

PATENT SPECIFICATION

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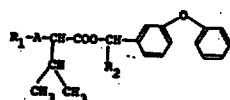
C2C 1175 1177 200 220 221 222 225 226 227 22Y 231 234 240
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 658 65X 662 682 699 805 80Y AA BX BZ LU LY
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(54) ISOVALERIC ACID ESTER DERIVATIVES, PROCESS FOR PRODUCING THEREOF, AND INSECTICIDES CONTAINING SAID DERIVATIVES

(71) We, DAINIPPON JOCHUGIKU KABUSHIKI KAISHA, a corporation organised and existing under the laws of Japan, of 2—11, Tosabori-dori, Nishi-ku, Osaka-shi, Osaka-fu, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
 10 The present invention relates to isovaleric acid ester derivatives, a process for producing thereof and insecticides containing said derivatives.

15 According to one aspect of the present invention there is provided isovaleric acid ester derivatives and the optical and geometrical isomers thereof expressed by the general formula I:

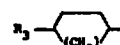


20 wherein

A represents O, NH, or CH₂,
 if A is O or NH, R₁ represents an alkyl, an alkenyl, a haloalkyl or a haloalkenyl radical with in each case 2—6 carbon atoms, or a radical selected from those of the general formulae II, III, IV and V:



(II)



(III)



(IV)



(V)

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in which n is an integer of 1—3 and R₂ represents hydrogen, a methyl group or a chlorine atom; and

if A is CH₂, R₁ represents an alkyl, an alkenyl, is haloalkyl or a haloalkenyl radical with in each case 1—5 carbon atoms, or alternatively

R₁-A represents a β-naphthyl group, and R₂ represents hydrogen or a cyano group.

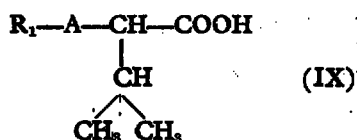
Cyclopropane carboxylic acid esters prepared from a variety of alcohols have been investigated and the esters are practically used. However, the compounds are easily decomposed by light and therefore the outdoor use of these compounds is restricted.

As the result of recent investigations on acid components of the esters, compounds which are more stable to light than the conventional pyrethroids have been produced by

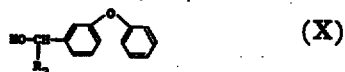
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substituting halogen atoms for methyl groups. However, taking the environmental pollution and chronic toxicity into consideration, insecticides having structures similar to those of natural organic compounds consisting of carbon, hydrogen, oxygen and nitrogen will be advantageous used in the future. The present inventors have carried out intensive investigations on insecticides and found that the compounds of the general formula (I) showed remarkably strong insecticidal action against various sanitary and agricultural pests, whilst being more stable to light than the conventional pyrethroids and have very low toxicity against warm blooded animals.

Thus, the present invention is based on the knowledge mentioned above. The compounds of the formula (I) used as active ingredients in the present invention can be produced according to processes known *per se* for producing esters by reacting a carboxylic acid, or a reactive derivative thereof, having the general formula IX:

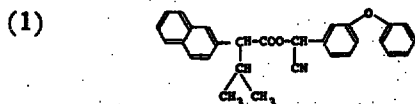


- wherein A and R₁ are as defined above with an alcohol, or a reactive derivative thereof, having the formula X:

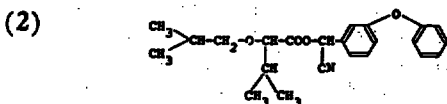


wherein R₂ represents hydrogen or cyano group.

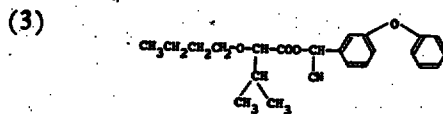
Reactive derivatives of the carboxylic acid are, for example, acid halides, acid anhydrides, lower alkyl esters and alkali metal salts. A reactive derivative of the alcohol is, for example, the chloride. The reaction is carried out in a suitable solvent in the presence of organic or inorganic base, or acid as deacidifying agent or catalyst, if desired, and optionally at elevated temperature. Representative compounds of the formula (I) are as follows:



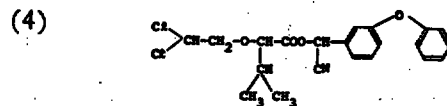
3' - phenoxy - α - cyanobenbyl α - naphthylisovalerate n_D²⁰ 1.5826



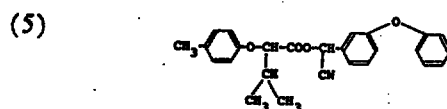
3' - phenoxy - α - cyanobenzyll α - isobutoxyisovalerate n_D²⁰ 1.5139



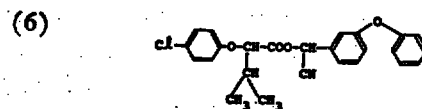
3' - phenoxy - α' - cyanobenzyll α - butoxyisovalerate n_D²⁰ 1.5107



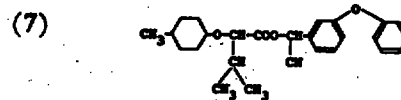
3' - phenoxy - α' - cyanobenzyll α - (2,2-dichloroethoxy)isovalerate n_D²⁰ 1.5293



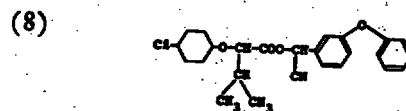
3' - phenoxy - α' - cyanobenzyll α - (p-methylphenoxy)isovalerate n_D²⁰ 1.5611



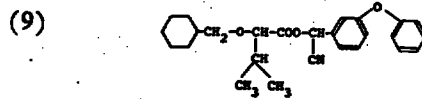
3' - phenoxy - α' - cyanobenzyll α - (p-chlorophenoxy)isovalerate n_D²⁰ 1.5685



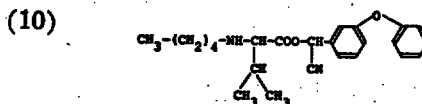
3' - phenoxy - α' - cyanobenzyll α - (4-methylcyclohexyloxy)isovalerate n_D²⁰ 1.5548



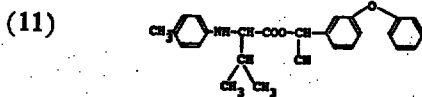
3' - phenoxy - α' - cyanobenzyll α - (4-chlorocyclohexyloxy)isovalerate n_D²⁰ 1.5606



3' - phenoxy - α' - cyanobenzyll α - cyclohexylmethoxyisovalerate n_D²⁰ 1.5408

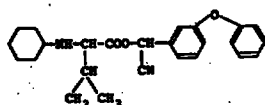


3' - phenoxy - α - cyanobenzyll α - amylaminoisovalerate n_D²⁰ 1.5268



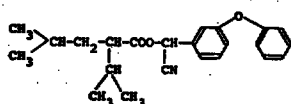
3' - phenoxy - α - cyanobenzyll α - (p-toluidino)isovalerate n_D²⁰ 1.5753

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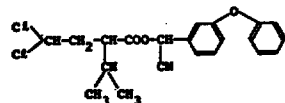
3' - phenoxy - α' - cyanobenzyl α - cyclohexylaminoisovalerate n_D^{20} 1.5470

(13)



5 3' - phenoxy - α' - cyanobenzyl α - isobutylisovalerate n_D^{20} 1.5074

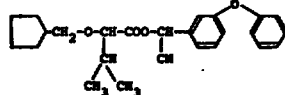
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3' - phenoxy - α' - cyanobenzyl α - (2,2-dichloroethyl)isovalerate n_D^{20} 1.5187

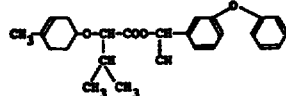
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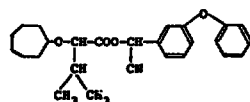
3' - phenoxy - α' - cyanobenzyl α - cyclopentylmethoxyisovalerate n_D^{20} 1.5384

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15 3' - phenoxy - α' - cyanobenzyl α - (4-methyl - 3 - cyclohexenyloxy)isovalerate n_D^{20} 1.5507

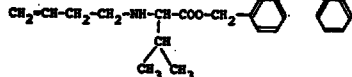
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3' - phenoxy - α - cyanobenzyl α - cycloheptyloxyisovalerate n_D^{20} 1.5615

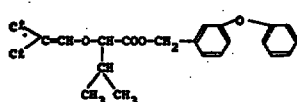
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3' - phenoxybenzyl α - (3 - butenylamino)isovalerate n_D^{20} 1.5133

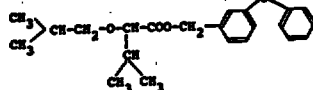
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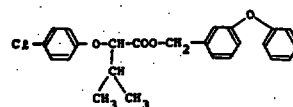
3' - phenoxybenzyl α - (2,2 - dichlorovinyl)isovalerate n_D^{20} 1.5260

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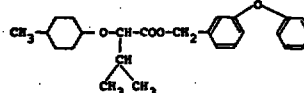
3' - phenoxybenzyl α - isobutoxyisovalerate n_D^{20} 1.5089

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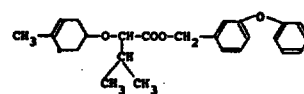
3' - phenoxybenzyl α - (p - chlorophenoxy)isovalerate n_D^{20} 1.5579

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3' - phenoxybenzyl α - (4 - methyl - cyclohexyloxy)isovalerate n_D^{20} 1.5490

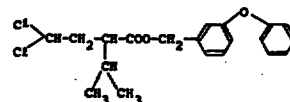
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3' - phenoxybenzyl α - (4 - methyl - 3 - cyclohexenyloxy)isovalerate n_D^{20} 1.5433

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3' - phenoxybenzyl α - (2,2 - dichloroethyl)isovalerate n_D^{20} 1.5064

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The compounds of the present invention are solid or liquid at room temperature and are usually readily soluble in organic solvents. Accordingly, they may be used as ingredients in insecticidal sprays in the form of an emulsion, solution, powder, wettable powder and aerosol. In addition, they may be used as insecticides for fumigation by mixing them with some appropriate substrate such as powdered wood and making mosquito incense sticks. Furthermore, these compounds show also a strong effect as mosquito incense sticks when they are employed as insecticides for heating and evaporating use. For such use, they are dissolved in a suitable organic solvent and the solution is absorbed into a carrier and then the resulting product is heated on an appropriate heater. As the compounds of the present invention are more stable to light than the conventional pyrethroids, they may be used as agricultural insecticides.

Addition of some synergists into the compounds, for example, N-octylbicycloheptene dicarboxyimide (MGK-264 is the commercial name), a mixture composed of N-octylbicycloheptene dicarboxyimide and alkylaryl-sulfonic acid salt (MGK-S026 is the commercial name), octachlorodipropylether, or pyperonylbutoxide, can enhance the insecticidal effect.

The stability of the present compounds can be increased by adding a phenolic- or amine-antioxidant such as 2,6 - di - tert - butyl - 4-methylphenol (BHT) and 2,6 - di - tert-butylphenol. More highly active insecticides

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can be obtained by joint use of the compounds with the conventional pyrethroids such as allethrin, phthalthrin, resmethrin and furamethrin.

5 In the following Test Examples, the insecticidal effect of the compounds used as active ingredients is demonstrated.

Test Example 1.

Insecticidal effect by spraying.

10 The relative effects of three types of solution A, B and C were estimated from the knockdown rate of house flies by spraying and the mortality after 24 hours was obtained. The

results are shown in the table below.

Solution A comprises a white kerosene solution containing 0.2% of each of the 24 compounds of the present invention which are exemplified above; solution B comprises a white kerosene solution containing 0.2% of each compound of the present invention and 0.8% of piperonylbutoxide; and solution C comprises a white kerosene solution containing 0.1% of each compound of the present invention and 0.1% of phthalthrin (C), a 0.2% white kerosene solution of allethrin and a 0.2% white kerosene solution of phthalthrin.

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Test preparation	(A)	(B)	(C)
Allethrin	1.00 (26)		
Phthalthrin	2.15 (34)		
(1)	1.35 (98)	1.60 (100)	1.63 (100)
(2)	1.77 (100)	2.04 (100)	1.98 (100)
(3)	1.50 (100)	1.75 (100)	1.84 (100)
(4)	1.68 (100)	1.88 (100)	1.89 (100)
(5)	1.82 (100)	2.27 (100)	2.01 (100)
(6)	1.84 (100)	2.41 (100)	2.13 (100)
(7)	1.41 (100)	1.73 (100)	1.46 (100)
(8)	1.55 (100)	1.83 (100)	1.90 (100)
(9)	1.63 (100)	1.95 (100)	1.91 (100)
(10)	1.26 (95)	1.51 (100)	1.65 (100)
(11)	2.03 (100)	2.36 (100)	2.28 (100)
(12)	1.41 (100)	1.80 (100)	1.47 (100)
(13)	1.19 (90)	1.37 (100)	1.59 (93)
(14)	1.28 (96)	1.50 (100)	1.64 (100)
(15)	1.56 (100)	1.77 (100)	1.88 (100)
(16)	1.43 (100)	1.61 (100)	1.75 (100)
(17)	1.30 (92)	1.66 (100)	1.62 (91)
(18)	1.04 (87)	1.37 (98)	1.54 (88)
(19)	1.28 (90)	1.31 (93)	1.59 (91)
(20)	1.35 (94)	1.69 (100)	1.70 (100)
(21)	1.03 (93)	1.45 (100)	1.42 (100)
(22)	1.16 (88)	1.51 (100)	1.47 (90)
(23)	1.19 (90)	1.55 (100)	1.60 (100)
(24)	1.02 (84)	1.34 (100)	1.52 (86)

The parenthesized values show the mortality after 24 hrs.

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Test Example 2.

Insecticidal effect by fumigation.

5 Mosquito incense sticks each containing 0.5% active ingredient were prepared and tested for the known downrate of red house mosquitoes. These tests were carried out in

accordance with the procedure described by Nagasawa, Katsuda and others in "Bochu-Kagaku", Vol. 16, page 176 (1951). The test numbers of the active ingredients are the same as those of Example 1. The effects of these mosquito incense sticks are as follows:

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Test preparation	Probit 4	Probit 5	Probit 6
Allethrin	1.00	1.00	1.00
(1)	1.24	1.27	1.29
(2)	1.49	1.50	1.53
(3)	1.35	1.38	1.40
(4)	1.41	1.44	1.47
(5)	1.53	1.57	1.61
(6)	1.56	1.58	1.62
(7)	1.30	1.32	1.36
(8)	1.38	1.41	1.43
(9)	1.37	1.39	1.42
(10)	1.09	1.10	1.13
(11)	1.61	1.65	1.69
(12)	1.37	1.40	1.44
(13)	1.05	1.06	1.08
(14)	1.12	1.15	1.17
(15)	1.36	1.39	1.42
(17)	1.11	1.13	1.16
(19)	1.15	1.20	1.23
(23)	1.04	1.07	1.10

Example 1.

15 A solution of 4.7 g of α - cyclohexylmethoxyisovaleryl chloride in 15 ml of dry benzene was mixed with a solution of 4.7 g of 3-phenoxy - α - cyanobenzylalcohol in 20 ml of dry benzene. When 3 ml of dry pyridine were added into the solution as promotor of the condensation, crystals of pyridine hydrochloride were precipitated. The mixture was allowed to stand in a tightly stopped vessel for one night and the pyridine hydrochloride

was filtered off. The filtrate was dried over sodium sulfate and benzene was distilled off under reduced pressure to yield 68 g of 3-phenoxy - α' - cyanobenzyl α - cyclohexylmethoxyisovalerate.

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Example 2.

3.7 g of α -isobutoxyisovaleric acid and 4.7 g of 3 - phenoxy - α - cyanobenzyl alcohol were dissolved in 150 ml of benzene and 5 ml of concentrated hydrochloric acid were added into

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the solution with vigorously stirring. The mixture was refluxed with stirring and water distilled by azeotropy was removed with dehydrating agent. The reaction was continued for about 4 hrs. with supplying benzene at need.

The reaction mixture was washed with an aqueous solution of sodium hydrogencarbonate and with an aqueous solution of sodium chloride. Benzene was distilled off under reduced pressure to yield 6.4 g of 3'-phenoxy- α -cyanobenzyl α -isobutoxyisovalerate.

Example 3.

4.7 g of sodium α -(4-methyl-3-cyclohexenyloxy)-isovalerate and 4.5 g of 3-phenoxybenzylchloride were dissolved in 50 ml of benzene and the mixture was heated under reflux in nitrogen atmosphere for 3 hrs.

The reaction mixture was cooled and crystals of sodium chloride precipitated were filtered out. The filtrate was thoroughly washed with aqueous solution of sodium chloride and dried over sodium sulfate. Benzene was distilled off under reduced pressure to give 7.1 g of 3'-phenoxybenzyl α -(4-methyl-3-cyclohexenyloxy)-isovalerate.

Example 4.

A mixture of 4.2 g of methyl α -(p-toluidino)-isovalerate and 4.7 g of 3-phenoxy- α -cyanobenzyl alcohol was heated at 150°C. When the temperature of the mixture reached to 150°C, 0.25 g of sodium was added to start distillation of methanol. A further 0.25 g of sodium was added to the mixture when distillation of methanol ceased while keeping the temperature of 150°C. The procedure mentioned above was repeated until theoretical amount of methanol was distilled off. The reaction mixture was then cooled and dissolved in ether. The ethereal solution was washed with diluted hydrochloric acid, aqueous solution of sodium hydrogencarbonate and aqueous solution of sodium chloride and dried over sodium sulfate. Ether was distilled off under reduced pressure to yield 6.9 g of 3'-phenoxy- α' -cyanobenzyl α -(p-toluidino)-isovalerate.

Example 5.

7.6 g of α -(2,2-dichloroethyl)-isovaleric anhydride and 4.7 g of 3-phenoxy- α -cyanobenzyl alcohol were mixed and 8 g of 98% sulfuric acid was gradually added into the mixture. After conducting the reaction at 80-100°C for 3 hrs, the reaction mixture was dissolved in ether. The ethereal solution was thoroughly washed with aqueous solution of sodium hydrogen carbonate and then with aqueous solution of sodium chloride and dried over sodium sulfate. Ether was removed under reduced pressure to yield 6.2 g of 3'-phenoxy- α' -cyanobenzyl α -(2,2-dichloroethyl)-isovalerate.

Example 6.

Into a solution of 3.5 g α -(3-butenylamino)-isovaleric acid in 50 ml of dimethylformamide were added 5.4 g of 3-phenoxybenzylbromide. 4 ml of triethylamine were added to the mixture with stirring and the reaction was carried out at 60-80°C for 3 hrs. The reaction mixture was dissolved into ether and the ethereal solution was thoroughly washed with aqueous solution of sodium hydrogen carbonate and then with aqueous solution of sodium chloride. After drying the solution over sodium sulfate, ether was removed under reduced pressure to yield 6.1 g of 3'-phenoxybenzyl α -(3-butenylamino)-isovalerate.

Reference Example 1.

0.2 parts of Compound (1) of the present invention are dissolved in sufficient white kerosene to form 100 parts of 0.2% solution.

Reference Example 2.

0.2 parts of Compound (2) of the present invention and 0.8 parts of pyperonylbutoxide are dissolved in sufficient white kerosene to form 100 parts of solution.

Reference Example 3.

20 parts of Compound (3) of the present invention, 10 parts of Solpol SM-200 (Trade-name of Toho Chemical Co.) and 70 parts of xylene are mixed with stirring to form 20% emulsion.

Reference Example 4.

0.4 parts of Compound (4) of the present invention, 0.1 part of resmethrin and 1.5 parts of octachlorodipropyl ether are dissolved in 28 parts of rectified kerosene. The solution is charged in an aerosol vessel and a jet-valve is attached to the vessel, through which 70 parts of propellant (liquidized natural gas) are compressed into the vessel to obtain an aerosol preparation.

Reference Example 5.

0.5 g of Compound (5) of the present invention and 0.5 g of BHT are uniformly mixed with 99.0 g of substrate for mosquito incense sticks such as pyrethrum extract powder, powdered wood and starch. The resulting substance is molded into mosquito incense stick by a publicly known process.

Reference Example 6.

0.4 g of Compound (7) of the present invention and 1.0 g of MGK-5026 are uniformly blended with 98.6 g of substrate for mosquito incense sticks. The resulting substance is molded into mosquito incense stick by a publicly known process.

Reference Example 7.

3 parts of Compound (10) of the present

(14)

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invention and 97 parts of clay are blended and pulverized to obtain 3% powder.

1/10 in each case when compared to those before spraying.

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Reference Example 8.

- 5 40 parts of Compound (14) of the present invention, 35 parts of diatomaceous earth, 20 parts of clay, 3 parts of laurylsulfonic acid salt and 2 parts of carboxymethylcellulose are crushed and blended to form wettable powder.

Test Example 3.

- 10 Groups of 10 larvae at the third stage of tobacco cutworm (*Prodenia litura* Fabricius) were each placed in a tall glass vessel and 1 ml portions of 1/200 diluted solution of emulsion prepared by method of Reference Example 3, each containing Compounds (1), (3), (6),
15 (9), (13), (16), (19) and (22) of the present invention were sprayed on the larvae. The larvae were then transferred into another glass vessel in which feed had been previously placed. After 2 days, more than 80% of the larvae of tobacco cutworm were killed in each case.

Test Example 4.

- 25 Emulsions containing Compounds (2), (3), (8), (11), (15), (17), (20) and (23) of the present invention, which were prepared by the method mentioned in Reference Example 3, were diluted with water to prepare 1/200 solution. 100 l/tan (0.245 acre) of each solution was sprayed onto Japanese radish leaves at the 5—6 leaf stage, on which green peach aphid (*Myzus persicae* Sulzer) was grown all over the surface. After 2 days, the green peach aphides decrease to less than
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Test Example 5.

In a Wagner pot of 1/50,000 were planted rice-plants grown for 45 days after seeding. Wettable powders containing Compounds (4), (7), (10), (12), (14), (18), (21) and (24) of the present invention, prepared by the method of Reference Example 8 were diluted with water to prepare 1/400 solutions. 10 ml/pot of each solution was sprayed onto the rice plants. 20 adult smaller brown planthoppers (*Laodelphax striatellus* Fallén) were put into each pot which was covered with a cylindrical metal net. After 1 day, more than 80% of the smaller brown planthopper were killed in each case.

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Test Example 6.

Cotton plants which have grown in a seed-plot were sprayed with 20 ml of each of a series of aqueous emulsions obtained by the method of Reference Example 3 in such amount that the amount of active ingredient was 2 mg per one plant (about 0.2 kg/ha). On the second day and the fifth day after spraying, 12 leaves were taken from each cotton plant and a piece of leaf of 3.7 cm diameter was cut out. In a series of glass vessels of 9 cm diameter were placed sheets of wet filter paper on which 4 leaves prepared above were placed and 5 boll weevils were settled therein.

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Mortality of weevils due to each compound tested after 72 hrs is listed as follows:

Preparation	Day after spraying	
	2 days	5 days
Methylparathion	13 (%)	20 (%)
(1)	85	94
(3)	94	100
(6)	100	100
(12)	98	100
(17)	90	94
(20)	94	100
(24)	85	94

Test Example 7.

Wettable powders containing Compounds (2), (5), (8), (13), (18) and (22) of the present invention, prepared by the method mentioned in Reference Example 8, were diluted with water to prepare 1/2000 solutions. Cabbage leaves were thoroughly sprayed with the diluted solutions obtained above. After the coating had dried, the leaves were placed in a polyethylene plastic vessel with sand and 10 cabbage armyworms (*Mamestra brassicae* Linné) were settled on the cabbage leaves.

After 2 days, more than 80% of the worms were killed in each case.

Test Example 8.

One day before applying insecticide, about 200 aphides (*Aphis craccivora* Koch) were put on each of a series of broad bean plant (*Vicia faba* L) in pots. Wettable powder containing Compounds (4), (8), (11), (16) and (21) of the present invention, which had been prepared by the method of Reference Example 8, were diluted with water to prepare 1/4000 solutions. 10 ml/pot of each diluted solution was sprayed on the bean leaves, which have

swarmed with aphides, by means of compressed air spray. After two days, no increase of damage was observed in any case.

Reference Example 9.

20 parts of Compound (6), 20 parts of pyperonylbutoxide, 10 parts of Solpol SM-200 (Trade Mark of Toho Chemical Co.), and 50 parts of xylene were mixed and dissolved with stirring to prepare a 20% emulsion.

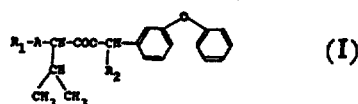
Test Example 9.

Emulsions containing Compounds (1), (5), (6), (11) and (21) of the present invention, which were prepared by the methods of Reference Example 3 and Reference Example 9 were diluted with water to prepare 1/2000 solutions. Cabbage leaves were immersed in the solutions for about five seconds. After the coatings dried, the leaves were put in a glass vessel in which 10 cabbage armyworm larvae were settled. The larvae were supplied twice, first, at the date when the test leaves were prepared, and then 5 days after that date. Mortality of armyworms due to compounds tested after 24 hrs is listed as follows:

Preparation	Reference Example 3		Reference Example 9	
	first day	5th day	first day	5th day
Salithion	40 (%)	5 (%)	45 (%)	5 (%)
(1)	80	70	95	90
(5)	85	75	100	95
(6)	85	75	100	95
(11)	85	65	100	90
(21)	75	60	95	85

From the above results, it is clear that the samples mixed with pyperonylbutoxide have the better effect at the first day and the five days later and the use of synergists enhances the effect of the compounds of the present invention.

optical and geometrical isomers thereof expressed by the general formula I:



wherein

A represents O, NH, or CH₂,

WHAT WE CLAIM IS:—

1. Isovaleric acid ester derivatives and



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Test Example 7.

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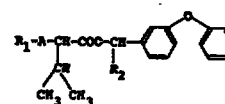
Test Example 9.

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From the above results, it is clear that the samples mixed with pyperonylbutoxide have the better effect at the first day and the five days later and the use of synergists enhances the effect of the compounds of the present invention.

optical and geometrical isomers thereof expressed by the general formula I:



(I)

WHAT WE CLAIM IS:—

1. Isovaleric acid ester derivatives and

wherein

A represents O, NH, or CH₂,

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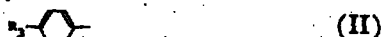
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if A is O or NH, R_1 represents an alkyl, an alkenyl, a haloalkyl or a haloalkenyl radical with in each case 2—6 carbon atoms, or a radical selected from those of the general formulae II, III, IV and V:

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10 in which n is an integer of 1—3 and R_2 represents hydrogen, a methyl group or a chlorine atom, and

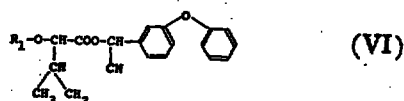
if A is CH_2 , R_1 represents an alkyl, an alkenyl, a haloalkyl or a haloalkenyl radical with in each case 1—5 carbon atoms, or, alternatively R_1 -A represents a β -naphthyl group, and

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R_2 represents hydrogen or a cyano group.

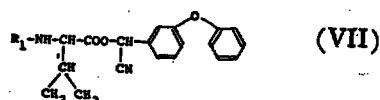
2. Isovaleric acid ester derivatives and the steric isomers thereof according to claim 1, which are expressed by the general formula VI:

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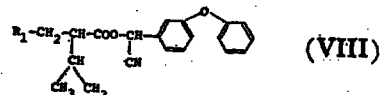
wherein R_1 has the meaning given in claim 1.

25 3. Isovaleric acid ester derivatives and the steric isomers thereof according to claim 1, which are expressed by the general formula VII:



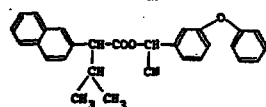
wherein R_1 has the meaning given in claim 1.

30 4. Isovaleric acid ester derivatives and the steric isomers thereof according to claim 1, which are expressed by the general formula VIII:



35 wherein R_1 has the meaning given in claim 1.

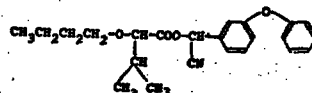
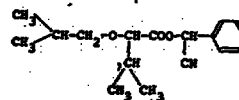
5. Isovaleric acid ester derivatives and the steric isomers thereof according to claim 1, which are expressed by the general formula:



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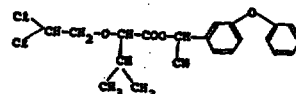
6. Compound according to claim 2 having the formula:

7. Compound according to claim 2 having the formula:



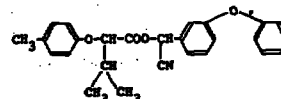
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8. Compound according to claim 2 having the formula:



9. Compound according to claim 2 having the formula:

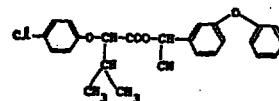
(5)



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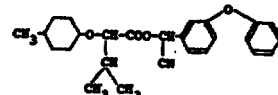
10. Compound according to claim 2 having the formula:

(6)



11. Compound according to claim 2 having the formula:

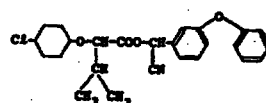
(7)



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12. Compound according to claim 2 having the formula:

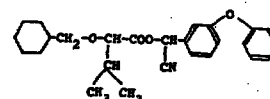
(8)



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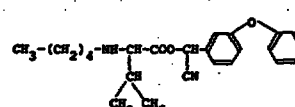
13. Compound according to claim 2 having the formula:

(9)



14. Compound according to claim 3 having the formula:

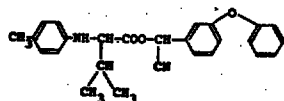
(10)



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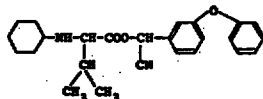
15. Compounds according to claim 3 having the formula:

(11)



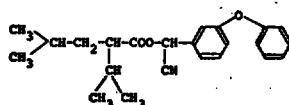
16. Compound according to claim 3 having the formula:

(12)



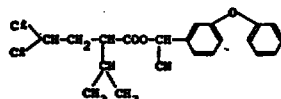
17. Compound according to claim 4 having the formula:

(13)

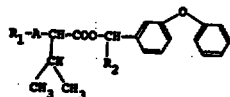


18. Compound according to claim 4 having the formula:

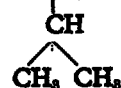
(14)



19. Process for producing isovaleric acid ester derivatives of the general formula I:

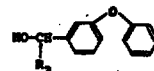


wherein A, R₁ and R₂ have the meanings given in claim 1, which process is characterized by reacting an isovaleric acid, or a reactive derivative thereof, having the general formula IX:



(IX)

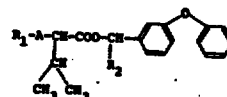
wherein A is O, NH, or CH₂, and R₁ are as defined in claim 1, with an alcohol, or a reactive derivative thereof, having the general formula X:



(X)

wherein R₂ represents hydrogen or cyano group.

20. Insecticide characterized by containing as active ingredient isovaleric acid ester derivatives of the general formula I:



(I)

wherein A, R₁ and R₂ are as defined in claim 1.

21. Insecticide according to claim (20), which is characterized by containing pyrethroids as synergists.

22. Isovaleric acid derivatives according to claim 1 substantially as described with reference to and as exemplified in any of the Examples.

23. Process for producing isovaleric acid ester derivatives according to claim 1 substantially as described with reference to the Examples.

ERIC POTTER & CLARKSON.

