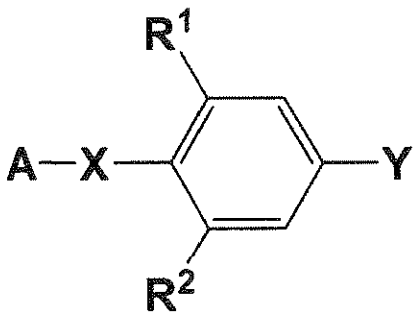
the like.

Summary

[0009a] In an aspect, there is provided a production method comprising reacting a compound represented by the following formula (1)



(1)

wherein in formula (1),

R^1 represents a hydrogen atom or halogen atom;

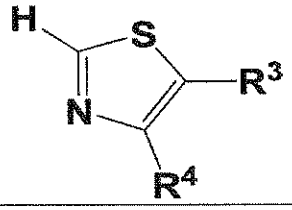
R^2 represents a hydrogen atom, a cyano group, a nitro group, a halogen atom, a formyl group or a halomethyl group;

A represents a hydrogen atom, a C_1 to C_8 alkyl group, a C_3 to C_6 cycloalkyl group, a phenyl group, a fluorine atom only when X is bond, or protecting group for a hydroxyl group only when X is an oxygen atom,

A may be substituted with 1 to 3 substituents, such substituents include a group selected from the group consisting of a halogen atom, a C_1 to C_4 alkyl group, a C_1 to C_4 alkoxy group, a C_1 to C_4 alkylthio group, a C_3 to C_6 cycloalkyl group, a phenyl group, a phenoxy group, and a pyridyl group;

X represents a bond only when A is a phenyl group or a fluorine atom, or an oxygen atom; and Y represents a leaving group,

and a compound represented by the following formula (2)



(2)

wherein in formula (2),

H represents a hydrogen atom;

R^3 represents a $-COOR^{3a}$ or $-COR^{3b}$;

R^{3a} represents a hydrogen atom, a C_1 to C_4 alkyl group, or an ester-type protecting group of a carboxyl group;

R^{3b} represents an amide-type protecting group for a carboxyl group, the protecting group forming an amide with a neighboring carbonyl group;

R^4 represents a hydrogen atom, a halogen atom, or C_1 to C_4 alkyl,

in the presence of

(i) a palladium compound,

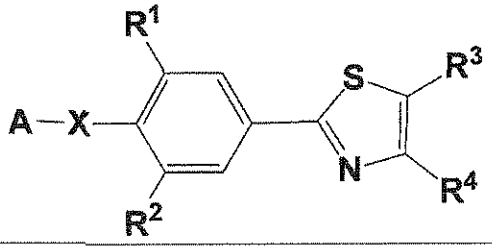
(ii) a ligand capable of coordinating to the palladium compound or a salt thereof,

(iii) a base,

(iv) a C_1 to C_{40} carboxylic acid or a salt thereof

(v) at least one additive selected from the group of consisting of copper, silver, and salts thereof, and complexes thereof;

to produce a phenyl-substituted heterocyclic derivative represented by the following formula (3)



(3)

Wherein in formula (3),

the definition of A, X, R^1 and R^2 is the same as defined in formula (1), and that of R^3 and R^4 is the same as in formula (2).

[Means for solving the problem]

[0010]

As a result of extensive efforts and investigation to solve the above-mentioned problems, the inventors have attained the finding that the phenyl ring of a phenyl derivative and a heterocyclic derivative at the position of C-H bond on the heterocyclic ring can be directly coupled and a desired coupling reaction progresses with high substrate selectivity by using;

(i) a palladium compound,

(ii) a ligand capable of coordinating to the palladium compound or a salt thereof,

(iii) a base,

(iv) a C_1 to C_{40} carboxylic acid or a salt thereof, and

(v) at least one additive selected from the group consisting of copper, silver, and salts thereof, and complexes thereof.

[0011]

Accordingly, the present invention relates to:

[1] A method comprising reacting

a compound represented by the following formula (1)

[0012]