

OCCASIONAL PAPERS - No:3

Bureau of Entomology

California Department of Agriculture



CONTENTS

The United States species of fire ants of the genus *Solenopsis*,
subgenus *Solenopsis* Westwood with synonymy of *Solenopsis aurea*
Wheeler. ----- Roy B. Snelling

January 14, 1963

Published By
California Department of Agriculture
Sacramento, California

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THE UNITED STATES SPECIES OF FIRE ANTS OF THE GENUS
SOLENOPSIS, SUBGENUS SOLENOPSIS WESTWOOD,
WITH SYNONYMY OF SOLENOPSIS AUREA WHEELER
(HYMENOPTERA: FORMICIDAE)

Roy R. Snelling*

The true fire ants of the genus Solenopsis, subgenus Solenopsis, rank among those ants which can be justifiably regarded as serious pests. Much publicity has been given to the imported fire ant, S. saevissima (F. Smith), which is the subject of all-out eradication efforts by the United States Department of Agriculture and the various state governments concerned. Although this species is an especially serious pest, the native fire ants may at times be locally just as objectionable.

In the preparation of this paper, I have drawn heavily upon the knowledge and materials of many individuals. For the loan of specimens so necessary in the preparation of the keys, I wish to extend my thanks to Dr. H.E. Evans, Museum of Comparative Zoology at Harvard University; Prof. W. S. Creighton, Rockport, Ontario; Prof. A. C. Cole, University of Tennessee; and Mr. R. H. Crandall of Altadena, California. I especially wish to express my gratitude to Dr. M. R. Smith of the United States National Museum, who has read and criticized this paper and given many helpful suggestions based upon his wide knowledge of ant taxonomy. To Mrs. Iris Savage I am deeply indebted for preparing figures 5 and 6, for inking the remainder, and for typing the manuscript for publication. Thanks are due also to Mr. H. H. Keifer, Program Supervisor, Insect Taxonomy, Bureau of Entomology, California Department of Agriculture, who has offered valuable suggestions during the preparation of this paper.

The biologies of the various species are basically similar. Swarming occurs from May through September, and large numbers of winged females and males may be seen during this period; they are frequently attracted to lights at night. Swarming usually occurs during the evening of a warm day, although S. saevissima, broad sense, is recorded swarming on sunny days in early summer (Green, 1952).

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The queens, after mating, shed their wings and crawl about seeking a suitable nesting site. Most commonly chosen sites are under objects lying on the ground, such as boards, bricks, stones, animal carcasses, logs, pavement and concrete walks. They may at times nest directly within the walls of buildings. An incipient colony may include one or more queens.

If the colony is initiated in a favorable situation, growth is quite rapid and the ants soon make their presence known. The ants invade houses and show particular partiality to foods with high oil content; they do not seem to be attracted to human foods with a high sugar content, but are very fond of the honeydew secretions of aphids and scale insects. They invade stored products in enormous numbers, with a preference for cracked or ground grains, such as barley, corn, maize and rice.

To poultrymen the ants are a threat, since they often attack and kill hatching or newly emerged chicks and turkey poults. Laying hens may at times be so annoyed as to cause a reduction in egg production. In fields and orchards, the fire ants can be especially important since they aggressively tend aphids, coccids and pseudococcids, transport them from plant to plant and defend them from parasites and predators. In addition, they infest fallen nuts and fruits, strip the epidermis from leaves and remove the bark from young fruit trees in order to feed upon the sap flowing from the tissues beneath. The presence of the large mounds in fields frequently makes the harvesting of the field crop difficult, if not impossible (Essig, 1926; Mallis, 1938).

The minor workers of the fire ants are very pugnacious and swarm out in overwhelming numbers when the nest is disturbed. They run about with the abdomen raised and vibrating; when the intruder is located, they swarm upon him, fastening on with their mandibles and then applying the sting with considerable effect. The major workers rarely sting. The effects of fire ant stings are variable, depending upon the species involved, the number of stings received, and the individual stung. The stings of S. aurea Wheeler and S. xyloni McCook are the least painful, while that of S. saevissima (F. Smith), broad sense, is especially bad.

The identification of the various fire ants which occur in the United States is not difficult if one is familiar

with ant taxonomy and has a large series of specimens in his sample, including both major and minor workers. Unfortunately, samples submitted for identification are frequently very limited, and may consist of all castes and forms, or include only one. Existing keys for the fire ants all embody the same shortcomings; they require both major and minor workers and none include characters for separation of the females and males. In the keys presented below I have prepared separate keys for major workers, minor workers, females and males, thus making it possible to identify, with a high degree of probable correctness, specimens on the basis of a single caste or sex.

In the keys given below, each species is identified on the basis of several characters rather than a single character. This is done because of the infraspecific variation which a single character may exhibit. By utilizing multiple characters, the probability of a correct identification is greatly increased.

A KEY TO THE NEARCTIC SPECIES OF SOLENOPSIS, SUBG.
SOLENOPSIS, THE "FIRE ANTS"

MAJOR WORKERS

1. Head large and bilobed; mandibles abruptly curved inward, the teeth often largely aborted or absent (Fig. 1); rudimentary anterior ocellus frequently present; anterior borders of mesopleurae dentate or irregular (South Carolina to Florida, west to Texas; Central America). geminata (Fabr.)

Head of moderate size, only slightly bilobed; mandibles evenly curved, with three or four apical teeth (Fig. 2); rudimentary anterior ocellus lacking; anterior borders of mesopleurae smooth, neither dentate nor irregular.2

2. Antennal scape failing to attain occipital corner by about length of first two funicular segments; front of head with only a few widely scattered punctures; eyes with no more than 50 facets, separated from insertion of mandibles by a distance twice as great as maximum diameter of eyes; petiole with distinct ventral tooth (western Texas to southern California, south into Mexico). . . . aurea Wheeler

Antennal scape length variable; front of head with numerous distinct punctures; eyes with 70 - 80 facets, separated from insertion of mandibles by about $1\frac{1}{2}$ times maximum diameter of eyes; petiole with or without ventral tooth 3

3. Mandibles tridentate, rarely slightly angulate on superior border (Fig. 2); mesoepinotal suture broadly rounded below; dorsal face of epinotum distinctly flattened (Fig. 3); petiole usually with distinct ventral tooth or projection; antennal scape failing to attain occipital corner by about length of first two funicular segments (South Carolina to northwestern Florida, west to California). xyloni McCook

Mandibles tridentate on cutting margin, with a distinct tooth on superior border; mesoepinotal suture V-shaped; dorsal face of epinotum sloping posteriorly (as in Fig. 4); antennal scape failing to attain occipital corner by less than length of first funicular segment (North Carolina to Florida, west to eastern Texas
. saevissima (F. Smith), broad sense

MINOR WORKERS

1. Epinotum laterally carinate (Fig. 5); petiole without ventral tooth or lamella; mesopleurae dull, roughened or striate; anterior border of mesopleurae with several small teeth geminata

Epinotum smooth laterally, not carinate (Fig. 6); petiole with or without ventral tooth or lamella; mesopleurae dull or shining; anterior border of mesopleurae without teeth 2

2. Tip of antennal scape surpassing occipital corner; petiole without ventral tooth or lamella; mesopleurae dull, roughened or striate, densely tessellate. saevissima, broad sense

Tip of antennal scape not attaining occipital corner; petiole with distinct small ventral tooth, lamella frequently present; mesopleurae shining, smooth, neither tessellate nor roughened 3

3. Eyes consisting of about 20 facets; epinotum strongly sloping toward apex, usually without distinct more or less horizontal basal and oblique posterior surfaces (Fig. 7); head, thorax and abdomen concolorous golden yellow aurea

Eyes consisting of about 50 facets; epinotum usually with distinct more or less horizontal basal area which rounds off to posterior slope (Fig. 8); head and thorax yellow to red, abdomen almost always darker xyloni

FEMALES

1. Head distinctly broader than long, occipital border deeply concave medially; mandibles abruptly curved inward; antennal scapes ending much before occipital corners geminata

Head slightly broader than long to slightly longer than broad; occipital border slightly concave medially; mandibles evenly curved; antennal scapes ending near occipital corners or extending beyond . . .2

2. Posterior two-thirds to three-fourths of epinotum distinctly transversely striate; antennal scape ending slightly beyond occipital corner; node of post-petiole distinctly transversely striate on its posterior half; mandibles quadridentate
 saevissima, broad sense

Posterior one-half or less of epinotum with transverse striae; antennal scape ending slightly before occipital corners; node of post-petiole with transverse striae obsolescent or absent; mandibles tri- or quadridentate.3

3. Mandibles quadridentate; petiole with ventral tooth which has a distinct lamella extending caudad; ground color of abdomen concolorous with that of head and thorax aurea

Mandibles tridentate; petiole usually with ventral tooth, but lacking lamella; ground color of abdomen much darker than that of head and thorax . . . xyloni

MALES

1. Ocelli large, separated by about one-third an ocellar diameter; as seen from above, clypeus flat, not projecting between antennal sockets (Fig. 9); ventral carina of petiole not produced into a small projection anteriorly (Fig. 10). geminata

Ocelli small, separated by two-thirds or more times an ocellar diameter; as seen from above, clypeus convex, projecting forward between antennal sockets (Fig. 11); ventral carina of petiole frequently with a small projection (Fig. 12). 2

2. Genae roughened, tessellate, moderately shining; mesosternal suture broad, deeply impressed; head thorax and abdomen uniformly black; legs, except tarsal segments, black. . . . saevissima, broad sense

Genae smooth, polished, with scattered, minute punctures; mesosternal suture a mere thin, unimpressed line; at least sides of thorax distinctly brownish; legs definitely brownish 3

3. Lateral areas of epinotum tessellate, somewhat shining; petiole with anterior tooth ventrally, from which extends caudally a distinct thin lamella; abdomen usually somewhat slightly darker brownish than thorax; genital capsule yellow aurea

Lateral areas of epinotum dull, roughened and striate; petiole with anterior ventral tooth but lacking lamella; abdomen very dark brown, appearing black, little, if any, darker than thoracic dorsum; genital capsule grayish-brown xyloni

Solenopsis (Solenopsis) aurea W. Wheeler

Of the four Nearctic fire ants, this is the least common species so far as available material indicates. It occurs in arid regions of the Southwest from Texas to southern California, south into Mexico. Wheeler separated the mountain populations as the subspecies S. aurea amblychila Wheeler; the major workers of this form are claimed to have the clypeal teeth absent. However, I have examined some of the material (including cotypes) on which the original

description was based and find that the clypeal teeth are present. Admittedly, these teeth are somewhat reduced, but such a distinction would be most tenuous. A subspecies founded upon such little evidence cannot stand under the light of critical examination. In the absence of further supportive characters for this "subspecies" I have no hesitation in placing S. aurea amblychila Wheeler in the synonymy of S. aurea Wheeler (new synonym).

This species is closely allied to S. xyloni McCook and single individuals may be at times very difficult to determine. This is especially true of the minor workers and males. An important criterion for recognition of the worker phases of S. aurea is the uniformly golden yellow color of the entire body. In S. xyloni the abdomen, except in occasional minors, is always darker than the head and thorax which are usually distinctly reddish.

Although Cook (1953) records this species from Visalia, "mountains near Claremont" and Needles, based upon the records published by Wheeler, only the last appears to be correct. No material from the two former localities can be found in the Wheeler collection at the Museum of Comparative Zoology. There are, however, series from these two localities which are now referred to S. xyloni (Evans, in litt.). I have examined the specimens from Needles and am in agreement with the determination made by Wheeler. The series consists of minor workers, females and males. A series of workers (major and minor) has been collected by Mr. R. H. Crandall in lower Rubio Canyon, San Gabriel Mountains, Los Angeles County, California, in July, 1960.

Solenopsis aurea does not appear to be conspicuously present within its range and very little is known of its biology. According to Creighton (1950), "the nests of aurea . . . are usually built in fully exposed positions in dry, coarse, gravelly soil and without any mound of heaped-up material above the nest." This species apparently is not economically important.

Solenopsis (Solenopsis) geminata (Fabricius)
Fire Ant or Tropical Fire Ant

Although the List of Common Names calls this simply "fire ant", the species is more widely known among ento-

mologists as "tropical fire ant". Common names should be a reflection of some distinctive characteristic of the ant's appearance, origin or habits. The name adopted by the Entomological Society of America conveys none of these, since it is applicable to any member of the group. The name long used by myrmecologists is certainly more apropos and is sanctioned by many years of usage.

For many years it has been customary to recognize the variety with a mesosternal spine as S. g. rufa (Jerdon). While I do not see any reason at the present time to argue the validity of this form in other parts of the world, there is no justification for its continued recognition in this country. Within our borders this form acts as a variant, appearing sporadically throughout the distribution of the nominate form and freely intergrading with it. Nest samples containing both forms, and intergrades, have been examined from many parts of the range of S. geminata. There is no area in the United States where S. g. rufa is the dominant form; its occurrence in this country is completely blanketed by that of S. g. geminata. Dr. Creighton (1950) felt that ". . . this behavior may be the result of introduction" and retained the variant as a subspecies. However, nothing is to be gained by our recognition of the variant form in the United States except the continued cluttering of the literature with an unnecessary name. Therefore, it is my suggestion that this name be dropped from our lists of ants, since its continued usage can only create additional confusion.

According to Creighton (1950), "the main range of this insect lies in Central America and the Antilles. In the United States it occurs from Texas to South Carolina. The majority of these records come from areas on or near the coast. As one goes inland the incidence usually decreases except in Florida, where the insect seems to be uniformly distributed over the entire state." There is a very notable tendency for this ant to restrict its distribution not only to areas of relatively mild winters but also to areas where the atmospheric humidity remains quite high. Its occurrence in desert and semi-arid regions seems to be open to question. There are no authenticated records of this species occurring in the far western states. The records published by Wheeler (1908) from the Colorado River area of California, and subsequently repeated by Mallis (1941) and Cook (1953), are almost certainly based

upon misidentifications, since extensive collecting by many myrmecologists in the ensuing years has failed to validate these records. Certainly an ant as aggressive and conspicuous as this species is would not have been missed by persons attempting to establish the fact of its occurrence within the state.

Solenopsis (Solenopsis) xyloni McCook
Southern Fire Ant

Although McCook originally described S. xyloni as a distinct species, W. M. Wheeler considered it as a subspecies of S. geminata (Fabr.). This, however, was a result of his extremely conservative viewpoint; Wheeler placed all the then recognized Nearctic fire ants under that species.

In his "Insects of Western North America", E. O. Essig (1926) followed Wheeler's arrangement and appended the note that "in most of the California records the subspecies maniosa Wheeler was responsible for most of the damage." Creighton (1930) separated S. xyloni from S. geminata and restricted the latter to the common species of the Gulf Coast area from Texas to Florida, Georgia and South Carolina. To S. xyloni was ascribed the subspecies S. x. maniosa.

In 1941, Mallis returned to Wheeler's concept and considered S. xyloni a subspecies of S. geminata, but gave no reason for his action. Creighton (1950) accorded S. xyloni full specific rank and reduced S. x. maniosa to the synonymy. At the same time he elevated S. aurea, previously considered a form of S. xyloni, to full specific rank and attributed to it the subspecies amblychila.

This action on the part of Dr. Creighton was followed by T. W. Cook's "Ants of California" (1953), in which he reversed the latest view of Prof. Creighton and returned to the latter's 1930 system. This remarkable and unjustified action can only confuse an already muddled situation, and it is unfortunate that Cook's volume conveys such an impression of authority for the non-myrmecologists. The best method of dealing with this volume is to disregard entirely the statements of the author as well as the orthography used.

Solenopsis (Solenopsis) saevissima (F. Smith), broad sense
Imported Fire Ant

This species became introduced in the United States around 1918 at Mobile, Alabama. For about ten years the species remained confined to this area; at this time the entire population consisted of the so-called "dark phase" which has been called S. saevissima richteri Forel, a form which comes from the southern portions of the normal range of the species in South America. "Around 1930 a second form, lighter in color and smaller in size, made an appearance and in the ensuing twenty years rose to predominance in the population. With the appearance of the light phase the species as a whole commenced a rapid spread . . ." (Wilson and Brown, 1958). This species is now reported over a very large area in the southeastern United States from North Carolina south to Florida and west to Texas and Arkansas.

The populations of this ant which are now present in this country consist almost entirely of the "light phase" which is not equivalent to S. saevissima richteri Forel. Since the now dominant form apparently originated in the "blend zone" of the species in South America, Wilson (1952) has referred the introduced populations to the species, but not to a subspecies. Thus, it becomes apparent that we should simply refer to the imported fire ant as Solenopsis saevissima (F. Smith), broad sense, and not as S.s. richteri Forel.

Perhaps the most interesting phenomenon resulting from the introduction of this species has been the reaction of the two species of fire ants native to the area ". . . S. xyloni has been almost completely eliminated within the range of S. saevissima," while ". . . S. geminata, which shows color variation parallel to that of saevissima, has survived primarily because its dark phase is able to nest in woodland, where saevissima is scarce to absent." (Wilson and Brown, 1958).

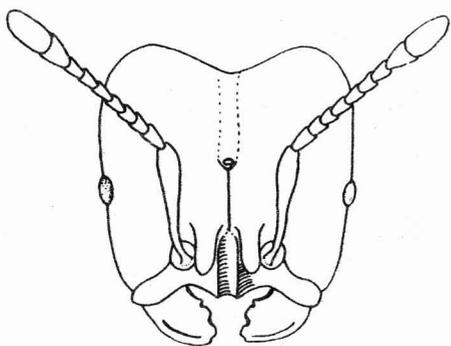
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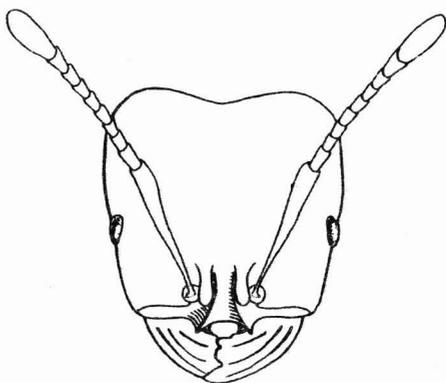
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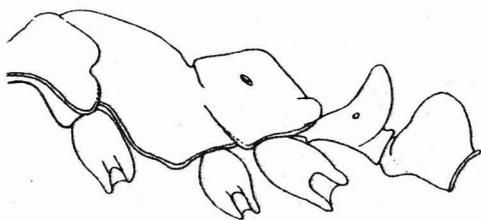
- Fig. 1. S. geminata, major worker. Anterior aspect of head.
2. S. xyloni, major worker. Anterior aspect of head.
3. S. xyloni, major worker. Lateral aspect of thorax.
4. S. saevissima, major worker. Lateral aspect of thorax.
5. S. geminata, minor worker. Dorsal aspect of epinotum.
6. S. xyloni, minor worker. Dorsal aspect of epinotum.



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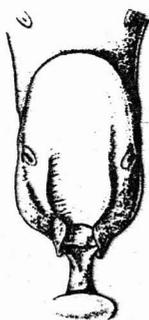
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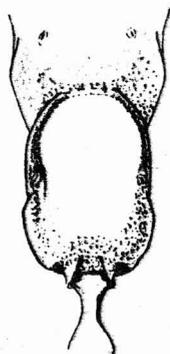
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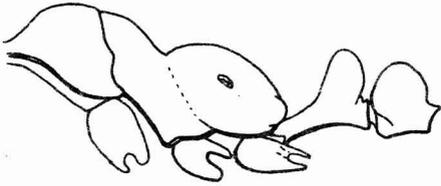


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- Fig. 7. S. aurea, minor worker. Lateral aspect of thorax.
8. S. xyloni, minor worker. Lateral aspect of thorax.
9. S. geminata, male. Dorsal aspect of head.
10. S. geminata, male. Lateral aspect of petiole.
11. S. xyloni, male. Dorsal aspect of head.
12. S. xyloni, male. Lateral aspect of petiole.



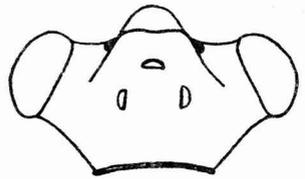
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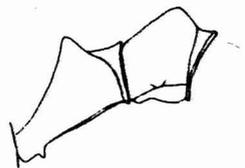
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