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THE FIRE ANTS (SOLENOPSIS) OF FLORIDA  
(HYMENOPTERA: FORMICIDAE)<sup>1</sup>

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INTRODUCTION: SOLENOPSIS IS A WORLDWIDE GENUS OF ANTS, PERHAPS MOST NOTORIOUS FOR PUGNACIOUS MEMBERS OF THE SUBGENUS SOLENOPSIS, OR FIRE ANTS. THIS SUBGENUS IS RESTRICTED TO THE NEW WORLD WITH 5 SPECIES OCCURRING IN THE UNITED STATES. PRESENTLY, ONLY 2 SPECIES OF THE SUBGENUS SOLENOPSIS ARE KNOWN TO OCCUR IN FLORIDA: SOLENOPSIS INVICTA BUREN, THE RED IMPORTED FIRE ANT, AND S. GEMINATA (FABRICIUS), THE TROPICAL OR NATIVE FIRE ANT. S. XYLONI MCCOOK, THE SOUTHERN FIRE ANT, WAS REPORTED ONLY ONCE FROM EXTREME NORTHWEST FLORIDA (SMITH, 1933) BEFORE THE INVASION BY S. INVICTA. THE OTHER U.S. MEMBERS OF THE SUBGENUS ARE S. RICHTERI FOREL, THE BLACK IMPORTED FIRE ANT, KNOWN IN THE UNITED STATES ONLY FROM NORTHERN ALABAMA AND NORTHERN MISSISSIPPI (BUREN, 1972), AND S. AUREA WHEELER, KNOWN ONLY FROM THE SOUTHWESTERN STATES (CREIGHTON, 1950). TWO OTHER SUBGENERA OF SOLENOPSIS (EUOPHTHALMA, DIPLORHOPTRUM) ARE PRESENT IN THE UNITED STATES, BUT ARE SMALLER IN SIZE AND RELATIVELY INNOCUOUS TO MAN. THE FIRE ANTS OF FLORIDA WERE TREATED BY DENMARK (1962) IN ENTOMOLOGY CIRCULAR No. 3, BUT SINCE THAT TIME SOME CHANGES, ESPECIALLY IN NOMENCLATURE, HAVE BEEN MADE. BECAUSE EXISTING KEYS TO THE SUBGENUS SOLENOPSIS ARE OFTEN MISLEADING AND BASED ON INVALID CHARACTERS, A NEW KEY TO THE FLORIDA SPECIES IS GIVEN.

IDENTIFICATION: THE MUDDLED TAXONOMY OF THE GENUS SOLENOPSIS, THE "CRUX MYRMECOLOGORUM" (CREIGHTON, 1930), WAS PARTIALLY CLARIFIED BY BUREN (1972). HE DISCUSSED THE TAXONOMY OF 6 SPECIES IN SOUTH AND NORTH AMERICA, AND DEMONSTRATED THAT 2 SPECIES OF IMPORTED FIRE ANTS (RICHTERI, INVICTA) WERE PRESENT IN THE UNITED STATES AS A RESULT OF AT LEAST 2 SEPARATE INTRODUCTIONS FROM SOUTH AMERICA. THE 3 SPECIES REPORTED TO OCCUR IN FLORIDA, S. INVICTA, S. XYLONI, AND S. GEMINATA, ARE USUALLY THOUGHT TO BE POLYMORPHIC, BUT A SIZE CONTINUUM IS ACTUALLY REPRESENTED. THE TERMS MAJOR, MEDIA, MINOR, AND MINIMUM ARE USED FOR CONVENIENCE ONLY. THE TERM MAJOR ARBITRARILY REFERS TO THE LARGEST WORKERS PRESENT IN A COLONY.

- 1. PETIOLE WITH 2 NODES (FIG. 1, 2); ANTENNA 10-SEGMENTED, WITH A VERY DISTINCT 2-SEGMENTED APICAL CLUB (FIG. 1, 3, 4, 5); CLYPEUS WITH 2 LONGITUDINAL RIDGES OR KEELS WHICH EXTEND FORWARD INTO TEETH (FIG. 3, 4, 5); PROPODEUM WITHOUT SPINES OR TEETH (FIG. 1, 6, 7, 8, 9, 10) . . . . . (GENUS SOLENOPSIS) 2
- 1'. WITHOUT ABOVE COMBINATION OF CHARACTERS . . . . . OTHER ANTS
- 2. USUALLY LARGER ANTS, 1.6-6 MM; SECOND AND THIRD FUNICULAR JOINTS OF ANTENNAE AT LEAST 1 1/2 TIMES LONGER THAN BROAD (FIG. 4) . . . . . (SUBGENUS SOLENOPSIS) 3
- 2'. SMALLER ANTS, 1.5-2.2 MM; SECOND AND THIRD FUNICULAR JOINTS OF ANTENNAE BROADER THAN LONG . . . . . SUBGENERA EUOPHTHALMA AND DIPLORHOPTRUM
- 3. MAJORS WITH DISPROPORTIONATELY LARGE HEAD (FIG. 11), THE OCCIPITAL LOBES PRONOUNCED (FIG. 3); ALL SIZE WORKERS WITH ELEVATED CARINAE (RIDGES) ON EITHER SIDE OF THE BASAL FACE OF THE PROPODEUM (FIG. 6, 7); MESOPLEURAL FLANGE BROKEN INTO VARIOUS PROJECTIONS (FIG. 13, 14); MEDIAL CLYPEAL TOOTH ABSENT (FIG. 3, 4) . . . . . S. GEMINATA (FABRICIUS)
- 3'. MAJORS WITH MEDIUM SIZED HEAD WITH THE OCCIPITAL LOBES ONLY MODERATELY ENLARGED (FIG. 5, 12); ALL SIZE WORKERS WITHOUT ELEVATED CARINAE ON BASAL FACE OF PROPODEUM (FIG. 8, 9, 10); MESOPLEURAL FLANGE ENTIRE OR ABSENT, NOT BROKEN INTO JAGGED PROJECTIONS (FIG. 1, 9); MEDIAL CLYPEAL TOOTH PRESENT OR ABSENT . . . . . 4
- 4. PETIOLE USUALLY WITH DISTINCT ANTERO-VENTRAL TOOTH (FIG. 10); MESOPLEURON FINELY SCULPTURED (FIG. 9); MEDIAL CLYPEAL TOOTH ABSENT; IN MAJOR, ANTENNAL SCAEP EXTENDING HALF WAY BETWEEN POINT OF INSERTION AND OCCIPITAL LOBES . . . . . S. XYLONI MCCOOK
- 4'. PETIOLE USUALLY WITHOUT A DISTINCT TOOTH, AT MOST A SLIGHT KNOB PRESENT (AS IN FIG. 2); MESOPLEURON DENSELY SCULPTURED (FIG. 1, 8); MEDIAL CLYPEAL TOOTH USUALLY PRESENT (FIG. 5); IN MAJOR, ANTENNAL SCAPE NEARLY REACHING OCCIPITAL LOBE . . . . . S. INVICTA BUREN

IN GENERAL, S. GEMINATA AND S. XYLONI HAVE MORE ERECT HAIRS THAN S. INVICTA, ESPECIALLY IN THE MAJOR WORKERS. GENERALLY S. INVICTA BUILDS HIGHER, MORE CONICAL MOUNDS THAN THE 2 NATIVE SPECIES, BUT THIS VARIES CONSIDERABLY WITH SOIL TYPE AND MOISTURE CONDITIONS. COLORATION VARIES CONSIDERABLY IN ALL 3 SPECIES, FROM RED TO BLACK IN S. GEMINATA, FROM YELLOW TO REDDISH BROWN IN S. XYLONI, AND FROM REDDISH BROWN TO DARK BROWN IN S. INVICTA. THE DARK BROWN COLOR VARIETY OF S. INVICTA HAS SOMETIMES BEEN CALLED THE "INTERMEDIATE BROWNS" BY WRITERS WHO BELIEVE THIS COLOR FORM REPRESENTS HYBRIDS BETWEEN S. INVICTA AND S. RICHTERI. HOWEVER, THE DARK VARIANTS OCCUR THROUGHOUT THE KNOWN RANGE OF S. INVICTA, BOTH IN THE UNITED STATES AND IN SOUTH AMERICA, AND SINCE THE RANGES OF THE 2 SPECIES BARELY OVERLAP (FIG. 15), INTERMEDIATE COLOR FORMS CANNOT BE EXPLAINED BY HYBRIDIZATION.

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OTHER CHARACTERS WHICH HAVE BEEN USED IN KEYS ARE INVALID. THE RELATIVE ANTENNAL LENGTH, THE DEGREE OF CURVATURE OF THE MANDIBLES, AND THE NUMBER OF MANDIBULAR TEETH VARIES WITH WORKER SIZE. THE ABSENCE OF MANDIBULAR TEETH, USED AS A KEY CHARACTER FOR S. GEMINATA, IS AGE DEPENDENT, THE TEETH BEING WORN DOWN WITH USE. CREIGHTON (1930, 1950) USED THE TERM "MESOSTERNAL SPINE" FOR THE MESOPLEURAL FLANGE. THIS TERM IS INCORRECT MORPHOLOGICALLY AND MOREOVER A TRUE SPINE-LIKE PROCESS ONLY OCCURS IN S. GEMINATA RUFA (JERDON), A SUBSPECIES APPARENTLY LIMITED TO THE OLD WORLD AND THE PACIFIC OCEANIC ISLANDS. THE REDDISH FORM OF S. GEMINATA WHICH OCCURS IN THE UNITED STATES DOES NOT HAVE THIS SPINE.

DISTRIBUTION: S. GEMINATA WAS REPORTED THROUGHOUT THE STATE (SMITH, 1930, 1933; WHEELER, 1932). S. XYLONI HAS BEEN REPORTED ONLY FROM THE PANHANDLE, BUT MAY STILL EXIST IN ISOLATED AREAS IN EXTREME NORTHERN FLORIDA. BOTH S. GEMINATA AND S. XYLONI ARE NOW ABSENT FROM LARGE AREAS WHERE THEY WERE ONCE ABUNDANT BECAUSE OF PRESSURE FROM S. INVICTA AND INSECTICIDE TREATMENTS. S. INVICTA IS REPORTED FROM ALL COUNTIES EXCEPT DIXIE, GILCHRIST, AND MONROE, AND THE ENTIRE STATE IS NOW UNDER QUARANTINE REGULATIONS (USDA, 1976).

BIOLOGY: THESE SPECIES OF ANTS BUILD MOUNDS WHICH MAY, IN THE CASE OF S. INVICTA, BE UP TO 60 CM TALL AND 60 CM IN DIAMETER AT THE BASE. THE COLONIES MAY BE EXTREMELY LARGE; MOUNDS OF S. INVICTA MAY CONTAIN UP TO ONE-QUARTER MILLION WORKERS. NEW COLONIES ARE USUALLY STARTED BY MATED QUEENS AFTER MATING FLIGHTS. COLONIES MAY ALSO BE ESTABLISHED BY TRANSPORTATION OF PORTIONS OF COLONIES IN NURSERY STOCK OR FILL DIRT. ALL 3 SPECIES ARE HIGHLY PREDACEOUS BUT ALSO FEED ON SUGAR, HONEYDEW, OR CARRION. S. INVICTA IS MORE AGGRESSIVE AND MORE PUGNACIOUS THAN THE 2 NATIVE SPECIES. SEVERAL STUDIES HAVE SHOWN THAT S. INVICTA DISPLACES THE 2 NATIVE SPECIES (WHITCOMB ET AL., 1972; ROE, 1973; NAVES, 1974). ECOLOGICAL DISTURBANCES (INSECTICIDE TREATMENTS, ROAD BUILDING, ETC.) FAVOR REINFESTATION BY S. INVICTA OVER ALL OTHER ANTS, INCLUDING THE 2 NATIVE FIRE ANTS.

ECONOMIC IMPORTANCE: ALL 3 SPECIES STING, INJECTING VENOM WHICH CAUSES FIERY ITCHING, PUSTULES (ESPECIALLY S. INVICTA), AND SOMETIMES MORE SEVERE REACTIONS INCLUDING ANAPHYLACTIC SHOCK. IN SEVERE CASES, IF MEDICAL ASSISTANCE IS NOT RECEIVED, THE INDIVIDUAL MAY DIE (LOFGREN ET AL., 1975). ALL 3 SPECIES, ESPECIALLY S. INVICTA BECAUSE OF THE LARGER COLONY SIZE, CAUSE PROBLEMS IN LAWNS, PASTURES, AND ROADSIDES. ECONOMIC LOSSES HAVE BEEN ATTRIBUTED TO THE 3 SPECIES, PARTICULARLY S. INVICTA, IN THE HARVESTING OF SOYBEANS, HAY, AND OTHER CROPS, DEATH OF YOUNG LIVESTOCK, AND SMALL GAMEBIRDS. NURSERY STOCK, SOILS, LOGS, ETC., FROM AREAS INFESTED WITH S. INVICTA, MUST BE CERTIFIED ANT-FREE TO BE SHIPPED TO NON-INFESTED AREAS. TWO CHEMICALS ARE CURRENTLY REGISTERED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY FOR CONTROL OF IMPORTED FIRE ANTS. MIREX, A DELAYED TOXICANT, FORMULATED IN A CORNCOB GRIT-SOYBEAN OIL BAIT CONTAINING 0.3% MIREX, IS APPLIED BY AIRCRAFT AT A RATE OF 1.25 LB/ACRE (BULK RATE). MIREX BAIT, FORMULATED TO CONTAIN 0.15% MIREX, MAY BE APPLIED AT A RATE OF 2.5 LB/ACRE (BULK RATE) WITH GROUND EQUIPMENT. CHLORDANE, A CONTACT TOXICANT, MAY BE APPLIED AS A DRENCH FOR NURSERY STOCK OR APPLIED AS GRANULAR MATERIAL OR A DUST FOR TREATING LAWNS, ROADSIDES, AND OTHER NON-FOOD OR FORAGE PRODUCING AREAS AT A RATE OF 1.5 LB/ACRE (ACTUAL TOXICANT).

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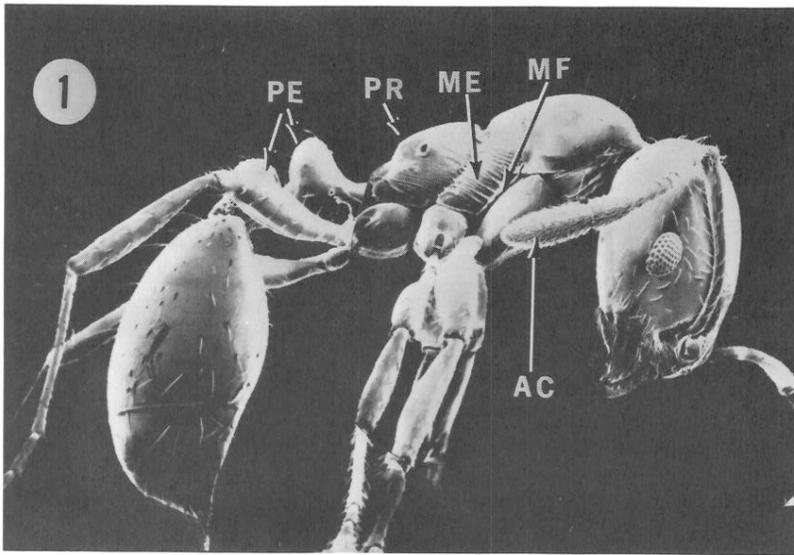


FIG. 1. SOLENOPSIS INVICTA. MEDIA WORKER (260X).  
AC: ANTENNAL CLUB, ME: MESOPLEURON, MF: MESOPLEURAL FLANGE, PE: PETIOLE, PR: PROPODEUM.

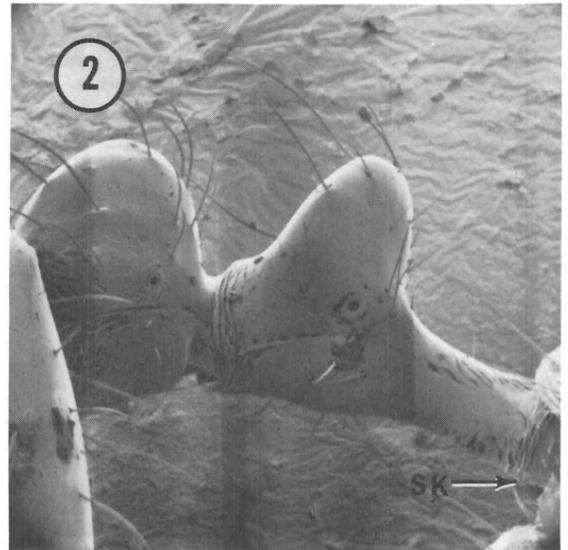


FIG. 2. SOLENOPSIS GEMINATA. TWO NODES OF PETIOLE BETWEEN THORAX AND GASTER (ABDOMEN) (140X). SK: SLIGHT KNOB.

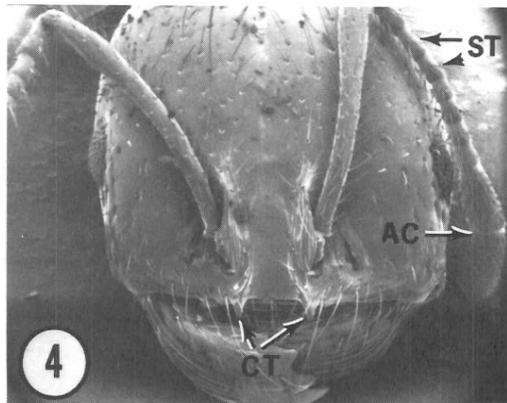
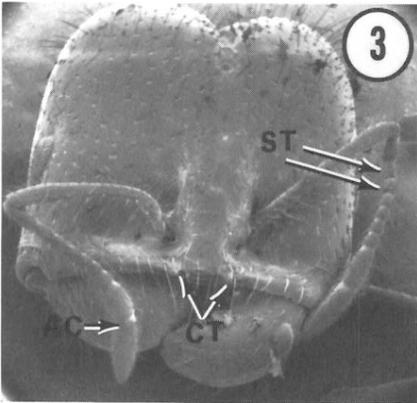


FIG. 3-4. SOLENOPSIS GEMINATA. FIG. 3. HEAD OF MAJOR WORKER (25X). FIG. 4. HEAD OF MINOR WORKER (46X). AC: ANTENNAL CLUB, CT: CLYPEAL TEETH, ST: SECOND AND THIRD FUNICULAR JOINTS.

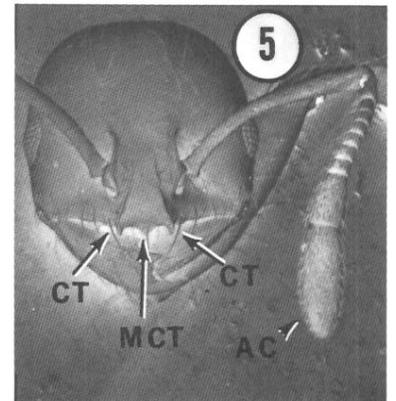


FIG. 5. SOLENOPSIS INVICTA. HEAD OF MINOR WORKER (46X). AC: ANTENNAL CLUB, CT: CLYPEAL TOOTH, MCT: MEDIAL CLYPEAL TOOTH.

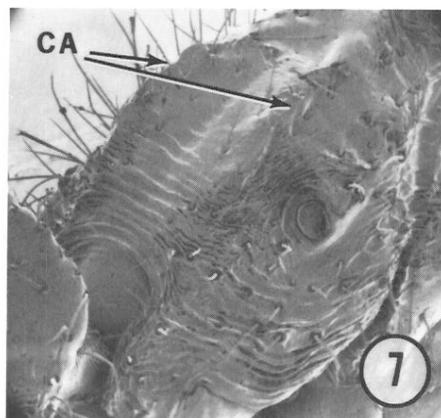
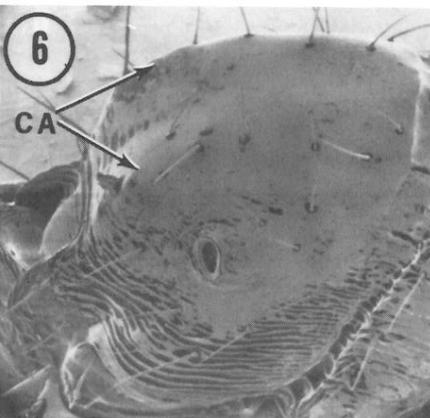


FIG. 6-7. SOLENOPSIS GEMINATA. PROPODEUM OF MINOR WORKER AT 156X (FIG. 6) AND MAJOR WORKER AT 82X (FIG. 7). CA: CARINAE.

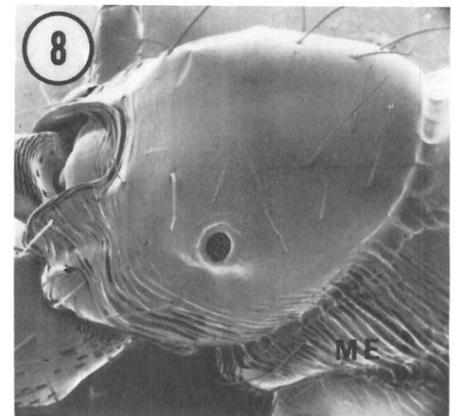


FIG. 8. SOLENOPSIS INVICTA. PROPODEUM OF MINOR WORKER (128X). ME: MESOPLEURON.

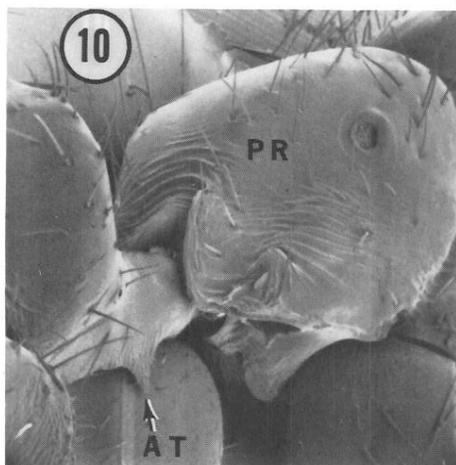
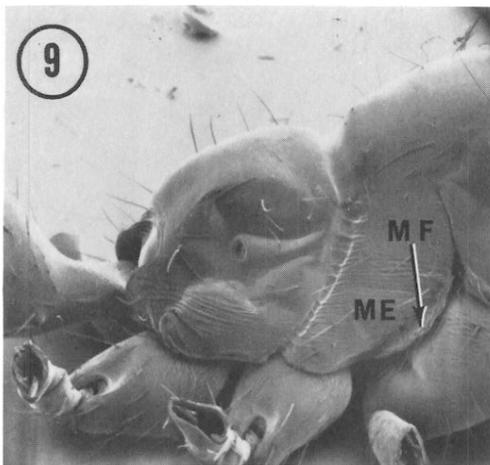


FIG. 9-10. *SOLENOPSIS XYLONI*.

FIG. 9. MESOPLEURAL AREA AND PROPODEUM (94X). ME: MESOPLEURON, MF: MESOPLEURAL FLANGE.

FIG. 10. PROPODEUM (PR) AND FIRST PETIOLAR NODE SHOWING ANTEROVENTRAL TOOTH (AT) (101X).



FIG. 11. *S. GEMINATA* HEAD AND ALITRUNK OF MAJOR



FIG. 12. *S. INVICTA* HEAD AND ALITRUNK OF MAJOR

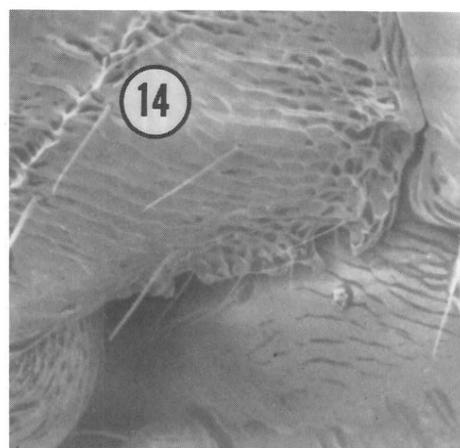
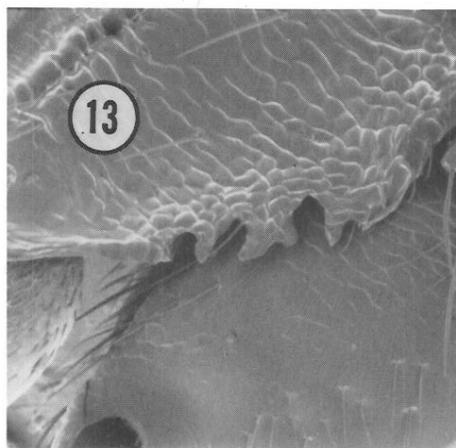


FIG. 13-14. *SOLENOPSIS GEMINATA*. VARIATION IN MESOPLEURAL FLANGE. FIG. 13. 199X. FIG. 14. 228X

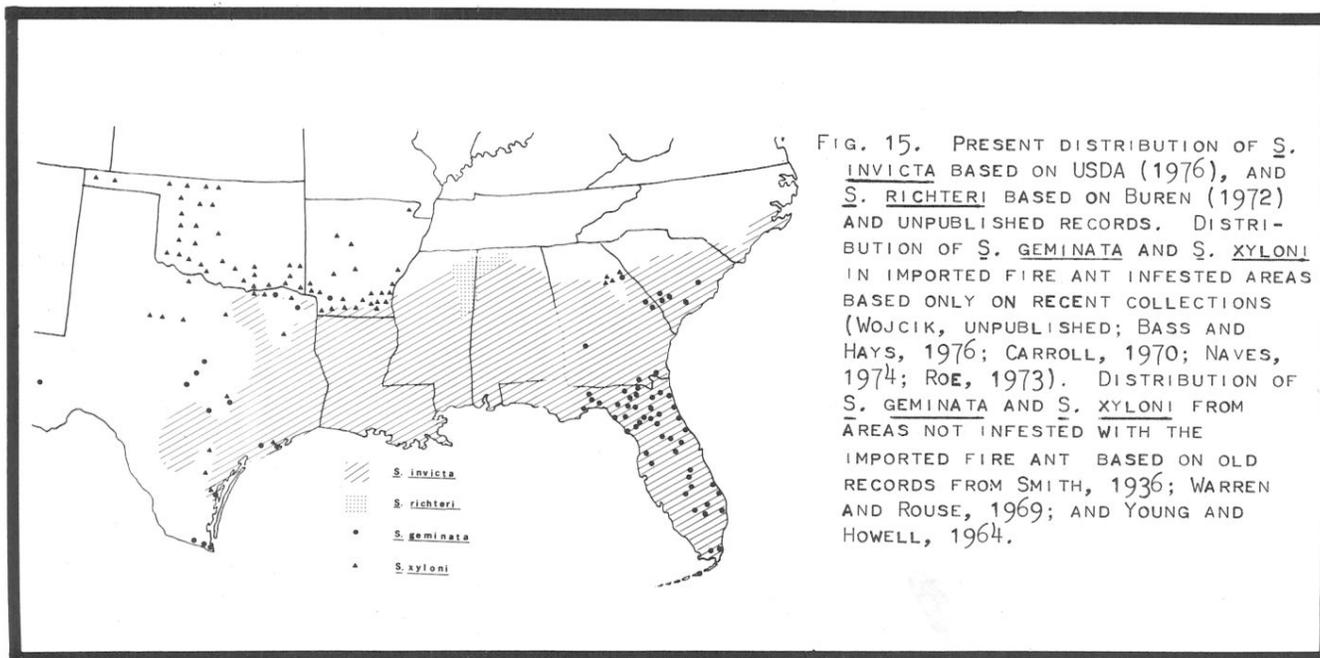


FIG. 15. PRESENT DISTRIBUTION OF *S. INVICTA* BASED ON USDA (1976), AND *S. RICHTERI* BASED ON BUREN (1972) AND UNPUBLISHED RECORDS. DISTRIBUTION OF *S. GEMINATA* AND *S. XYLONI* IN IMPORTED FIRE ANT INFESTED AREAS BASED ONLY ON RECENT COLLECTIONS (WOJCIK, UNPUBLISHED; BASS AND HAYS, 1976; CARROLL, 1970; NAVES, 1974; ROE, 1973). DISTRIBUTION OF *S. GEMINATA* AND *S. XYLONI* FROM AREAS NOT INFESTED WITH THE IMPORTED FIRE ANT BASED ON OLD RECORDS FROM SMITH, 1936; WARREN AND ROUSE, 1969; AND YOUNG AND HOWELL, 1964.