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RESEARCH ARTICLE

NOVEL PROPENONES BEARING NAPTHYL MOIETY AS POTENT ANTI-MALARIAL AGENTS: ANTI-TUBERCULAR SCREENING ACTIVITY AND THEIR SYNTHESIS AND CHARACTERIZATION

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ABSTRACT

Synthesis of novel propenones (2*E*)-1-(C)-3-(6-methoxynaphthalen-2-yl) prop-2-en-1-one **(3)** by the condensation reaction. The new target compounds were analyzed for their structures using FT-IR,^{1}H-NMR, ^{13}C-NMR and LC-Mass further these newly synthesized compounds were screened for their anti-TB and anti-malarial agents and the results of each such studies of these synthesized compounds revealed to possess excellent activity.

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INTRODUCTION

Species of mosquito spread different kinds of disease caused by bacteria, viruses or parasite globally .These mosquitoes actually don't cause disease they just act as vector they inject the disease through their bites which contains anti coagulants. Prevention is better than cure .Hence it is better to destroy the mosquitoes in the larval stage rather than avoiding their bites.
In the present study we are mainly focusing on the three disease vectors**.** Anopheles stephensi – it is an important vector which carries malaria parasite in both human and rodent such as: Plasmodium falciparum and Plasmodium berghei. Aedes aegypti –it transmits yellow fever, dengue fever, Zika fever and Chikungunya. Culex quinquefasciatus: it is a vector of lymphatic filariasis caused by the nematode Wuchereria bancrofti .Mosquito control is currently the best method for the prevention of disease caused by the mosquitoes. It mainly includes source reduction or use of chemical agent. Chalcones are the one of the most important class of heterocyclic organic compounds .They show broad spectrum of pharmacological activity and show pronounced activities like including antifungal (Lahtchev, 2008), antibacterial (Bhatia, 2009), antioxidant (Sivakumar, 2010), larvicidal (Begum, 2010), (Antiprotozoal, antileishmanial antitrypanosomal) (Lunardi, 2003), anti-inflammatory (Yadav, 2010), antimalarial (Motta, 2006), antifilarial (Awasthi, 2009), antimicrobial (Yayli, 2006), anticonvulsant (Kaushik, 2010), anticancer (Romagnoli, 2008). Enthusized by the enormous activity of the chalcones various chalcones were synthesized and screened for various biological activities.

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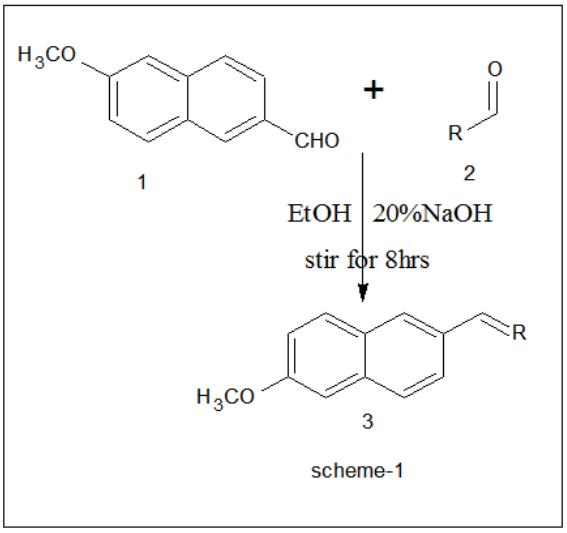
MATERIALS AND METHODS

The new target compounds were analyzed for their structures using FT-IR,^{1}H-NMR, (Saundane, 2012) C-NMR, LC-Mass and elemental analysis further these newly synthesized compounds were screened for their anti-TB, anti-inflammatory, anti-bacterial and larvicidal activity in mosquito and the results of each such studies are discussed in detail here in. Melting points of the compounds (3a-l) were determined in open capillary tubes and are uncorrected. The purity of synthesized compounds was checked by TLC observing single spot on Merck silica gel 60 F_{254}coated alumina plates. The structures of these novel compounds were confirmed through spectral studies. The IR spectra (cm^{-1}) were recorded on a Shimadzu-FTIR 577 infrared spectrometer in KBr pellets. The ^{1}H-NMRand (Saundane, 2012) C-NMR spectra was recorded

on Brucker AMX-400(400MHz) spectrometer using $CDCl_3$-d as solvent and TMS as the internal standard. The mass spectra were recorded on Perkin –Elmer 018444Y, triple quadrapole LC/MS spectrometer. The synthesized novel compounds showed the molecular ion peak (m/z) equivalent to their molecular weight. The Characterization data is given in Table-I. General procedure for the synthesis of the propenones (2*E*)-1-(C)-3-(6 methoxynaphthalen-2-yl) prop-2-en-1-one. (3a-l). The novel compounds (3a-l) were done acc ording to the standard procedure [12-13] .the target compounds are synthesized by the condensation of 6-methoxy naphthalene-2-carbaldehyde in the presence of KOH catalyst and methanol solvent, stirred overnight with different substituted aromatic ketones. The mixture of 6-methoxy naphthalene-2-carbaldehyde (1) (0.01mol) and different substituted aromatic ketones were stirred at room temperature in ethanol(30ml) and aqueous solution of NaOH(20% , 20ml) for 8 hrs to yield a new target compounds 1-12 viz (2*E*)-1-(C)-3-(6-methoxynaphthalen-2-yl) prop-2-en-1-one.(3a-l) (Scheme-1).

Reaction schemes



scheme-1

RESULTS AND DISCUSSION

Spectroscopic Data

(2*E*)-3-(6-methoxynaphthalen-2-yl)-1-(2,3,4-trichlo rophenyl)prop-2-en-1-one (3a)

IR (KBr, Cm^{-1}): 3247.92 (>CH=CH< adjacent to methoxy napthyl moiety), 1697.12(>C=0, adjacent to phenyl moiety) 1591.27(aromatic >C=C<), 2994.17(-C-H stretch, OCH_3 attached to napthyl moiety)830,728 (-C-Cl stretch) . ^{13}C-NMR: 53.47 (1C atom of methoxy group) 137.10, 138.17, 137.18, 134.29, 130.96, 130.75, 130.46, 130.34, 129.91, 128.35 (10C atoms of naphthalene moiety) 127.66, 126.51, 124.35, 119.37, 119.67, 106.14 (6C atoms 2, 3, 4-trichloro phenyl moiety) 187.98 (>C=0 adjacent to 2, 3, 4-trichloro phenyl moiety) 159.74, 145.47 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.947 (3H, s, methoxy groups of naphthalene moiety), 8.188 (6H, m, hydrogen of naphthalene moiety), 7.681, 7.630 (2H, d, J=16and J=15.6Hz of enone moiety), δ7.258 and 7.183 (2H, d, J=8.8 and 8.4 of 2,3, 4-tri chloro phenyl moiety) . LC-mass: $[M^{+}+1]$, (m/Z): 391.67.

(2E)-1-(3,4-dichlorophenyl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3b)

IR (KBr, Cm^{-1}): 3056.73(>CH=CH< adjacent to methoxy napthyl moiety), 1687.79 (>C=0, adjacent to 3, 4-dichloro phenyl moiety) 1592.57(aromatic >C=C<),2945.55(-C-H stretch , OCH_3 attached to napthyl moiety)852.76, 822.64 (-C-Cl stretch). ^{13}C-NMR: 55.44 (1C atom of methoxy group) 138.10, 137.17, 136.18, 133.29 130.96, 130.75, 130.46, 130.34, 129.91, 128.75 (10C atoms of naphthalene moiety) 127.66, 127.51, 124.35, 119.96, 119.67, 106.14 (6C atoms 3, 4-dichloro phenyl moiety) 187.98 (>C=0 adjacent to 3, 4-dichloro phenyl moiety) 159.24, 153.238 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.947 (3H, s, methoxy groups of naphthalene moiety), 8.127 (6H,m, hydrogen of naphthalene moiety) , 7.604 , 7.517 (2H, d, J=16and J=15.6Hz of enone moiety), 7.199 , 6.94 (2H, d, J=8.8 and 8.4 - of 3, 4-di chloro phenyl moiety) 7.205 (1H,s, 3, 4-di chloro phenyl moiety). LC-mass: $[M^{+}+1]$, (m/Z): 357.22.

(2E)-1-(4-bromophenyl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3c)

IR (KBr, Cm^{-1}): 3311.17 (>CH=CH< adjacent to methoxy napthyl moiety), 1692.44 (>C=0, adjacent to 4-nitro phenyl moiety) 1588.91(aromatic >C=C<),2934.67(-C-H stretch , OCH_3 attached to napthyl moiety)699.91 (-C-Br stretch). ^{13}C-NMR: 57.83 (1C atom of methoxy group) 149.301, 144.339, 135.81, 137.18, 133.120, 131.422, 131.363, 129.862, 129.134, 129.021 (10C atoms of naphthalene moiety) 125.760, 124.260, 122.088, 120.662, 108.006, 106.070 (6C atoms 4-bromo phenyl moiety) 189.978 (>C=0 adjacent to 4-bromophenyl moiety) 158.634 155.237 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.895 (3H, s, methoxy groups of naphthalene moiety), 8.254 (6H,m, hydrogen of naphthalene moiety) , 7.367 , 7.269 (2H, d, J=16and J=15.6Hz of enone moiety), 7.205 , 7.199 ,7.056, 6.94 (4H, d, J=8.8 of 4-bromo phenyl moiety). LC-mass: $[M^{+}+1]$, (m/Z): 367.23.

(2E)-1-(biphenyl-4-yl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3d)

IR (KBr, Cm^{-1}): 3400.92(>CH=CH< adjacent to methoxy napthyl moiety), 1688.91(>C=0, adjacent to biphenyl moiety) 1599.17 (aromatic >C=C<), 2981.17(-C-H stretch , OCH_3 attached to napthyl moiety) . ^{13}C-NMR: 57.85 (1C atom of methoxy group) 144.767, 144.34, 143.021, 143.468, 143.444, 136.471, 135.512, 134.326, 133.120, 131.422, 131.363, 129.862, 129.134, 128.021 125.760, 124.260, 123.091, 122.088, 121.57, 120.662, 108.006, 106.070 (22C atoms of naphthalene and biphenyl moiety) 189.367 (>C=0 adjacent to biphenyl moiety) 159.637, 155.987(2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.876 (3H, s, methoxy groups of naphthalene moiety), 8.084 (6H, m, hydrogen of naphthalene moiety), 7.645 ,7.656 (2H, d, J=16and J=15.6Hz of enone moiety), 7.957 , 6.731 (9H, m, biphenyl moiety). LC-mass: $[M^{+}+1]$, (m/Z): 364.43.

(2E)-1-(furan-2-yl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3e)

IR (KBr, Cm^{-1}): 3399.01(>CH=CH< adjacent to methoxy napthyl moiety), 1691.27(>C=0, adjacent to furan moiety)

1580.12(aromatic >C=C<), 2917.18 (-C-H stretch, OCH_3 attached to napthyl moiety). ^{13}C-NMR: 53.47 (1C atom of methoxy group) 137.10, 138.17, 137.18, 134.29 130.96, 130.75, 130.46, 130.34, 129.91, 128.35 (10C atoms of naphthalene moiety) 126.51, 124.35, 119.37, 119.67, (4C atoms of furan moiety) 187.981 (>C=0 adjacent to furan moiety) 159.74, 145.47 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.457 (3H, s, methoxy groups of naphthalene moiety), 8.098 (6H, m, hydrogen of naphthalene moiety), 7.234,7.124 (2H, d, J=16and J=15.6Hz of enone moiety), 7.176 , 6.941 (3H, m, furan moiety). LC-mass: [M^++1], (m/Z): 278.30.

(2E)-2-[(6-methoxynaphthalen-2-yl)methylidene]-4-methylcyclohexanone (3f)

IR (KBr, Cm^{-1}): 3401.15(>CH=CH< adjacent to methoxy napthyl moiety), 1684.12(>C=0, of 4-methyl cyclohexanone moiety)1589.12 (aromatic >C=C<),2899.17(-C-H stretch , OCH_3 attached to napthyl moiety). ^{13}C-NMR: 56.93 (1C atom of methoxy group) 144.767, 143.468, 135.910, 135.857, 130.438, 130.321, 130.206, 129.311, 128.810, 128.645 (10C atoms of naphthalene moiety) 125.760, 124.260, 122.088, 120.662, 108.006, 106.070 (6C atoms 4-methyl cyclohexanone moiety) 159.74, 145.47 (2C atom of C=C next to 4-methyl cyclohexanone moiety). ^{1}H NMR: 2.436 (3H, s, methyl of cyclohexanone), 3.879 (3H, s, methoxy groups of naphthalene moiety), 8.076 (6H, m, hydrogen of naphthalene moiety), 7.234, 7.124 (2H, d, J=16and J=15.6Hz of enone moiety), 8.876 (4H, m, cyclohexanone moiety). 8.265(2H, d, 8.8 cyclohexanone moiety). LC-mass: [M^++1], (m/Z): 280.36.

(2E)-2-[(6-methoxynaphthalen-2-yl) methylidene] cyclohexanone (3g)

IR (KBr, Cm^{-1}): 3397.16(>CH=CH< adjacent to methoxy napthyl moiety), 1689.14 (>C=0, of cyclohexanone moiety) 1588.23 (aromatic >C=C<), 2997.14(-C-H stretch, OCH_3 attached to napthyl moiety). ^{13}C-NMR: 57.85 (1C atom of methoxy group) 137.10, 138.17, 137.18, 134.29 130.96, 130.75, 130.46, 130.34, 129.91, 128.35 (10C atoms of naphthalene moiety) 125.760, 124.260, 122.088, 120.662, 108.006, 106.070 (6C atoms cyclohexanone moiety) 159.74, 145.47 (2C atom of C=C next to cyclohexanone moiety). ^{1}H NMR: 3.578 (3H, s, methoxy groups of naphthalene moiety), 7.987 (6H, m, hydrogen of naphthalene moiety), 7.456, 7.675 (2H, d, J=16and J=15.6Hz of enone moiety), 8.876 (5H, m, cyclohexanone moiety). LC-mass: [M^++1], (m/Z): 266.33.

2-[(*Z*)-(3,5-dichloro-6-fluorocyclohexa-2,4-dien-1-ylidene)methyl]-6-methoxynaphthalene (3h)

IR (KBr, Cm^{-1}): 3400.92 (>CH=CH< adjacent to methoxy napthyl moiety), 1684.12 (>C=0, adjacent to 3,5-dichloro,6-fluoro phenyl moiety), 1580.12 (aromatic >C=C<),2917.18 (-C-H stretch , OCH_3 attached to napthyl moiety) . ^{13}C-NMR: 53.47 (1C atom of methoxy group) 137.10, 138.17, 137.18, 134.29 130.96, 130.75, 130.46, 130.34, 129.91, 128.35 (10C atoms of naphthalene moiety) 125.760, 124.260, 122.088, 120.662, 108.006, 106.070 (4C atoms of 3, 5-dichloro, 6-fluoro phenyl) 159.74, 145.47 (2C atom of C=C attached to 3,5-dichloro,6-fluoro phenyl). ^{1}H NMR: 3.947 (3H, s, methoxy groups of naphthalene moiety), 8.188 (6H, m, hydrogen of naphthalene moiety), 7.681, 7.630 (2H, d, J=16and J=15.6Hz of enone moiety), δ7.258 and 7.183 (2H, s, 3,5-dichloro,6-fluoro phenyl moiety). LC-mass: [M^++1], (m/Z): 335.19.

(2E)-1-(4-bromo-3-chlorophenyl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3i)

IR (KBr, Cm^{-1}): 3356.73(>CH=CH< adjacent to methoxy napthyl moiety), 1677.79 (>C=0, adjacent to 3, 4-dichloro phenyl moiety) 1592.57(aromatic >C=C<),2945.55(-C-H stretch , OCH_3 attached to napthyl moiety), 822.64 (-C-Cl stretch), 699.91 (-C-Br stretch). ^{13}C-NMR: 57.53 (1C atom of methoxy group) 138.12, 136.17, 135.18, 132.29 131.96, 130.75, 130.46, 130.34, 129.91, 128.75 (10C atoms of naphthalene moiety) 123.66, 124.51, 124.35, 118.96, 118.67, 104.14 (6C atoms 4-bromo, 3-chloro phenyl moiety) 189.98 (>C=0 adjacent to 4-bromo, 3-chloro phenyl moiety) 158.24, 154.238 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.963 (3H, s, methoxy groups of naphthalene moiety), 7.764 (5H, m, hydrogen of naphthalene moiety) , 7.675 ,7.629 (2H, d, J=16and J=15.6Hz of enone moiety), 7.176 , 6.941 (3H, d, J=9.2 and 8.4 of 4-bromo,3-chloro phenyl moiety) 7.205 (1H,s, 3, 4-di chloro phenyl moiety). LC-mass: [M^++1], (m/Z): 401.67.

(2E)-1-(3,4-dibromophenyl)-3-(6-methoxynaphthalen-2-yl)prop-2-en-1-one (3j)

IR (KBr, Cm^{-1}): 3246.83(>CH=CH< adjacent to methoxy napthyl moiety),1667.36 (>C=0, adjacent to 3, 4-dichloro phenyl moiety) 1591.54(aromatic >C=C<),2946.29(-C-H stretch , OCH_3 attached to napthyl moiety) 687.52, 696.21 (-C-Br l stretch). ^{13}C-NMR: 56.27 (1C atom of methoxy group) 139.10, 136.17, 135.18, 134.29 131.96, 131.75, 130.46, 131.34, 129.91, 127.75 (10C atoms of naphthalene moiety) 126.66, 123.51, 122.35, 117.96, 116.67, 109.14 (6C atoms 3, 4-dibromo phenyl moiety) 189.98 (>C=0 adjacent to 3, 4-dibromo phenyl moiety) 158.24, 154.238 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.879 (3H, s, methoxy groups of naphthalene moiety), 8.436 (6H,m, hydrogen of naphthalene moiety) , 7.653 , 7.256 (2H, d, J=16and J=15.6Hz of enone moiety), 7.176 , 6.789 (2H, d, J=8.8 and 8.4 - of 3, 4-di bromo phenyl moiety) 7.205 (1H,s, 3, 4-di bromo phenyl moiety). LC-mass: [M^++1], (m/Z): 446.13.

(2E)-3-(6-methoxynaphthalen-2-yl)-1-(6-methylnaphthalen-2-yl)prop-2-en-1-one (3k)

IR (KBr, Cm^{-1}): 3328.99(>CH=CH< adjacent to methoxy napthyl moiety), 1677.21(>C=0, adjacent to 4-fluoro phenyl moiety) 1598.17 (aromatic >C=C<), 2997.15(-C-H stretch, OCH_3 attached to napthyl moiety) . ^{13}C-NMR: 57.83, 57.98 (2C atom of methoxy group) 149.301, 144.339, 135.81, 137.18, 136.650, 135.560, 134.370, 134.120, 133.350, 133.120, 133.120, 131.422, 131.363, 129.862, 129.134, 129.021, 125.760, 124.260, 122.088, 120.662, (20C atoms of naphthalene moiety), 189.978 (>C=0 adjacent to 4-bromophenyl moiety) 158.634 155.237 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 2.436 (3H, s, methyl of napthyl ring), 3.879 (3H, s, methoxy of naphthalene moiety), 8.188

(12H, m, hydrogen of naphthalene moiety), 7.456, 7.675 (2H, d, J=16and J=15.6Hz of enone moiety). LC-mass: [M^++1], (m/Z): 352.42.

(2*E*)-3-(6-methoxynaphthalen-2-yl)-1-(2,4,5-trichlorophenyl)prop-2-en-1-one (3l)

IR (KBr, Cm^{-1}): 3412.97(>CH=CH< adjacent to methoxy napthyl moiety),1692.81 (>C=0, adjacent to 2,4-dichloro phenyl moiety)1581.11 (aromatic >C=C<),2991.42(-C-H stretch , OCH_3 attached to napthyl moiety) . 839, 898,798(-C-Cl stretch). ^{13}C-NMR: 54.36 (1C atom of methoxy group) 136.09, 137.06, 136.07, 133.18, 130.96, 130.75, 130.46, 130.34, 129.91, 129.35 (10C atoms of naphthalene moiety) 126.66, 125.51, 124.35, 119.37, 119.67, 107.14 (6C atoms 2, 4, 5-trichloro phenyl moiety) 188.98 (>C=0 adjacent to 2, 4, 5-trichloro phenyl moiety) 159.74, 145.47 (2C atom of C=C next to carbonyl group). ^{1}H NMR: 3.947 (3H, s, methoxy groups of naphthalene moiety), 8.188 (6H, m, hydrogen of naphthalene moiety) , 7.681 , 7.630 (2H, d, J=16and J=15.6Hz of enone moiety), δ7.258 and 7.183 (2H, s, 2, 4, 5-tri chloro phenyl moiety). LC-mass: [M^++1], (m/Z): 391.67.

Biological Activity

Anti-tubercular Activity

The anti-tubercular activity of the novel compounds (3a-l) were carried out by Micro plate Alamar Blue Assay [14] (MABA) by using the M.tuberculosis (H37 RV strain) bacterial strain for the screening.

Table 1. Characterization data of compounds 3a-l

SAMPLE	R	MF (MW)	MP (^{0}C)	% COMPOSITION FOUND (CALCULATED)		
				C	H	N
3a	-CO-(2,3,4(Cl)$_3$-Ph)	$C_{20}H_{13}Cl_3O_2$ (391.67)	170-173	61.33 (61.45)	3.35 (3.30)	-
3b	-CO-(3,4-(Cl)$_2$-Ph)	$C_{20}H_{14}Cl_2O_2$ (357.22)	134-139	67.24 (67.20)	3.95 (4.00)	-
3c	-CO-(4- (Br) -Ph)	$C_{20}H_{15}BrO_2$ (367.23)	128-132	65.41 (65.00)	4.12 (4.20)	-
3d	-CO-(C_6H_5-C_6H_5)	$C_{26}H_{20}O_2$ (364.43)	160-169	85.69 (85.75)	5.53 (5.67)	-
3e	-CO-(C_4H_40)	$C_{18}H_{14}O_3$ (278.30)	198-200	75.68 (76.20)	5.07 (5.00)	-
3f	-(4-CH_3-C_6H_90)	$C_{19}H_{20}O_2$ (280.36)	126-130	81.40 (80.99)	7.19 (7.00)	-
3g	-(C_6H_90)	$C_{18}H_{18}O_2$ (266.33)	165-170	80.82 (81.09)	7.85 (7.90)	-
3h	-(3,5-(Cl)$_2$,6-F-Ph)	$C_{18}H_{13}$ Cl_2FO (335.19)	143-150	64.50 (65.49)	3.91 (3.90)	-
3i	-CO-(3,4-(Br)(Cl)-Ph)	$C_{20}H_{14}Br$ ClO_2 (401.67)	205-209	59.80 (59.23)	3.51 (3.99)	-
3j	-CO-(3,4-(Br)$_2$-Ph)	$C_{20}H_{14}Br_2O_2$ (446.13)	167-169	53.84 (53.23)	3.16 (3.19)	-
3k	-CO-(4-CH_3($C_{10}H_8$)	$C_{25}H_{20}O_2$ (352.42)	110-112	85.20 (84.99)	5.72 (5.80)	-
3l	-CO-(2,4,5-(Cl)$_3$-Ph)	$C_{20}H_{13}Cl_3O_2$ (391.67)	178-180	61.33 (61.49)	3.35 (3.30)	-

The antibacterial activity of novel compounds *N*'-[(*Z*)-(2,3,5-trichlorophenyl) methylidene] pyridine-4-carbohydrazide (3a-l) was carried out *in vitro* by Disc Diffusion Method (Zone inhibition test) using the two gram positive bacteria, *Staphylococcus aureus(MTCC-7443)* and *Bacillus subtilius (MTCC-441)* viz., and two gram negative bacteria ; viz., *Escherichia coli(MTCC-725) and Klebsiella pneumonia(MTCC-1739)*viz.,. The reference standard used for screening is Ciprofloxacin, an antibiotic drug. The microorganisms for the screening were collected from Institute of Microbial Technology (IMTECH), Chandigarh, India. The colonies of the microbial strains were inoculated on nutrient agar plates with the help of sterile loop and visually adjusted the turbidity with broth to broth to match that of 0.5 McFarland standards. The excess of the inoculums was removed by rotating the sterile swab dipped in to the inoculum against the wall of the tube against it approximately 60^{o}C between streaking, the procedure is repeated three times to ensure even distribution. After 3 mins sterile discs of the size 6mm diameter were aseptically impregnated with the test compounds at a concentration 50µg/ml.The plates were incubated at 37^{0}C for 24h.The compounds that produce distinct circular zones of inhibition around the discs. The diameter of clear zone indicates the anti-bacterial activity.

Mosquito larvicidal activity

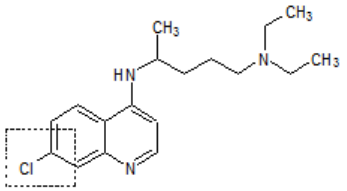
Larvicidal bioassay for the synthesized compounds was conducted in accordance with the WHO (World Health Organization, 1981) using late third instar larvae. The experiment was performed in sterile 250-mL glass beaker, containing 1 mL test chemicals and 99 mL distilled water along with negative control containing 1 ml acetone with 0.001% Tween -80 , kept with each set of the experiment. Concentration ranging from 50 ppm to 800 ppm was prepared from the 1% stock solution (1% acetone + 0.001% Tween s of the 80).the death rate of the test mosquitoes were noted after 24 hours of incubation at room temperature. The experiment was carried out in triplets for each of the target compound and their mean (±SD) values were taken.

Table 2. Anti-tubercular activity of (2*E*)-1-(C)-3-(6-methoxynaphthalen-2-yl) prop-2-en-1-one (3a-l) by Micro plate Alamar Blue Assay Method (MABA) (MIC Test)

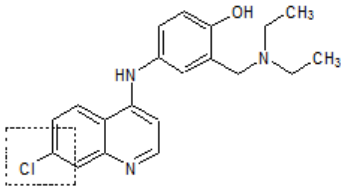
SAMPLES	100 µg/ml	50 µg/ml	25 µg/ml	12.5 µg/ml	6.25 µg/ml	3.12 µg/ml
3a	S	S	R	R	R	R
3b	S	S	S	S	S	R
3c	S	S	S	S	S	S
3d	S	S	R	R	R	R
3e	S	S	S	S	S	R
3f	S	S	S	R	R	R
3g	S	S	R	R	R	R
3h	S	S	S	S	R	R
3i	S	S	R	R	R	R
3j	S	S	S	S	S	R
3k	S	S	S	S	R	R
3l	S	S	S	S	R	R

Table 3. Results of Larvicidal Activity of the Novel Derivatives of Chalcones (3a-l) against Three Disease Vectors

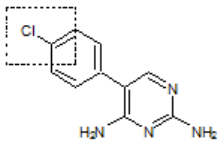
Test Compounds	*A. aegypti*		*C. quinquefasciatus*		*A. stephensi*		Average LC-50
	LC-50	LC-90	LC-50	LC-90	LC-50	LC-90	
Control	-		-	-	-	-	-
3a	20.1	30.5	17.8	27.0	18.6	28.8	18.83
3b	19.8	29.6	17.2	25.8	20.3	31.5	43.76
3c	2.1	3.2	2.7	4.1	1.9	2.7	5.43
3d	4.3	6.6	4.2	6.4	5.3	8.2	4.6
3e	5.3	8.1	5.7	8.8	4.1	6.3	5.03
3f	7.1	10.9	6.8	10.7	8.5	13.2	7.46
3g	3.4	5.2	4.2	6.4	3.9	5.9	3.83
3h	2.9	4.6	3.6	5.8	2.7	4.0	3.06
3i	2.6	4.1	3.2	4.7	3.8	5.7	3.2
3j	2.3	3.6	3.9	6.1	3.5	5.2	3.23
3k	2.1	3.2	2.7	4.1	1.9	2.7	5.43
3l	5.3	8.1	5.7	8.8	4.1	6.3	5.03
Ref.std. (Temephos)	0.019	0.0612	0.016	0.049	0.017	0.078	-



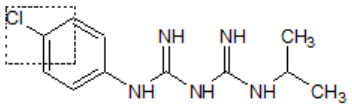
cloroquine



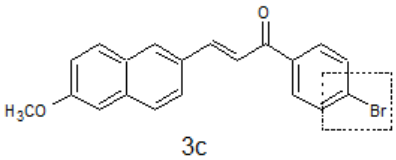
amidoquine



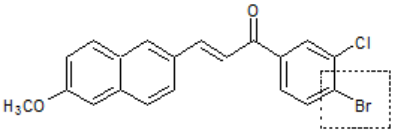
pyrimethamine



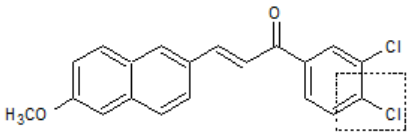
proguanin



3c



3i



3j

The Median lethal concentration (LC_{50}) with 95% confidence limit was calculated using Abbott's formula (1925) and Log probit analysis, and results are expressed as ppm. The synthesized novel compounds were tested against the three species of mosquito, among which most of the compounds were sensitive towards the larvae of C. *quinquefasciatus and* indicated by less LC-50 values compared to those of the other two species.

RESULTS AND DISCUSSION

The anti-tubercular activity of the target compounds showed that the compounds 3c and 3j were effective as that of the standard compounds pyrazinamide and ciprofloxacin drugs similarly the compounds 3b and 3e showed activity equal to streptomycin. Whereas other synthesized compounds exhibited moderate Anti- TB activity against the standard reference drug

ciprofloxacin. Hence these synthesized compounds may be considered as Anti –TB agent. The results are discussed in Table-II. The mosquito larvicidal activity showed that the LC-50 values <2.1mg/ml as the substantial activity, among the test compounds, the compound 3i is found to be more effective against all the three bacterial strains *A. Aegypti, C. quinquefasciatus and A. stephensi.* The *compounds* 3c, 3j and 3k are *more* effective against *A. Aegypti.* The average LC-50 values indicate that 3c and 3k is more effective followed by 5iand 5j. Thus, among the test compounds, 3c and 3k can be considered as a potential broad spectrum larvicidal agent. If this compound is found to be less toxic to non-target organisms upon other toxicity studies, it may be recommended as a larvicidal agent. Reference standard temephos exhibited very high larvicidal activity. However, it has greater limitations in terms of its toxic effects on non-target organisms. Hence these synthesized compounds may be considered as Anti –larvicidal agent. The results are discussed in Table-III.

Conclusion

In conclusion we have synthesized a series of novel propenones containing naphthalene moiety. The structural activity relationship of the target compounds shows that the presence of electron withdrawing groups like Cl and Br groups in the para position of the phenyl moiety enhances the mosquito larvicidal activity and anti-tubercular activity in the synthesized compounds. Hence these compounds can be used as potent drug candidate against many diseases that are caused by mosquitoes and the presence of electron donating groups like CH_3 and OCH_3 as the substituent to the phenyl ring shown to decrease the biological activity. Further screening test is under progress.

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