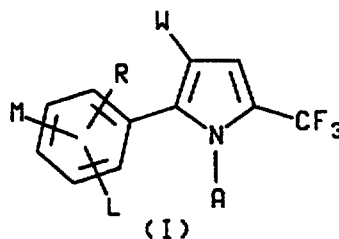


**PROCESS FOR THE PREPARATION OF 2-ARYL-1-SUBSTITUTED-
5-(TRIFLUOROMETHYL)PYRROLE COMPOUNDS USEFUL AS
INSECTICIDAL, ACARICIDAL AND NEMATOCIDAL AGENTS AND
AS INTERMEDIATES FOR THE MANUFACTURE OF SAID AGENTS**

In view of the fundamental utility of certain arylpyrrole compounds for the control of insect, acarid and nematode pests and for the protection of important agronomic crops from the ravages of said pests, more
5 methods of preparation of said arylpyrrole compounds are needed. It is an object of this invention to provide an efficient and effective single step process for the preparation of insecticidal 2-aryl-1-substituted-5-(trifluoromethyl)pyrrole compounds.

10 The present invention relates to a process for the preparation of arylpyrrole compounds of formula I

15



20

wherein A is C_1-C_6 alkyl, phenyl or C_1-C_6 alkyl substituted with phenyl;

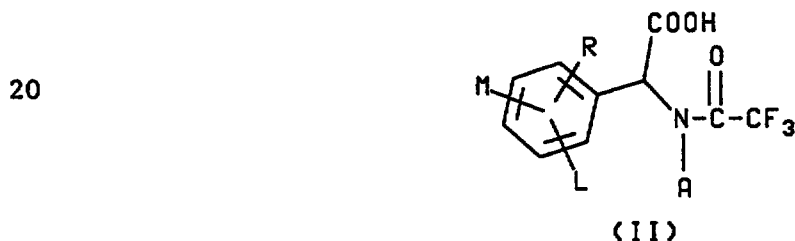
W is CN, NO_2 or $COOR_1$;

L is hydrogen or halogen and

M and R are each independently hydrogen, C_1-C_4 alkyl,

5 C_1-C_4 alkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 alkylsulfonyl, CN, NO_2 , halogen, CF_3 , R_2CF_2Z , R_3CO or NR_4R_5 and when M and R are on adjacent positions they may be taken together with the carbon atoms to which they are attached to form a ring in which MR represents the structure

$-OCH_2O-$, $-OCF_2O-$ or $-CH=CH-CH=CH-$;
 Z is $S(O)_n$ or O;
 10 R_1 is C_1-C_6 alkyl, C_3-C_6 cycloalkyl or phenyl;
 R_2 is hydrogen, F, CHF_2 , $CHFCl$ or CF_3 ;
 R_3 is C_1-C_4 alkyl, C_1-C_4 alkoxy or NR_3R_4 ;
 R_4 is hydrogen or C_1-C_4 alkyl;
 R_5 is hydrogen, C_1-C_4 alkyl or R_6CO ;
 15 R_6 is hydrogen or C_1-C_4 alkyl; and
 n is an integer of 0, 1 or 2 which comprises reacting a 2-arylamino acid compound of formula II



wherein A, L, M and R are as defined above with about
 25 one molar equivalent of a 1,3-dipolarophile of formula III



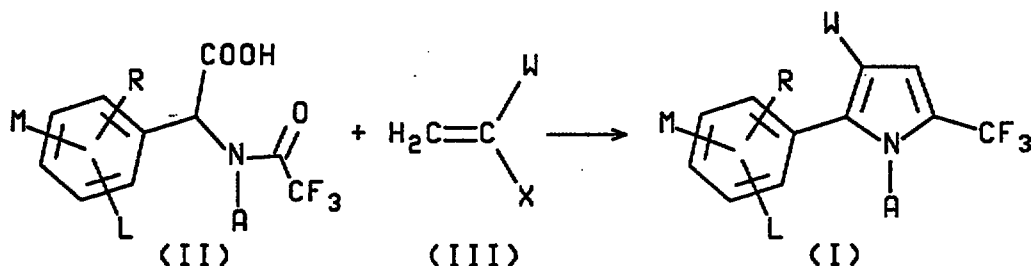
wherein X is Cl or Br and W is defined above and at least one molar equivalent of an organic base in the presence of an acid anhydride and a solvent at an elevated temperature.

The product arylpyrrole compounds of formula I are highly useful as insecticidal, acaricidal and nematocidal agents and, further, are important intermediates in the manufacture of certain insecticidal arylpyrrole compounds. Compounds of formula II and a method for the preparation thereof are described in copending U.S. application Serial Number 06/634,287.

Advantageously, it has been found that a 2-arylamino acid compound of formula II efficiently undergoes a one step 1,3-cycloaddition to form a 5-membered heterocyclic compound of formula I.

Hence, arylpyrrole compounds of formula I may be prepared by reacting a 2-arylamino acid compound of formula II with about one molar equivalent of a 1,3-dipolarophile of formula III and at least one molar equivalent of an organic base in the presence of an acid anhydride and a solvent, preferably at an elevated temperature. The reaction is shown in flow diagram I

FLOW DIAGRAM I



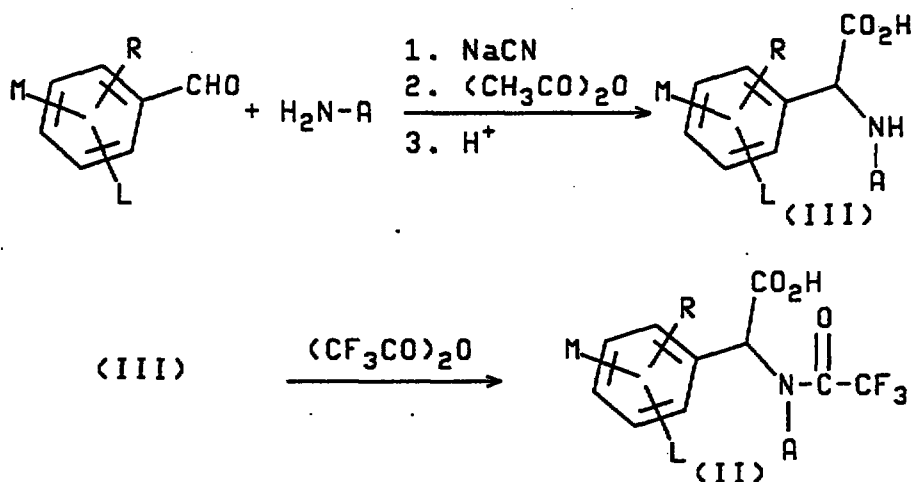
Solvents that may be used in the method of invention include aprotic organic solvents for example nitriles such as acetonitrile; esters such as ethyl acetate, methyl propionate and the like; ethers such as diethyl ether, tetrahydrofuran, dioxane, ethylene

glycol dimethyl ether and the like; halogenated hydrocarbons such as methylene chloride, 1,2-dichloroethane, chloroform, 1,1,1-trichloroethane, carbon tetrachloride and the like; carboxylic acid amides such as N,N-
5 dimethylformamide, N-methylpyrrolidinone and the like; sulfoxides such as dimethyl sulfoxide; sulfones such as tetramethylene sulfone; aromatic hydrocarbons such as benzene, toluene, xylene and the like; halogenated aromatic hydrocarbons such as chlorobenzene, o-di-
10 chlorobenzene and the like. One of the preferred organic solvents is acetonitrile. Acid anhydrides suitable for use in the method of invention are lower-alkyl anhydrides such as acetic anhydride. Among the organic bases that may be used in the inventive method
15 are pyridine, morpholine, tri(C₁-C₄)alkylamine, hexamethylenetetramine, dimethylamino pyridine and the like. A preferred organic base is a tri(C₁-C₄)alkylamine such as triethylamine.

The rate of formation of the formula I
20 arylpyrrole is directly related to the reaction temperature. Lower reaction temperatures result in increased reaction time. Advantageously, it has been found that elevated temperatures such as about 30°-100°C, preferably 50°-90°C result in efficient
25 product formation.

Compounds of formula II may be prepared via condensation of the appropriate arylaldehyde with cyanide and a suitable amine to form the corresponding amino nitrile, which is acetylated and hydrolyzed to
30 form the amino acid intermediate of formula III, which is then trifluoroacetylated to obtain the desired formula II compound as shown in Flow Diagram II.

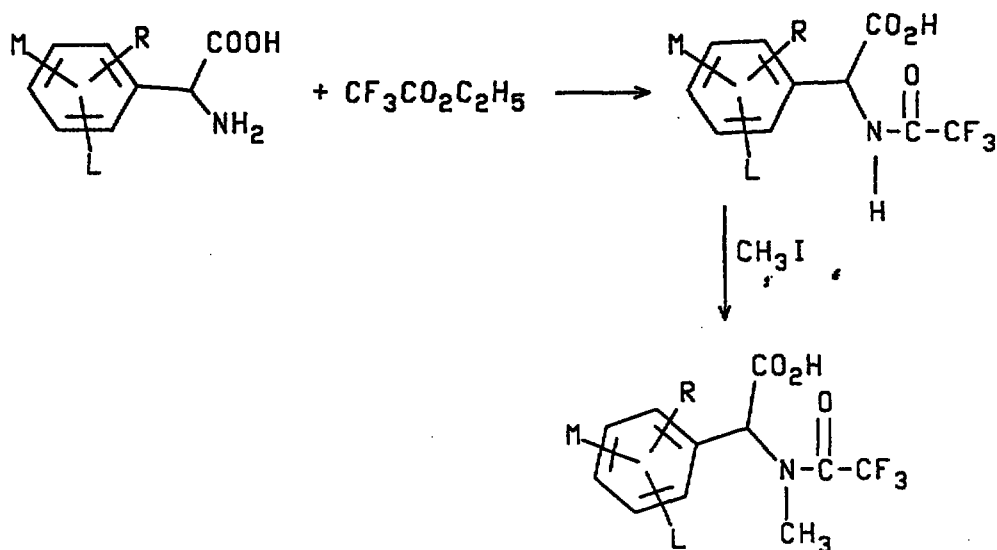
FLOW DIAGRAM II



Compounds of formula II may also be prepared via trifluoroacetylation of the appropriate arylglycine precursor followed by alkylation of the thus-obtained compound using an alkylating agent such as a lower alkylhalide. Using methyl iodide as the alkylating agent, the reaction sequence is illustrated in flow diagram III.

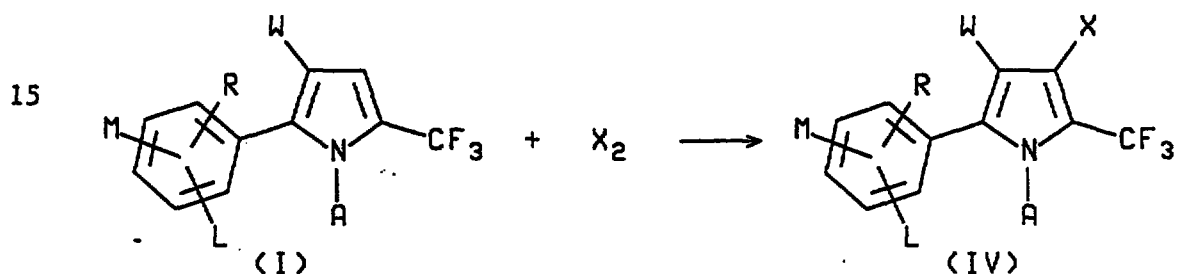
15

FLOW DIAGRAM III



Compounds of formula I are useful for the control of insect, acarid and nematode pests and for protecting growing and harvested crops from the ravages of said pests. Compounds of formula I are also useful as key intermediates in the manufacture of certain insecticidal arylpyrrole compounds. For example, compounds of formula I may be halogenated to afford the corresponding 2-aryl-4-halopyrrole insecticidal agents of formula IV as shown in flow diagram IV.

FLOW DIAGRAM IV



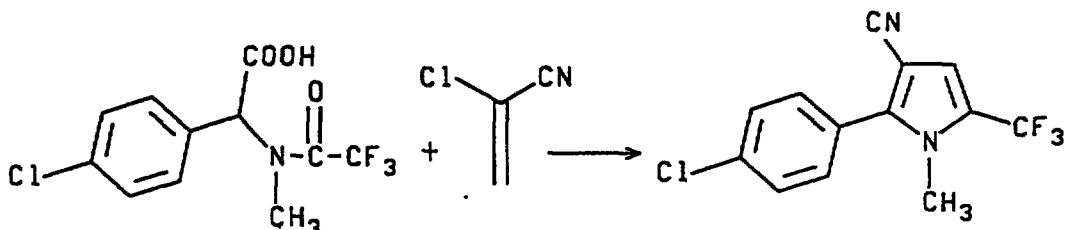
20 By varying the substituents A, W, L, M and R and the halogen, X₂, numerous possible insecticidal arylpyrroles may be prepared from the key intermediate compound of formula I.

25 In order to facilitate a further understanding of the invention, the following examples are set forth primarily for the purpose of illustrating certain more specific details thereof. The invention is not to be limited thereby except as defined in the claims.

30 The term HPLC designates high pressure liquid chromatography.

EXAMPLE 1

Preparation of 2-(p-Chlorophenyl)-1-methyl-5-(trifluoromethyl)pyrrole-3-carbonitrile



A mixture of 2-(p-chlorophenyl)-N-(trifluoroacetyl)sarcosine (147.7 g, 0.50 mol) in acetonitrile is treated dropwise with α -chloroacrylonitrile (54.7 g, 0.62 mol) and acetic anhydride (153 g, 1.5 mol), stirred vigorously, treated dropwise with triethylamine (58.1 g, 0.57 mol) at 56-60°C over a 1 1/4 hour period, heated at 60°C for 16 hours and concentrated in vacuo to give a residue. The residue is partitioned between ethyl acetate and water. The organic phase is concentrated in vacuo to afford an amber solid residue. Said solid is purified by flash chromatography (silica; ethyl acetate/hexanes) and recrystallized from methanol to give the title product as a pale yellow solid, mp 129.5-130.5°C.

20

EXAMPLE 2

Preparation of 2-Aryl-1-(substituted)-5-(trifluoromethyl)pyrrole compounds

Using essentially the same procedure described in Example 1 and substituting the appropriate 2-aryl-N-(trifluoroacetyl)substrate and suitable 1,3-dipolarophile yields the title products shown in Table I.

25

TABLE I

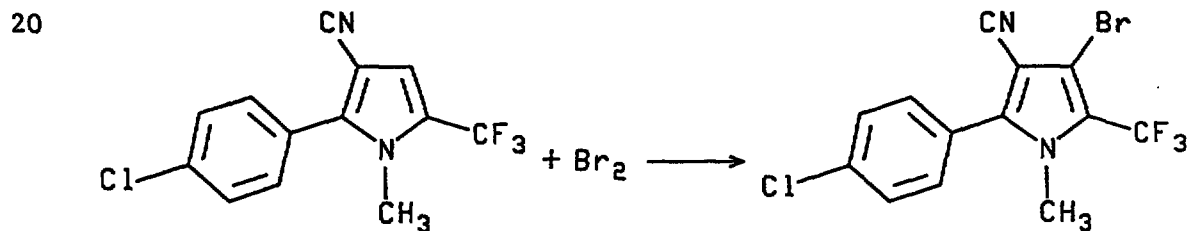
5

10

<u>L</u>	<u>M</u>	<u>R</u>	<u>A</u>	<u>W</u>	<u>X</u>	<u>mp °C</u>
3-Cl	4-Cl	H	CH ₃	NO ₂	Cl	100 - 103
H	4-Cl	H	C ₆ H ₅ Cl-p-	CN	Cl	135 - 137
H	4-Cl	H	CH ₂ C ₆ H ₅	CN	Cl	96 - 98
H	4-CF ₃	H	CH ₃	CN	Cl	-
H	4-F	H	CH ₃	CN	Cl	-
2-Cl	3-Cl	H	CH ₃	CN	Cl	-

EXAMPLE 3

Preparation of 2-(p-chlorophenyl)-4-bromo-1-methyl-5-(trifluoromethyl)pyrrole-3-carbonitrile



25 A solution of 2-(p-chlorophenyl)-1-methyl-5-(trifluoromethyl)pyrrole-3-carbonitrile (5.70 g, 0.02 mol) in chlorobenzene is treated with bromine (3.52 g, 0.022 mol), heated at 80°C for 20 hours, cooled to room temperature, treated with additional bromine (3.52 g, 0.022 mol) and heated at 100°C until reaction is complete by HPLC analysis. The reaction

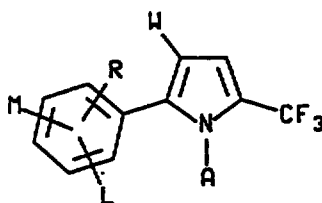
30

mixture is cooled to room temperature and diluted with ethyl acetate and water. The organic phase is washed with aqueous sodium metabisulfite, dried (MgSO_4) and concentrated in vacuo to afford a solid residue. The
5 residue is recrystallized from ethyl acetate/heptane to give the title product as a white solid, 6.50 g (89.4% yield), mp 126-129°C.



I claim:

1. A process for the preparation of a compound characterized by formula I



(I)

wherein A is C_1-C_6 alkyl, phenyl or C_1-C_6 alkyl substituted with phenyl;

W is CN, NO_2 or $COOR_1$;

L is hydrogen or halogen and

M and R are each independently hydrogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, C_1-C_4 alkylthio, C_1-C_4 alkylsulfinyl, C_1-C_4 alkylsulfonyl, CN, NO_2 , halogen, CF_3 , R_2CF_2Z , R_3CO or NR_4R_5 and when M and R are on adjacent positions they may be taken together with the carbon atoms to which they are attached to form a ring in which MR represents the structure



Z is $S(O)_n$ or O;

R_1 is C_1-C_6 alkyl, C_3-C_6 cycloalkyl or phenyl;

R_2 is hydrogen, F, CHF_2 , $CHFC1$ or CF_3 ;

R_3 is C_1-C_4 alkyl, C_1-C_4 alkoxy or NR_4R_5 ;

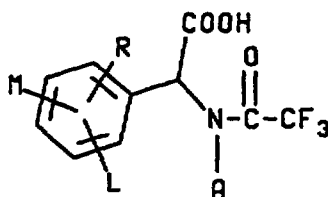
R_4 is hydrogen or C_1-C_4 alkyl;

R_5 is hydrogen, C_1-C_4 alkyl or R_6CO ;

R_6 is hydrogen or C_1-C_4 alkyl; and

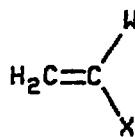
n is an integer of 0, 1 or 2

which comprises reacting a compound of formula II



(II)

wherein A, L, M and R are as defined above with one molar equivalent of a compound of formula III



(III)

wherein X is Cl or Br and W is described above and at least one molar equivalent of an organic base in the presence of an acid anhydride and a solvent at an elevated temperature.

2. The process according to claim 1 wherein the temperature is 30° to 100°C.

3. The process according to claim 1 wherein the organic base is tri(C₁-C₄ alkyl)amine and the solvent is acetonitrile.

4. The process according to claim 3 wherein the organic base is triethylamine.

5. The process according to claim 1 wherein X is Cl and W is CN or NO₂.