75 feet away. The nearest mound to a litter probably destroyed by fire ants was 10 feet away.

Much of the evidence relating the dead nestling rabbits with the fire ants that were feeding on them is circumstantial. I found it helpful in analyzing the problems to calculate the shortest period of time prior to death, that litters were known to have been alive. In many instances, this was the period from the time the litter was last observed in apparently good condition. In the majority of the cases, it was the length of time corresponding to the litters age when death occurred. The period of time that the 41 litters were known to have been alive before death was one day for 17 litters, two days for 13 litters, three days for 3 litters, four days for 7 litters, and five days for 1 litter. There were usually clues in each nest that aided in estimating ages of the nestlings at the time of death. Among these were: size and development, amount of hair, weight, nose hump length, ear length, length of tarsus, stomach contents, and the length of time since death if the time of birth was known.

Young of cottonrats (*Sigmadon hispidus*) which build nests similar to those of the cottontail did not appear to fall prey to fire ants. Seven live cottonrat litters and eighteen old nests were found in the 200′ x 200′ pens. No indications of fire ant predation were found and no fire ants were found in old or active cottonrat nests. Johnson (1961:105) noted that newborn young of cottonrats are rarely if ever harmed by imported fire ants, and he suggested that other mammals with precocial young would be free from fire ant depredation. I favor the hypothesis that while early pelage development and a higher degree of precociousness shortly after birth are probably factors limiting fire ant predation on nestling cottonrats, the finely macerated plant material in cottonrat nests is probably a more significant factor in protecting cottonrats less than 3 days of age from fire ants. There is insufficient space for ants to penetrate the plant material in the cottonrat nests whereas the typical cottontail nest is lined with loosely bunched grass or other ground litter that permits easy passage to ants.

Naked cottonrats that happen to stray from their nests are vunerable to attack by ants. I disturbed a cottonrat nest and caught all but one of the young. Within approximately two minutes, the other small rat was located in thick grass about eight feet from the nest. I was able to pinpoint the other one through cries it emitted as two fire ants stung it on its head.

Results in Large Enclosures

During work in large enclosures, 65 nests were found that provided reliable data. Litters, 23 of which were successful, were born in 43 of these nests. Table 4 contains a summation of the information on these nests.

The first encounter with what was thought to be chicken predation occurred following a night observation of nest construction by an adult cottontail. Apparently undisturbed by the author's spotlight, the cottontail made two trips to collect ground litter, primarily pine straw, and packed it in a newly excavated nest cavity. The following morning, a rabbit was flushed from the nest site, but no young or fur lining had been placed in the nest. When the nest was checked the next morning, it had been lined with fur, and the contents of the nest had been removel or scattered. Ground litter for several yards up and down the fence line was also scattered. Chickens that had free run of the

rabbit enclosure were suspected of having destroyed the nest and its contents. I took two day-old nestlings that had been drowned and offered one of these to a rooster and the other to a group of hens. Hens ate both of the nestlings after fighting over and pecking them for about five minutes.

TABLE 4. Summation of observations and reconstructed histories of 65 cottontail nests found in large enclosures during 1963-1966.

Stage or event	Number
Nest cavities found	65
Nests unused	22
Litters born	43
Litters successful	23
Litters probably destroyed by fire ants	10
Litters drowned by heavy rains	4
Litters probably destroyed by chickens	2
Litters destroyed by unknown predator	3
Litters destroyed by farming	1

The ground litter around one other nest probably destroyed by chickens had also been scratched over. The dead nestlings appeared to have been recently pecked to death. They were slightly large (approximately 4 days old) to be consumed whole by chickens and were not eaten.

In addition to nests in pens and enclosures, six active or recently active nests were found at random outside of fenced or enclosed areas. Litters were born in five of the nests. Three of these litters were successful. One was probably destroyed by fire ants, and one was destroyed by a cow.

RESULTS DURING FIELD EXPERIMENTS

Fur on the back, neck, and head of white rats and cottontails of about four days of age and older prevented ants from positioning their abdominal segments near enough to insert their stingers into these areas. These older animals were also better able to crawl under each other and dig down into the bottom of the nest to avoid the ants. With the exception of the simulated nest of three-day-old white rats in which fire ants increased in numbers and caused death after 36 minutes, the events at each nest were similar. Generally, after approximately 20 minutes the ants escaped, were injured, killed, or due to disorientation or entanglement in the fur lining of the nests, gradually decreased in number. After that the nestlings appeared to be resting calmly. Most of the nestlings were stung on the feet, near the nostrils, on the abdomen, and around the anus. White rats 7 days of age and cottontails 6 days of age were not killed by numerous stings on the areas mentioned above.

Lack of fur developed on nestling cottontails and white rats of approximately 3 days of age and younger rendered them defenseless against ant stings. Ants appeared to sting randomly rather than being confined to specific areas as in the case of older animals.

It was estimated that 10 to 30 per cent of the ants shaken into the nest inflicted the stings, while the other ants crawled out of the nest immediately.

It became apparent that this method of introducing ants into a nest did not stimulate normal, ant foraging conditions. Wilson (1962:134) lists nine categories of communication and the responses they trigger in worker fire ants. Four of them appear significantly related to this study. They are: (1) regurgitation which induces a feeding response in other workers, (2) the emission of a chemical secretion from the Dufour's gland as a trail which attracts other workers and induces a

trail following response, (3) a chemical secretion from the Dufour's gland during attack which attracts other ants to disturbed workers, and (4) the emission of a chemical from the head region which triggers alarm behavior.

Although the method used to introduce ants into nests may have triggered several of the other responses, the latter category is thought to have been the major type of communication and response of the ants shaken into the nests from disturbed mounds. Also the method probably caused disorientation among the ants and interfered with the trail laying process from the rabbit nest to the ant mound, and due to the time factor, the subsequent following of these trails by other workers from the disturbed mound.

Wilson (1962:135) described methods of obtaining the pheremone component of the Dufour's gland through steam distillation and chromatographic separation of a petroleum ether extract. His analysis of trail laying, trail following, and other associated behavior through the use of this material provided basic information which aided me considerably in this study.

Fire ants from three large mounds were collected with a vacuum powdered aspirator described by Hill (1962:21). These ants were killed by freezing, ground with mortar and pestle, and an ether extract was made from a steam distillate of their bodies. Day-old white rats were placed in simulated nests without fur linings near mounds from which the ants were collected. Odor trails of the ether extract and filtrate were laid between the simulated nests and the ant mounds by using hypodermic syringes. When the mound was disturbed slightly, ants immediately followed the odor trails and attacked the white rats in the simulated nests located 3′, 4′, and 7′ along a winding trail leading from the mounds. The small rats appeared helpless within five minutes and were dead after 15 minutes. During the process ants increased in number in each nest and ants from the simulated nests were observed returning to the mounds.

DISCUSSION AND CONCLUSION

Generally the events which probably occur in cottontail litters after they are killed by fire ants are as follows: When the nestlings ceased to struggle, the skin and muscular tissues are eaten first, or are most likely carried from the nest by the ants. Small bones, undigested milk, visera, and eyeballs appeared low in preference. A few fire ants could usually be found in the nest two or three weeks after they were first discovered feeding on the nestlings. On one occasion, a fire ant mound was built in the nest after fire ants had fed on nestling cottontails.

Predation problems associated with fire ants appeared to increase in intensity after the onset of warm weather. Hays and Hays (1959:457) found that fire ant activities were impeded at lower temperatures, and that the ants were completely immobilized by temperatures of 4°C. (39.2°F.). Cool night temperatures (40° to 50° F.) of early spring could, therefore, be expected to limit disturbances to cottontail litters born prior to mid-April. Once warm weather arrived, fire ant activities resulting in litter destruction occurred primarily at night or on overcast days. On clear sunny days, dead nestling rabbits exposed to direct sunlight were not fed on as extensively as on overcast days or when the nestlings were shaded or deep in a nest. This agrees with the findings of Wilson and Eads (1949) who reported foraging activities of fire ants in May were greatest from 6:00 p.m. until about 12:00 p.m.

Johnson (1965) suggested that there is a seasonal change in ant food preferences. He used ants to clean raccoon skulls during summer months by placing the skulls in inhabited mounds, but he had little success with this technique during colder months even though ants were active on the surface.

The per cent of litters probably destroyed by fire ants was 15.8 in 50′

x 50′ pens, 50.6 in 200′ x 200′ pens, and 23.2 in large enclosures. The time of year during which the observations were made probably influenced these results. For example, most of the observations in large enclosures were made during March and early April before the vegetation reached a height that interfered with searches for nests. Cool weather appeared to retard ant activity at this time and, perhaps, caused less destruction in enclosures. The comparatively low rate of nest destruction found in 50′ x 50′ pens was probably influenced by constant mechanical disturbance of the active mounds whenever they were encountered.

Observations of cottontail litters and parts of litters that survived fire ant attacks, observations of a litter under ant attack, and observations in which cottontails and white rats were attacked under experimental conditions indicate that fire ants will attack nestling cottontail rabbits. In field tests, fire ants demonstrated their capability of killing nestling cottontails and white rats of approximately 4 days of age or less. The numerous observations in which litters were in good condition one day and were dead and being fed on by fire ants the next day add considerable weight to these conclusions.

Because of the controversial aspects in such a relationship a conservative approach should be followed in reaching any conclusions. One such approach is, through careful evaluation of the data, to accept or reject the hypothesis that factors other than fire ants caused the mortalities.

Avian, reptilian, and most mammalian predators could be eliminated as the cause of nest destruction as they usually eat their kill or leave some identifying marks on the victim. In addition, for the most part, they were excluded or controlled in the penned experiments.

If large insects were involved, it would appear that some would have been observed in the act of killing or found in the nest afterwards. If toxic materials were involved, either secondarily, or through direct contact, tolerance differences to the hypothetical material should have been demonstrated within various litters.

One subscribing to the hypothesis that an undetected factor or factors were responsible for the mortalities must accept the fact that the unknown killer is ineffective against litters reaching the age and development of approximately four days. They must also accept the fact that the unknown killer is less effective against early or first born litters. In addition they must also accept one of the following: (a) the unknown killer has limited distribution, (b) is ineffective against cottontails in their northern range, or (c) similar mortalities have not been detected or reported from the North Central and Northeastern states where most of the research on the cottontail has been conducted. In addition, they must be prepared to accept accompanying inconsistencies in ant feeding behavior with respect to feeding on nestling rabbits. Hays and Hays (1959) reported that insects placed in wire cages near mounds were immediately attacked and killed by ants. Ants readily utilize nestling rabbits for food so it seems unlikely that foraging fire ants would forego their usual stinging attack and wait for the unknown killer to provide them with food.

In view of the above discussion, the hypotheses that factors other than the fire ants caused the mortalities in the study cannot readily be accepted. While some of the data are circumstantial, the alternate hypothesis, that fire ants caused the mortalities in this study, appears more acceptable. Additional research is needed to ascertain the extent of fire ant predation in natural habitat, and its significance in affecting wild cottontail population levels.

Since 1954, year round counts have been made of traffic-killed rabbits along Alabama highways. Between 22,000 and 45,000 miles of road are surveyed each month by biologists and refuge managers of the Alabama Department of Conservation, Game and Fish Division. Results of these surveys were tabulated each month to provide the number of rabbits killed per 1,000 miles. The results indicate that a relatively stable

cottontail population is being maintained. If in fact, population levels are, or appear to be, down from past years, consideration should be given to the many factors involved before blame is placed on the fire ant. Land use changes over the past 25 years have converted much of the previously favorable cottontail habitat into pine forest and pasture land. The carrying capacity of these lands has therefore been reduced for farm game such as the cottontail. Since wild cottontail population levels as indicated by highway counts appear to be relatively stable, one could hardly recommend ant eradication programs, to protect cottontails particularly since the literature indicates that such programs have not been effective. If consideration is given to the importance placed on the cottontail by the average hunter in Alabama, perhaps the only situation where current methods of fire ant control could be justified in rabbit management is in intensively managed rabbit enclosures where rabbits are the prime consideration.

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