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Stereoselective Synthesis of 2-Aryl-4-en-1-ols, Promising Synthons for the Preparation of Oxygen Heterocycles

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Abstract—Reactions of arylacetic acids with *N*-methoxymethanamine afford corresponding Weinreb amides which at alkenylation with methallyl and prenyl bromides in the presence of $(Me_3Si)_2N^-Na^+$ form unsaturated amides ArCHRCONMe(OMe) (R = $CH_2CMe{=}CH_2$, $CH_2C{=}CMe_2$). Amides readily react with BuLi and BnMgCl to give ketones ArCHRCOR' (R' = Bu, Bn). A stereoselective reduction of the latter with $LiBH(s\text{-}Bu)_3$ leads to a quantitative formation of *syn*-isomers of 2-aryl-4-en-1-ols.

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Oxygen heterocyclic compounds are important structural fragments in many biologically active molecules and naturally occurring substances [1–5]. The most widely spread among them are tetrahydrofuran and tetrahydropyran derivatives present in the composition of diverse biologically active compounds and pharmaceuticals [6–10]. Compounds of this class attract a high interest as shows a considerable recent growth of the number of respective publications [11–21].

In extension of our research on the synthesis of oxygen heterocyclic compounds [22–24] and their precursors [25, 26] we have developed in this study a new strategy of a stereoselective preparation of 2-aryl-4-en-1-ols as building blocks for subsequent design [27] of various types of oxygen heterocyclic structures.

In the course of developing this synthesis strategy (Scheme 1) we used available initial compounds, arylacetic acides, which by treating with *N*-methoxymethanamine in appropriate reaction conditions [28–31] were converted into *N*-methyl-*N*-methoxyamides **1a–1d** in 95–97% yields. Then these amides were alkenylated with methallyl and prenyl bromides in the presence of sodium bistrimethylsilylamide used as a deprotonating agent[1] in anhydrous tetrahydrofuran at –70°C with subsequent warming to room temperature. Under these conditions only monoalkylation occurred of substrates **1a–1d** to form unsaturated compounds **2a–2d** and **3a–3d**.

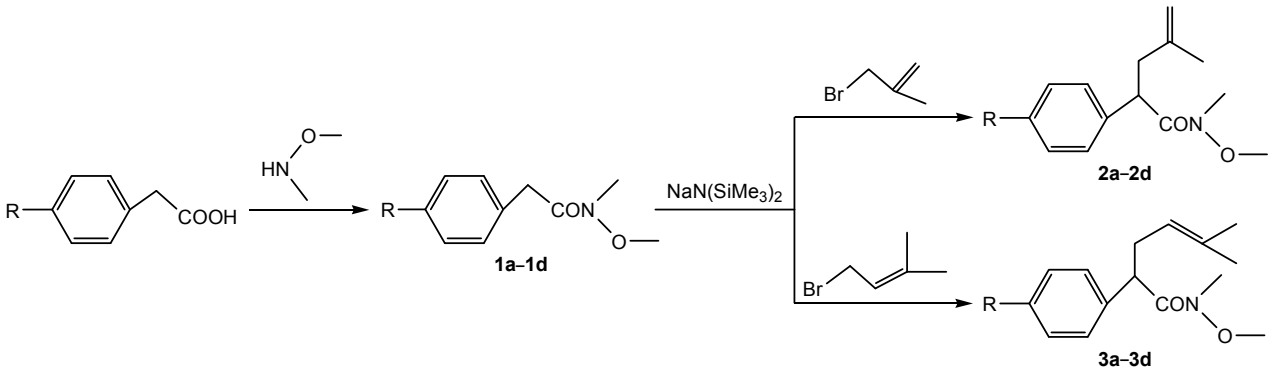
These reaction products being Weinreb amides [33] fairly easily reacted [33, 34] with organometallic compounds, BuLi and BnMgCl, forming ketones **4a–4d**–**7a–7d** (Schemes 2, 3). These compounds we stereoselectively reduced with L-selectride [lithium tris(*sec*-butyl)hydridoborate] in anhydrous THF [26] to obtain exclusively *syn*-isomers of alcohols **8a–8d**–**11a–11d** in nearly quantitative yields.

The composition and structure of compounds **1–11** were confirmed by the data of elemental analysis, IR, ^{1}H NMR, and mass spectra presented in Experimental. The purity of *syn*-alcohols **8–11** was proved by GC on a high efficient capillary column, and their sterical identification was performed by ^{1}H NMR spectra basing on the data of [26].

Thus we have developed preparative methods of the synthesis of 2-aryl-4-en-1-ols **8–11** which we plan to use in the subsequent preparation of oxygen heterocyclic compounds, potential biologically active substances.

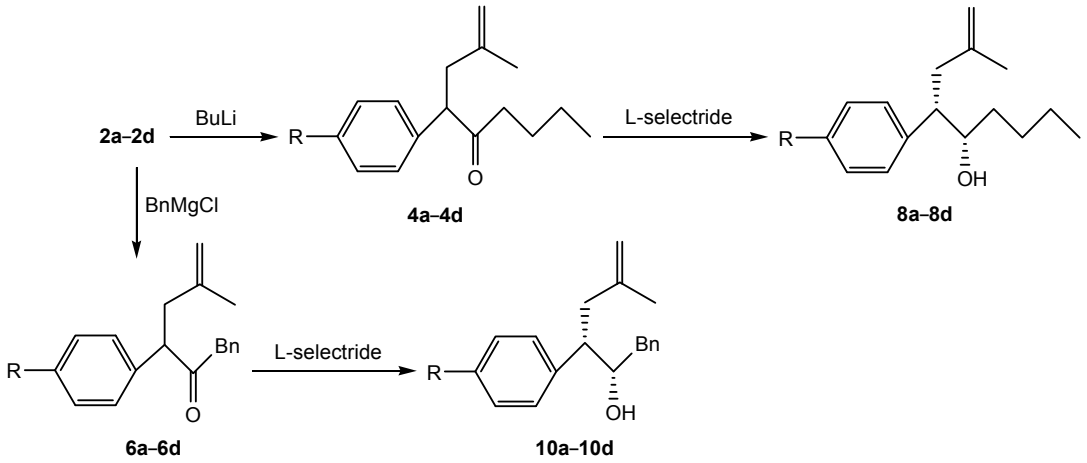
[1] Previously less available $(Me_3Si)_2N^-Li^+$ was used [32].

Scheme 1.



R = H (**a**), Me (**b**), Cl (**c**), Br (**d**).

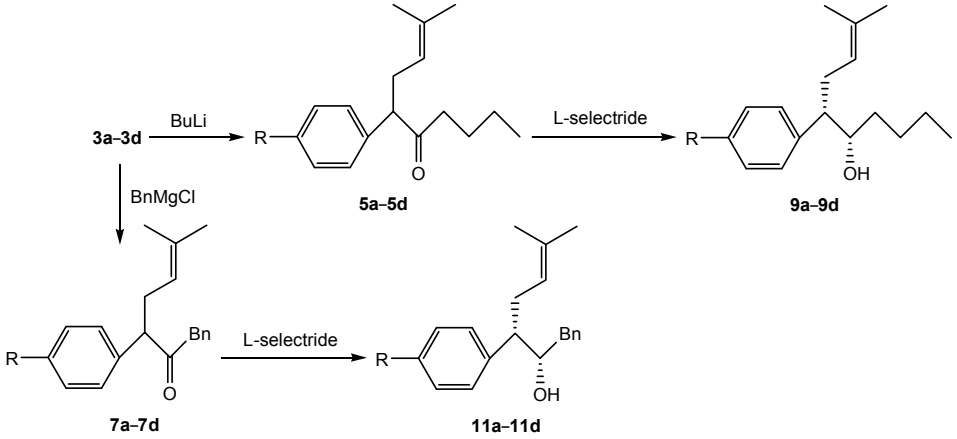
Scheme 2.



EXPERIMENTAL

IR spectra were recorded on a spectrophotometer Specord 75 IR from pellets with KBr. ^{1}H NMR spectra were registered on a spectrometer Varian MercuryPlus-400 (400 MHz) in $CDCl_3$ (internal reference HMDS). HPLC-MS was performed on an instrument Surveyor MSQ Thermo Finnigan equipped with a column Phenomenex Onyx Monolithic C18 250 × 4.6 mm, solvent DMSO–acetonitrile, 1 : 1, eluent 0.1% water

Scheme 3.



R = H (**a**), Me (**b**), Cl (**c**), Br (**d**).

solution of formic acid–acetonitrile, gradient elution within 4 min. Column temperature 25°C, flow rate of the mobile phase 1.5 mL/min. Probe volume 2 μL, analysis time 4.5 min. GC was carried out on an instrument GCMS-QP 2010S Shimadzu (electron impact, 70 eV). Capillary column P3-1MS (30 m × 0.25 mm × 0.25 μm), vaporizer temperature 300°C, ionizing chamber temperature 220°C. Analysis was carried out at a ramp from 50 to 300°C, heating rate 10 deg/min, carrier gas helium (1.2 mL/min).

The reaction progress was monitored by TLC on Silufol UV-254 plates, eluent hexane–ethyl acetete, 5 : 1, 3 : 1, or 1 : 1 v/v, development under UV irradiation or with 1% $KMnO_4$ solution. Silica gel 60 Merck was used for column chromatography.

***N*-Methyl-*N*-methoxy-2-phenylacetamide (1a).** To a solution of 40.53 g (0.3 mol) of phenylacetic acid in 300 mL of anhydrous THF was added 64.8 g (0.4 mol) of 1,1'-carbonyldiimidazole, and the mixture was stirred for 1 h. At the same time to 48.75 g (0.5 mol) of *N*-methoxymethanamine hydrochloride in 300 mL of anhydrous acetonitrile was added 52.5 g (0.52 mol) of trimethylamine, and this mixture also was stirred for 1 h. Then both reaction mixtures were combined and stirred for 20 h (TLC monitoring), 600 mL of dichloromethane was added, the obtained solution was washed in succession with water, 7% aqueous HCl, 15% aqueous K_2CO_3, dried with anhydrous Na_2SO_4, and concentrated. Yield 97%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1671 (C=O). ^1H NMR spectrum, δ, ppm: 3.24 s (3H, NMe), 3.66 s (3H, OMe), 3.78 s (2H, CH_2), 7.22–7.35 m ($5H_{arom}$) [28]. Mass spectrum, *m/z* (I_{rel}, %): 180 (100) $[M + H]^+$. Found, %: C 66.93; H 7.24; N 7.73. $C_{10}H_{13}NO_2$. Calculated, %: C 67.02; H 7.31; N 7.82. *M* 179.22.

Compounds **1b–1d** were synthesized similarly.

***N*-Methyl-2-(4-methylphenyl)-*N*-methoxyacetamide (1b).** Yield 95%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1669 (C=O). ^1H NMR spectrum, δ, ppm: 2.35 s (3H, CH_3), 3.26 s (3H, NMe), 3.65 s (3H, OMe), 3.80 s (2H, CH_2), 7.21–7.32 m ($4H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 194 (100) $[M + H]^+$. Found, %: C 68.21; H 7.68; N 7.20. $C_{11}H_{15}NO_2$. Calculated, %: C 68.37; H 7.82; N 7.25. *M* 193.24.

***N*-Methyl-*N*-methoxy-2-(4-chlorophenyl)acetamide (1c).** Yield 97%, colorless crystals, mp 47–48°C. IR spectrum, ν, cm^{-1}: 1672 (C=O). ^1H NMR spectrum, δ, ppm: 3.19 s (3H, NMe), 3.64 s (3H, OMe), 3.74 s (2H, CH_2), 7.22 d ($2H_{arom}$, *J* 9.0 Hz), 7.28 d ($2H_{arom}$, *J* 9.0 Hz) [30]. Mass spectrum, *m/z* (I_{rel}, %): 214 (100) $[M + H]^+$. Found, %: C 56.18; H 5.44; Cl 16.71; N 6.42. $C_{10}H_{12}ClNO_2$. Calculated, %: C 56.21; H 5.66; Cl 16.59; N 6.56. *M* 213.60.

2-(4-Bromophenyl)-*N*-methyl-*N*-methoxyacetamide (1d). Yield 96%, colorless crystals, mp 65–66°C. IR spectrum, ν, cm^{-1}: 1670 (C=O). ^1H NMR spectrum, δ, ppm: 3.18 s (3H, NMe), 3.63 s (3H, OMe), 3.73 s (2H, CH_2), 7.17 d ($2H_{arom}$, *J* 8.5 Hz), 7.44 d ($2H_{arom}$, *J* 8.5 Hz) [31]. Mass spectrum, *m/z* (I_{rel}, %): 260 (100) $[M + H]^+$. Found, %: C 46.51; H 4.73; Br 30.61; N 5.54. $C_{10}H_{12}BrNO_2$. Calculated, %: C 46.53; H 4.69; Br 30.96; N 5.43. *M* 258.11.

***N*,4-Dimethyl-N-methoxy-2-phenylpent-4-enamide (2a).** To a solution of 35.80 g (0.2 mol) of reagent **1a** in 200 mL of anhydrous THF in an argon atmosphere was added 110 mL (0.22 mol) 2 M solution of sodium bistrimethylsilylamide in THF at –70°C, the mixture was stirred for 1h, then 32.8 g (0.22 mol) of methallyl bromide (3-bromo-2-methylprop-1-ene) was added, the mixture was stirred at the same temperature for 1 h and 16 h at room temperature. The reaction mixture was evaporated, 300 mL of ethyl acetate and 350 mL of saturated water solution of NH_4Cl was added, the reaction mixture was shaken in a separatory funnel, the organic layer was separated, the water layer was extracted with 150 mL of ethyl acetate. The combined organic solutions were washed with water, with brine, dried with anhydrous Na_2SO, and concentrated. The residue was purified by chromatography on silica gel, eluent hexane–ethyl acetate, 3 : 1. Yield 75%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1671 (C=O), 1602 (C=C). ^1H NMR spectrum, δ, ppm: 1.82 s (3H, CH_3), 2.16 s (2H, CH_2C=C), 3.26 s (3H, NMe), 3.67 s (3H, OMe), 4.04 t (1H, CH, *J* 6.5 Hz), 4.76 d (1H, CH=C, *J* 7.8 Hz), 4.92 d (1H, CH=C, *J* 7.8 Hz), 7.18–7.29 m ($5H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 234 (100) $[M + H]^+$. Found, %: C 72.18; H 8.06; N 5.87. $C_{14}H_{19}NO_2$. Calculated, %: C 72.07; H 8.21; N 6.00. *M* 233.14.

Compounds **2b–2d** and **3a–3d** were synthesized similarly.

***N*,4-Dimethyl-2-(4-methylphenyl)-*N*-methoxypent-4-enamide (2b).** Yield 78%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1670 (C=O), 1601 (C=C). ^1H NMR spectrum, δ, ppm: 1.82 s (3H, CH_3), 2.17 d (2H, CH_2C=C, *J* 6.2 Hz), 2.36 s (3H, CH_{3arom}), 3.25 s (3H, NMe), 3.68 s (3H, OMe), 4.03 t (1H, CH, *J* 6.2 Hz),

4.76 d (1H, CH=C, *J* 8.1 Hz), 4.91 d (1H, CH=C, *J* 8.1 Hz), 7.20–7.32 m (4H_{arom}). Mass spectrum, *m/z* (I_{rel}, %): 248 (100) $[M + H]^+$. Found, %: C 72.68; H 8.42; N 5.63. $C_{15}H_{21}NO_2$. Calculated, %: C 72.84; H 8.56; N 5.66. *M* 247.33.

***N*,4-Dimethyl-*N*-methoxy-2-(4-chlorophenyl)-pent-4-enamide (2c).** Yield 67%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1672 (C=O), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.83 s (3H, CH_3), 2.17 d (2H, CH_2C=C, *J* 6.1 Hz), 3.20 s (3H, NMe), 3.65 s (3H, OMe), 4.04 t (1H, CH, *J* 6.1 Hz), 7.22 d (2H_{arom}, *J* 8.9 Hz), 7.31 d (2H_{arom}, *J* 8.9 Hz). Mass spectrum, *m/z* (I_{rel}, %): 268 (100) $[M + H]^+$. Found, %: C 62.93; H 6.71; Cl 13.04; N 5.18. $C_{14}H_{18}ClNO_2$. Calculated, %: C 62.80; H 6.78; Cl 13.24; N 5.23. *M* 267.75.

2-(4-Bromophenyl)-*N*,4-dimethyl-*N*-methoxy-pent-4-enamide (2d). Yield 32%, yellow oil. IR spectrum, ν, cm^{-1}: 1670 (C=O), 1603 (C=C). ^1H NMR spectrum, δ, ppm: 1.84 s (3H, CH_3), 2.18 d (2H, CH_2C=C, *J* 6.3 Hz), 3.18 s (3H, NMe), 3.65 s (3H, OMe), 4.03 t (1H, CH, *J* 6.3 Hz), 7.16 d (2H_{arom}, *J* 8.5 Hz), 7.42 d (2H_{arom}, *J* 8.5 Hz). Mass spectrum, *m/z* (I_{rel}, %): 313 (100) $[M + H]^+$. Found, %: C 53.74; H 5.78; Br 25.43; N 4.36. $C_{14}H_{18}BrNO_2$. Calculated, %: C 53.86; H 5.81; Br 25.59; N 4.49. *M* 312.20.

***N*,5-Dimethyl-*N*-methoxy-2-phenylhex-4-enamide (3a).** Yield 81%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1671 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.55 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.36–2.44 m (1H, CHC=C), 2.67–2.74 m (1H, CHC=C), 3.14 s (3H, NMe), 3.52 s (3H, OMe), 3.94 t (1H, CH_{arom}, *J* 6.7 Hz), 5.03 t (1H, CH=C, *J* 6.5 Hz), 7.16–7.25 m (5H_{arom}). Mass spectrum, *m/z* (I_{rel}, %): 248 (100) $[M + H]^+$. Found, %: C 72.66; H 8.57; N 5.42. $C_{15}H_{21}NO_2$. Calculated, %: C 72.84; H 8.56; N 5.66. *M* 247.33.

***N*,5-Dimethyl-2-(4-methylphenyl)-*N*-methoxy-hex-4-enamide (3b).** Yield 79%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1671 (C=O), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.54 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.31 s (3H, CH_{3arom}), 2.36–2.44 m (1H, CHC=C), 2.66–2.73 m (1H, CHC=C), 3.14 s (3H, NMe), 3.51 s (3H, OMe), 3.94 t (1H, CH_{arom}, *J* 6.7 Hz), 5.03 t (1H, CH=C, *J* 6.5 Hz), 7.18–7.27 m (4H_{arom}). Mass spectrum, *m/z* (I_{rel}, %): 262 (100) $[M + H]^+$. Found, %: C 73.41; H 8.78; N 5.26. $C_{16}H_{23}NO_2$. Calculated, %: C 73.53; H 8.87; N 5.36. *M* 261.36.

***N*,5-Dimethyl-*N*-methoxy-2-(4-chlorophenyl)-hex-4-enamide (3c).** Yield 74%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1673 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.55 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.36–2.45 m (1H, CHC=C), 2.67–2.74 m (1H, CHC=C), 3.16 s (3H, NMe), 3.51 s (3H, OMe), 3.95 t (1H, CH_{arom}, *J* 6.7 Hz), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.21 d (2H_{arom}, *J* 8.9 Hz), 7.35 d (2H_{arom}, *J* 8.9 Hz). Mass spectrum, *m/z* (I_{rel}, %): 282 (100) $[M + H]^+$. Found, %: C 63.84; H 7.08; Cl 12.44; N 4.83. $C_{15}H_{20}ClNO_2$. Calculated, %: C 63.94; H 7.15; Cl 12.58; N 4.97. *M* 281.78.

2-(4-Bromophenyl)-*N*,5-dimethyl-*N*-methoxy-hex-4-enamide (3d). Yield 30%, yellow oil. IR spectrum, ν, cm^{-1}: 1671 (C=O), 1606 (C=C). ^1H NMR spectrum, δ, ppm: 1.55 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.35–2.44 m (1H, CHC=C), 2.67–2.75 m (1H, CHC=C), 3.16 s (3H, NMe), 3.51 s (3H, OMe), 3.96 t (1H, CH_{arom}, *J* 6.8 Hz), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.21 d (2H_{arom}, *J* 8.2 Hz), 7.42 d (2H_{arom}, *J* 8.2 Hz). Mass spectrum, *m/z* (I_{rel}, %): 327 (100) $[M + H]^+$. Found, %: C 55.18; H 6.04; Br 24.37; N 4.32. $C_{15}H_{20}BrNO_2$. Calculated, %: C 55.23; H 6.18; Br 24.49; N 4.29. *M* 326.23.

2-Methyl-4-phenylnon-1-en-5-one (4a). To 12.3 mL (0.03 mol) of 2.5 M BuLi solution in hexane under an argon atmosphere at –70°C was added 4.66 g (0.02 mol) of compound **2a** in 40 mL of anhydrous THF, the mixture was stirred for 40 min, the temperature was raised to ambient, the stirring was continued for 1 h (TLC monitoring). The reaction mixture was evaporated, 100 mL of ethyl acetate and 120 mL of 5% HCl was added, the mixture was stirred for 10 min, the organic layer was separated, the water layer was extracted with 100 mL of ethyl acetate. The combined organic solutions were washed with brine, dried with anhydrous Na_2SO, and concentrated. The residue was purified by chromatography on silica gel, eluent hexane–ethyl acetate, 10 : 1. Yield 94%, colorless fluid. IR spectrum, ν, cm^{-1}: 1702 (C=O), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.8 Hz), 1.19–1.26 m (2H, CH_2), 1.45–1.52 m (2H, CH_2), 2.19 d (2H, CH_2C=C, *J* 6.2 Hz), 2.36 t (2H, CH_2C=O, *J* 7.1 Hz), 3.69 t (1H, CH_{arom}, *J* 6.2 Hz), 4.78 d (1H, CH=C, *J* 8.3 Hz), 4.93 d (1H, CH=C, *J* 8.3 Hz), 7.18–7.28 m (5H_{arom}). Mass spectrum, *m/z* (I_{rel}, %): 231 (100) $[M + H]^+$. Found, %: C 83.26; H 9.51. $C_{16}H_{22}O$. Calculated, %: C 83.43; H 9.63. *M* 230.35.

Compounds **4b–4d** and **5a–5d** were synthesized similarly.

2-Methyl-4-(4-methylphenyl)non-1-en-5-one (4b). Yield 92%, colorless fluid. IR spectrum, ν, cm^{-1}:

1704 (C=O), 1603 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.8 Hz), 1.18–1.24 m (2H, CH_2), 1.45–1.53 m (2H, CH_2), 1.81 s (3H, CH_3C=C), 2.18 d (2H, CH_2C=C, *J* 6.3 Hz), 2.28 c (3H, CH_{3arom}), 2.35 t (2H, CH_2C=O, *J* 7.2 Hz), 3.70 t (1H, CH_{arom}, *J* 6.2 Hz), 4.78 d (1H, CH=C, *J* 8.6 Hz), 4.92 d (1H, CH=C, *J* 8.6 Hz), 7.22–7.34 m ($4H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 245 (100) $[M + H]^+$. Found, %: C 83.48; H 9.95. $C_{17}H_{24}O$. Calculated, %: C 83.55; H 9.90. *M* 244.37.

2-Methyl-4-(4-chlorophenyl)non-1-en-5-one (4c). Yield 84%, colorless oil. IR spectrum, ν, cm^{-1}: 1706 (C=O), 1606 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.84 t (3H, CH_3, *J* 6.9 Hz), 1.19–1.23 m (2H, CH_2), 1.46–1.55 m (2H, CH_2), 1.83 s (3H, CH_3C=C), 2.18 d (2H, CH_2C=C, *J* 6.3 Hz), 2.36 t (2H, CH_2C=O, *J* 7.4 Hz), 3.81 t (1H, CH_{arom}, *J* 6.5 Hz), 4.79 d (1H, CH=C, *J* 9.1 Hz), 4.94 d (1H, CH=C, *J* 9.1 Hz), 7.22 d ($2H_{arom}$, *J* 8.8 Hz), 7.35 d ($2H_{arom}$, *J* 8.8 Hz). Mass spectrum, *m/z* (I_{rel}, %): 265 (100) $[M + H]^+$. Found, %: C 72.63; H 8.06; Cl 13.44. $C_{16}H_{21}ClO$. Calculated, %: C 72.57; H 7.99; Cl 13.39. *M* 264.79.

4-(4-Bromophenyl)-2-methylnon-1-en-5-one (4d). Yield 56%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1705 (C=O), 1606 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.85 t (3H, CH_3, *J* 6.9 Hz), 1.18–1.24 m (2H, CH_2), 1.48–1.56 m (2H, CH_2), 1.83 s (3H, CH_3C=C), 2.19 d (2H, CH_2C=C, *J* 6.3 Hz), 2.34 t (2H, CH_2C=O, *J* 7.2 Hz), 3.82 t (1H, CH_{arom}, *J* 6.4 Hz), 4.78 d (1H, CH=C, *J* 9.1 Hz), 4.95 d (1H, CH=C, *J* 9.1 Hz), 7.18 d ($2H_{arom}$, *J* 8.6 Hz), 7.42 d ($2H_{arom}$, *J* 8.6 Hz). Mass spectrum, *m/z* (I_{rel}, %): 310 (100) $[M + H]^+$. Found, %: C 61.87; H 6.75; Br 25.61. $C_{16}H_{21}BrO$. Calculated, %: C 62.14; H 6.84; Br 25.84. *M* 309.24.

9-Methyl-6-phenyldec-8-en-5-one (5a). Yield 95%, colorless fluid. IR spectrum, ν, cm^{-1}: 1705 (C=O), 1603 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.84 t (3H, CH_3, *J* 6.5 Hz), 1.19–1.26 m (2H, CH_2), 1.46–1.54 m (2H, CH_2), 1.57 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.35–2.42 m (3H, CH_2C=O, CHC=C), 2.71–2.81 m (1H, CHC=C), 3.69 t (1H, CH_{arom}, *J* 6.5 Hz), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.15–7.24 m ($5H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 245 (100) $[M + H]^+$. Found, %: C 83.41; H 9.87. $C_{17}H_{24}O$. Calculated, %: C 83.55; H 9.90. *M* 244.37.

9-Methyl-6-(4-methylphenyl)dec-8-en-5-one (5b). Yield 93%, colorless fluid. IR spectrum, ν, cm^{-1}: 1704 (C=O), 1602 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.85 t (3H, CH_3, *J* 6.7 Hz), 1.18–1.26 m (2H, CH_2), 1.43–1.54 m (2H, CH_2), 1.57 s (3H, CH_3C=C), 1.63 s (3H, CH_3C=C), 2.29 s (3H, CH_{3arom}), 2.35–2.43 m (3H, CH_2C=O, CHC=C), 2.70–2.79 m (1H, CHC=C), 3.64 t (1H, CH_{arom}, *J* 6.5 Hz), 5.03 t (1H, CH=C, *J* 6.6 Hz), 7.19–7.27 m ($4H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 259 (100) $[M + H]^+$. Found, %: C 83.48; H 10.21. $C_{18}H_{26}O$. Calculated, %: C 83.67; H 10.14. *M* 258.40.

9-Methyl-6-(4-chlorophenyl)dec-8-en-5-one (5c). Yield 84%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1705 (C=O), 1606 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.84 t (3H, CH_3, *J* 6.8 Hz), 1.20–1.28 m (2H, CH_2), 1.45–1.56 m (2H, CH_2), 1.57 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.38–2.45 m (3H, CH_2C=O, CHC=C), 2.73–2.81 m (1H, CHC=C), 3.71 t (1H, CH_{arom}, *J* 6.8 Hz), 5.05 t (1H, CH=C, *J* 6.7 Hz), 7.22 d ($2H_{arom}$, *J* 9.2 Hz), 7.38 d ($2H_{arom}$, *J* 9.2 Hz). Mass spectrum, *m/z* (I_{rel}, %): 279 (100) $[M + H]^+$. Found, %: C 73.18; H 8.43; Cl 12.64. $C_{17}H_{23}ClO$. Calculated, %: C 73.23; H 8.31; Cl 12.72. *M* 278.82.

6-(4-Bromophenyl)-9-methyldec-8-en-5-one (5d). Yield 42%, yellow oil. IR spectrum, ν, cm^{-1}: 1704 (C=O), 1605 (C=C). ^{1}H NMR spectrum, δ, ppm: 0.84 t (3H, CH_3, *J* 6.8 Hz), 1.21–1.27 m (2H, CH_2), 1.45–1.54 m (2H, CH_2), 1.57 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.37–2.47 m (3H, CH_2C=O, CHC=C), 2.73–2.80 m (1H, CHC=C), 3.71 t (1H, CH_{arom}, *J* 6.8 Hz), 5.04 t (1H, CH=C, *J* 6.8 Hz), 7.22 d ($2H_{arom}$, *J* 7.9 Hz), 7.41 d ($2H_{arom}$, *J* 7.9 Hz). Mass spectrum, *m/z* (I_{rel}, %): 324 (100) $[M + H]^+$. Found, %: C 62.94; H 7.09; Br 24.63. $C_{17}H_{23}BrO$. Calculated, %: C 63.16; H 7.17; Br 24.72. *M* 323.27.

5-Methyl-1,3-diphenylhex-5-en-2-one (6a). To 15 mL (0.03 mol) of 2 M BnMgCl solution in THF at 0°C was added 4.66 g (0.02 mol) of compound **2a** in 30 mL of anhydrous THF, the mixture was stirred for 20 h at room temperature (TLC monitoring). The work up was the same as in the synthesis of ketone **4a**, eluent hexane–ethyl acetate, 5 : 1. Yield 83%, colorless oil. IR spectrum, ν, cm^{-1}: 1708 (C=O), 1602 (C=C). ^{1}H NMR spectrum, δ, ppm: 1.82 s (3H, CH_3C=C), 2.21 d (2H, CH_2C=C, *J* 6.6 Hz), 3.66 t (1H, CH_{arom}, *J* 6.6 Hz), 3.78 s (2H, CH_2C=O), 4.76 d (1H, CH=C, *J* 8.7 Hz), 4.92 d (1H, CH=C, *J* 8.7 Hz), 7.15–7.34 m ($10H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 265 (100) $[M + H]^+$. Found, %: C 86.21; H 7.55. $C_{19}H_{20}O$. Calculated, %: C 86.32; H 7.63. *M* 264.36.

Compounds **6b–6d** and **7a–7d** were synthesized similarly.

5-Methyl-3-(4-methylphenyl)-1-phenylhex-5-en-2-one (6b). Yield 85%, colorless oil. IR spectrum, ν, cm^{-1}: 1706 (C=O), 1603 (C=C). ^1H NMR spectrum, δ, ppm: 1.82 s (3H, CH_3C=C), 2.20 d (2H, CH_2C=C, *J* 6.4 Hz), 2.29 s (3H, CH_{3arom}), 3.68 t (1H, CH_{arom}, *J* 6.4 Hz), 3.77 s (2H, CH_2C=O), 4.76 d (1H, CH=C, *J* 8.9 Hz), 4.93 d (1H, CH=C, *J* 8.9 Hz), 7.21–7.38 m ($9H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 279 (100) [*M* + H]$^+$. Found, %: C 86.17; H 8.06. $C_{20}H_{22}O$. Calculated, %: C 86.29; H 7.97. *M* 278.39.

5-Methyl-1-phenyl-3-(4-chlorophenyl)hex-5-en-2-one (6c). Yield 78%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1708 (C=O), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.83 s (3H, CH_3C=C), 2.23 d (2H, CH_2C=C, *J* 6.5 Hz), 3.71 t (1H, CH_{arom}, *J* 6.5 Hz), 3.82 s (2H, CH_2C=O), 4.75 d (1H, CH=C, *J* 9.1 Hz), 4.94 d (1H, CH=C, *J* 9.1 Hz), 7.18–7.21 m ($5H_{arom}$), 7.24 d ($2H_{arom}$, *J* 8.5 Hz), 7.38 d ($2H_{arom}$, *J* 8.5 Hz). Mass spectrum, *m/z* (I_{rel}, %): 300 (100) [*M* + H]$^+$. Found, %: C 76.24; H 6.53; Cl 11.73. $C_{19}H_{19}ClO$. Calculated, %: C 76.37; H 6.41; Cl 11.86. *M* 298.81.

3-(4-Bromophenyl)-5-methyl-1-phenylhex-5-en-2-one (6d). Yield 56%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1708 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.83 s (3H, CH_3C=C), 2.22 d (2H, CH_2C=C, *J* 6.6 Hz), 3.72 t (1H, CH_{arom}, *J* 6.6 Hz), 3.82 s (2H, CH_2C=O), 4.76 d (1H, CH=C, *J* 9.2 Hz), 4.94 d (1H, CH=C, *J* 9.2 Hz), 7.17–7.23 m ($5H_{arom}$), 7.25 d ($2H_{arom}$, *J* 8.8 Hz), 7.43 d ($2H_{arom}$, *J* 8.8 Hz). Mass spectrum, *m/z* (I_{rel}, %): 344 (100) [*M* + H]$^+$. Found, %: C 66.51; H 5.58; Br 23.28. $C_{19}H_{19}BrO$. Calculated, %: C 66.48; H 5.58; Br 23.28. *M* 343.26.

6-Methyl-1,3-diphenylhept-5-en-2-one (7a). Yield 85%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1705 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.56 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.32–2.40 m (1H, CHC=C), 2.70–2.78 m (1H, CHC=C), 3.75 t (1H, CH_{arom}, *J* 6.4 Hz), 3.81 s (2H, CH_2C=O), 5.03 t (1H, CH=C, *J* 6.6 Hz), 7.16–7.32 m ($10H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 279.41 (100) [*M* + H]$^+$. Found, %: C 86.15; H 8.12. $C_{20}H_{22}O$. Calculated, %: C 86.29; H 7.97. *M* 278.39.

6-Methyl-3-(4-methylphenyl)-1-phenylhept-5-en-2-one (7b). Yield 87%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1705 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.56 s (3H, CH_3C=C), 1.63 s (3H, CH_3C=C), 2.28 s (3H, CH_{3arom}), 2.34–2.41 m (1H, CHC=C), 2.70–2.79 m (1H, CHC=C), 3.73 t (1H, CH_{arom}, *J* 6.3 Hz), 3.82 s (2H, CH_2C=O), 5.03 t (1H, CH=C, *J* 6.6 Hz), 7.18–7.29 m ($9H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 293 (100) [*M* + H]$^+$. Found, %: C 86.31; H 8.19. $C_{21}H_{24}O$. Calculated, %: C 86.26; H 8.27. *M* 292.41.

6-Methyl-1-phenyl-3-(4-chlorophenyl)hept-5-en-2-one (7c). Yield 81%, light-yellow oil. IR spectrum, ν, cm^{-1}: 1708 (C=O), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.57 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.35–2.42 m (1H, CHC=C), 2.72–2.81 m (1H, CHC=C), 3.81 s (2H, CH_2C=O), 3.89 t (1H, CH_{arom}, *J* 6.5 Hz), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.16–7.23 m ($5H_{arom}$), 7.27 d ($2H_{arom}$, *J* 8.6 Hz), 7.38 d ($2H_{arom}$, *J* 8.6 Hz). Mass spectrum, *m/z* (I_{rel}, %): 314 (100) [*M* + H]$^+$. Found, %: C 76.68; H 6.81; Cl 11.43. $C_{20}H_{21}ClO$. Calculated, %: C 76.79; H 6.77; Cl 11.33. *M* 312.83.

3-(4-Bromophenyl)-6-methyl-1-phenylhept-5-en-2-one (7d). Yield 58%, yellow oil. IR spectrum, ν, cm^{-1}: 1706 (C=O), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.57 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.34–2.43 m (1H, CHC=C), 2.72–2.80 m (1H, CHC=C), 3.80–3.92 m (3H, CH_2C=O, CH_{arom}), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.15–7.22 m ($5H_{arom}$), 7.25 d ($2H_{arom}$, *J* 8.4 Hz), 7.42 d ($2H_{arom}$, *J* 8.4 Hz). Mass spectrum, *m/z* (I_{rel}, %): 358 (100) [*M* + H]$^+$. Found, %: C 67.18; H 6.11; Br 22.43. $C_{20}H_{21}BrO$. Calculated, %: C 67.23; H 5.92; Br 22.36. *M* 357.28.

(4*S*,5*S*)-2-Methyl-4-phenylnon-1-en-5-ol (8a). To a solution of 2.30 g (0.01 mol) of compound **4a** in 40 mL of anhydrous THF was added at –78°C 10 mL (0.01 mol) of 1 M L-selectride solution in THF, the mixture was stirred for 1 h at the same temperature under an argon atmosphere, the reaction mixture was warmed to room temperature, stirred for 1 h (TLC monitoring), 10 mL of water was added at cooling. The reaction mixture was evaporated on a rotary evaporator, the residue was diluted with 40 mL of ethyl acetate and 40 mL of water, the mixture was stirred for 15 min, the organic layer was separated, the water layer was extracted with 40 mL of ethyl acetate. The combined organic solutions were washed with brine, dried with anhydrous Na_2SO, and concentrated. Yield 98%, colorless oil. IR spectrum, ν, cm^{-1}: 3442 (OH), 1601 (C=C). ^1H NMR spectrum, δ, ppm: 0.82 t (3H, CH_3, *J* 6.5 Hz), 1.16–1.21 m (2H, CH_2), 1.41–1.56 m (4H, CH_2CH_2), 1.80 s (3H, CH_3C=C), 2.18 d (2H, CH_2C=C, *J* 6.4 Hz), 2.78–2.86 m (1H, CH_{arom}), 3.97 q (1H, HCO, *J* 4.6 Hz), 4.76 d (1H, CH=C, *J* 8.7 Hz), 4.94 d (1H, CH=C, *J* 8.7 Hz), 7.12–7.23 m ($5H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 233 (63) [*M* + H]$^+$, 215.32 (100) [*M* – 18 + H]$^+$. Found, %: C 82.61;

H 10.28. $C_{16}H_{24}O$. Calculated, %: C 82.70; H 10.41. *M* 232.36.

Compounds **8b–8d** and **9a–9d**–**11a–11d** were synthesized similarly.

(4*S*,5*S*)-2-Methyl-4-(4-methylphenyl)non-1-en-5-ol (8b). Yield 96%, colorless oil. IR spectrum, ν, cm^{-1}: 3446 (OH), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.6 Hz), 1.17–1.23 m (2H, CH_2), 1.44–1.56 m (4H, CH_2CH_2), 1.81 s (3H, CH_3C=C), 2.19 d (2H, CH_2C=C, *J* 6.5 Hz), 2.30 s (3H, CH_{3arom}), 2.79–2.87 m (1H, CH_{arom}), 3.98 q (1H, HCO, *J* 4.8 Hz), 4.76 d (1H, CH=C, *J* 9.1 Hz), 4.93 d (1H, CH=C, *J* 9.1 Hz), 7.17–7.31 m ($4H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 247 (24) $[M + H]^+$, 229 (100) $[M - 18 + H]^+$. Found, %: C 82.69; H 10.75. $C_{17}H_{26}O$. Calculated, %: C 82.87; H 10.64. *M* 246.39.

(4*S*,5*S*)-2-Methyl-4-(4-chlorophenyl)non-1-en-5-ol (8c). Yield 97%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3452 (OH), 1606 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.4 Hz), 1.19–1.24 m (2H, CH_2), 1.43–1.58 m (4H, CH_2CH_2), 1.81 s (3H, CH_3C=C), 2.18 d (2H, CH_2C=C, *J* 6.5 Hz), 2.84–2.92 m (1H, CH_{arom}), 4.01 q (1H, HCO, *J* 4.7 Hz), 4.81 d (1H, CH=C, *J* 9.2 Hz), 4.95 d (1H, CH=C, *J* 9.2 Hz), 7.23 d ($2H_{arom}$, *J* 9.1 Hz), 7.38 d ($2H_{arom}$, *J* 9.1 Hz). Mass spectrum, *m/z* (I_{rel}, %): 268 (23) $[M + H]^+$, 260 (100) $[M - 18 + H]^+$. Found, %: C 71.84; H 8.53; Cl 13.18. $C_{16}H_{23}ClO$. Calculated, %: C 72.03; H 8.69; Cl 13.29. *M* 266.81.

(4*S*,5*S*)-4-(4-Bromophenyl)-2-methylnon-1-en-5-ol (8d). Yield 96%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3454 (OH), 1603 (C=C). ^1H NMR spectrum, δ, ppm: 0.84 t (3H, CH_3, *J* 6.5 Hz), 1.18–1.25 m (2H, CH_2), 1.43–1.57 m (4H, CH_2CH_2), 1.81 s (3H, CH_3C=C), 2.20 d (2H, CH_2C=C, *J* 6.5 Hz), 2.83–2.90 m (1H, CH_{arom}), 4.02 q (1H, HCO, *J* 4.9 Hz), 4.79 d (1H, CH=C, *J* 9.2 Hz), 4.94 d (1H, CH=C, *J* 9.2 Hz), 7.20 d ($2H_{arom}$, *J* 8.8 Hz), 7.43 d ($2H_{arom}$, *J* 8.8 Hz). Mass spectrum, *m/z* (I_{rel}, %): 312 (28) $[M + H]^+$, 294 (100) $[M - 18 + H]^+$. Found, %: C 61.68; H 7.53; Br 25.41. $C_{16}H_{23}BrO$. Calculated, %: C 61.74; H 7.45; Br 25.67. *M* 311.26.

(5*S*,6*S*)-9-Methyl-6-phenyldec-8-en-5-ol (9a). Yield 98%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3451 (OH), 1601 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.6 Hz), 1.17–1.24 m (2H, CH_2), 1.40–1.52 m (4H, CH_2CH_2), 1.58 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.32–2.41 m (1H, CHC=C), 2.69–2.78 m (1H, CHC=C), 2.84–2.93 m (1H, CH_{arom}), 3.98 q (1H, HCO, *J* 4.7 Hz), 5.04 t (1H, CH=C, *J* 6.6 Hz), 7.14–7.21 m ($5H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 247 (18) $[M + H]^+$, 229 (100) $[M - 18 + H]^+$. Found, %: C 82.54; H 10.71. $C_{17}H_{26}O$. Calculated, %: C 82.87; H 10.64. *M* 246.39.

(5*S*,6*S*)-9-Methyl-6-(4-methylphenyl)dec-8-en-5-ol (9b). Yield 97%, light-yellow oil . IR spectrum, ν, cm^{-1}: 3449 (OH), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.7 Hz), 1.18–1.23 m (2H, CH_2), 1.41–1.51 m (4H, CH_2CH_2), 1.57 s (3H, CH_3C=C), 1.66 s (3H, CH_3C=C), 2.28 s (3H, CH_{3arom}), 2.34–2.42 m (1H, CHC=C), 2.68–2.76 m (1H, CHC=C), 2.83–2.91 m (1H, CH_{arom}), 3.99 q (1H, HCO, *J* 4.7 Hz), 5.05 t (1H, CH=C, *J* 6.6 Hz), 7.18–7.25 m ($4H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 261 (21) $[M + H]^+$, 243 (100) $[M - 18 + H]^+$. Found, %: C 82.87; H 10.67. $C_{18}H_{28}O$. Calculated, %: C 83.02; H 10.84. *M* 260.41.

(5*S*,6*S*)-9-Methyl-6-(4-chlorophenyl)dec-8-en-5-ol (9c). Yield 97%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3512 (OH), 1607 (C=C). ^1H NMR spectrum, δ, ppm: 0.82 t (3H, CH_3, *J* 6.8 Hz), 1.19–1.25 m (2H, CH_2), 1.42–1.53 m (4H, CH_2CH_2), 1.58 s (3H, CH_3C=C), 1.68 s (3H, CH_3C=C), 2.35–2.43 m (1H, CHC=C), 2.68–2.78 m (1H, CHC=C), 2.94–3.02 m (1H, CH_{arom}), 4.01 q (1H, HCO, *J* 5.1 Hz), 5.06 t (1H, CH=C, *J* 6.8 Hz), 7.23 d ($2H_{arom}$, *J* 9.2 Hz), 7.39 d ($2H_{arom}$, *J* 9.2 Hz). Mass spectrum, *m/z* (I_{rel}, %): 282 (24) $[M + H]^+$, 264 (100) $[M - 18 + H]^+$. Found, %: C 72.45; H 8.81; Cl 12.84. $C_{17}H_{25}ClO$. Calculated, %: C 72.71; H 8.97; Cl 12.62. *M* 280.83.

(5*S*,6*S*)-6-(4-Bromophenyl)-9-methyldec-8-en-5-ol (9d). Yield 96%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3514 (OH), 1606 (C=C). ^1H NMR spectrum, δ, ppm: 0.83 t (3H, CH_3, *J* 6.7 Hz), 1.19–1.26 m (2H, CH_2), 1.42–1.53 m (4H, CH_2CH_2), 1.58 s (3H, CH_3C=C), 1.69 s (3H, CH_3C=C), 2.36–2.42 m (1H, CHC=C), 2.68–2.76 m (1H, CHC=C), 2.94–3.01 m (1H, CH_{arom}), 4.02 q (1H, HCO, *J* 5.1 Hz), 5.06 t (1H, CH=C, *J* 6.8 Hz), 7.23 d ($2H_{arom}$, *J* 8.1 Hz), 7.41 d ($2H_{arom}$, *J* 8.1 Hz). Mass spectrum, *m/z* (I_{rel}, %): 326 (18) $[M + H]^+$, 308 (100) $[M - 18 + H]^+$. Found, %: C 62.81; H 7.63; Br 24.18. $C_{17}H_{25}BrO$. Calculated, %: C 62.77; H 7.75; Br 24.56. *M* 325.28.

(2*S*,3*S*)-5-Methyl-1,3-diphenylhex-5-en-2-ol (10a). Yield 98%, colorless oil. IR spectrum, ν, cm^{-1}: 3458 (OH), 1601 (C=C). ^1H NMR spectrum, δ, ppm: 1.82 s (3H, CH_3C=C), 2.23 d (2H, CH_2C=C, *J* 6.8 Hz),

2.63 d (2H, CH_{2arom}, *J* 7.1 Hz), 2.81–2.93 m (1H, CH_{arom}), 3.98 q (1H, HCO, *J* 4.6 Hz), 4.75 d (1H, CH=C, *J* 8.8 Hz), 4.93 d (1H, CH=C, *J* 8.8 Hz), 7.12–7.26 m ($10H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 267 (18) $[M + H]^+$, 249 (100) $[M - 18 + H]^+$. Found, %: C 85.42; H 8.17. $C_{19}H_{22}O$. Calculated, %: C 85.67; H 8.32. *M* 266.38.

(2*S*,3*S*)-5-Methyl-3-(4-methylphenyl)-1-phenylhex-5-en-2-ol (10b). Yield 98%, colorless oil . IR spectrum, ν, cm^{-1}: 3455 (OH), 1603 (C=C). ^1H NMR spectrum, δ, ppm: 1.83 s (3H, CH_3C=C), 2.22 d (2H, CH_2C=C, *J* 6.7 Hz), 2.31 s (3H, CH_{3arom}), 2.64 d (2H, CH_{2arom}, *J* 7.2 Hz), 2.80–2.91 m (1H, CH_{arom}), 3.98 q (1H, HCO, *J* 4.7 Hz), 4.76 d (1H, CH=C, *J* 8.9 Hz), 4.94 d (1H, CH=C, *J* 8.9 Hz), 7.20–7.36 m ($9H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 281 (28) $[M + H]^+$, 263 (100) $[M - 18 + H]^+$. Found, %: C 85.56; H 8.71. $C_{20}H_{24}O$. Calculated, %: C 85.67; H 8.63. *M* 280.40.

(2*S*,3*S*)-5-Methyl-1-phenyl-3-(4-chlorophenyl)-hex-5-en-2-ol (10c). Yield 97%, colorless oil. IR spectrum, ν, cm^{-1}: 3461 (OH), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.83 s (3H, CH_3C=C), 2.24 d (2H, CH_2C=C, *J* 6.5 Hz), 2.66 d (2H, CH_{2arom}, *J* 7.2 Hz), 2.87–2.98 m (1H, CH_{arom}), 4.75 d (1H, CH=C, *J* 9.0 Hz), 4.94 d (1H, CH=C, *J* 9.0 Hz), 7.17–7.22 m ($5H_{arom}$), 7.25 d ($2H_{arom}$, *J* 8.6 Hz), 7.40 d ($2H_{arom}$, *J* 8.6 Hz). Mass spectrum, *m/z* (I_{rel}, %): 302 (17) $[M + H]^+$, 284 (100) $[M - 18 + H]^+$. Found, %: C 75.68; H 6.93; Cl 11.82. $C_{19}H_{21}ClO$. Calculated, %: C 75.86; H 7.04; Cl 11.79. *M* 300.82.

(2*S*,3*S*)-3-(4-Bromophenyl)-5-methyl-1-phenylhex-5-en-2-ol (10d). Yield 95%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3462 (OH), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.84 s (3H, CH_3C=C), 2.23 d (2H, CH_2C=C, *J* 6.7 Hz), 2.68 d (2H, CH_{2arom}, *J* 7.0 Hz), 2.91–3.01 m (1H, CH_{arom}), 4.75 d (1H, CH=C, *J* 9.1 Hz), 4.93 d (1H, CH=C, *J* 9.1 Hz), 7.16–7.21 m ($5H_{arom}$), 7.28 d ($2H_{arom}$, *J* 8.9 Hz), 7.43 d ($2H_{arom}$, *J* 8.9 Hz). Mass spectrum, *m/z* (I_{rel}, %): 346 (38) $[M + H]^+$, 328 (100) $[M - 18 + H]^+$. Found, %: C 65.91; H 6.21; Br 22.65. $C_{19}H_{21}BrO$. Calculated, %: C 66.09; H 6.13; Br 23.14. *M* 345.27.

(2*S*,3*S*)-6-Methyl-1,3-diphenylhept-5-en-2-ol (11a). Yield 97%, colorless oil. IR spectrum, ν, cm^{-1}: 3465 (OH), 1603 (C=C). ^1H NMR spectrum, δ, ppm: 1.57 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.33–2.41 m (1H, CHC=C), 2.64 d (2H, CH_{2arom}, *J* 6.8 Hz), 2.72–2.79 m (1H, CHC=C), 2.83–2.95 m (1H, CH_{arom}), 4.01 q (1H, HCO, *J* 5.2 Hz), 5.03 t (1H, CH=C, *J* 6.7 Hz), 7.15–7.29 m ($10H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 282 (32) $[M + H]^+$, 263 (100) $[M - 18 + H]^+$. Found, %: C 85.47; H 8.67. $C_{20}H_{24}O$. Calculated, %: C 85.67; H 8.63. *M* 280.40.

(2*S*,3*S*)-6-Methyl-3-(4-methylphenyl)-1-phenylhept-5-en-2-ol (11b). Yield 96%, colorless oil. IR spectrum, ν, cm^{-1}: 3458 (OH), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.56 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.28 s (3H, CH_{3arom}), 2.34–2.42 m (1H, CHC=C), 2.61 d (2H, CH_{2arom}, *J* 6.9 Hz), 2.73–2.80 m (1H, CHC=C), 2.85–2.93 m (1H, CH_{arom}), 4.00 q (1H, HCO, *J* 5.1 Hz), 5.04 t (1H, CH=C, *J* 6.9 Hz), 7.17–7.26 m ($9H_{arom}$). Mass spectrum, *m/z* (I_{rel}, %): 295 (18) $[M + H]^+$, 277 (100) $[M - 18 + H]^+$. Found, %: C 85.76; H 8.73. $C_{21}H_{26}O$. Calculated, %: C 85.67; H 8.90. *M* 294.43.

(2*S*,3*S*)-6-Methyl-1-phenyl-3-(4-chlorophenyl)-hept-5-en-2-ol (11c). Yield 98%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3456 (OH), 1604 (C=C). ^1H NMR spectrum, δ, ppm: 1.57 s (3H, CH_3C=C), 1.65 s (3H, CH_3C=C), 2.35–2.41 m (1H, CHC=C), 2.65 d (2H, CH_{2arom}, *J* 7.0 Hz), 2.74–2.84 m (1H, CHC=C), 2.91–2.99 m (1H, CH_{arom}), 4.03 q (1H, HCO, *J* 5.1 Hz), 5.04 t (1H, CH=C, *J* 7.1 Hz), 7.16–7.25 m ($5H_{arom}$), 7.30 d ($2H_{arom}$, *J* 8.8 Hz), 7.41 d ($2H_{arom}$, *J* 8.8 Hz). Mass spectrum, *m/z* (I_{rel}, %): 316 (22) $[M + H]^+$, 298 (100) $[M - 18 + H]^+$. Found, %: C 76.18; H 7.43; Cl 11.08. $C_{20}H_{23}ClO$. Calculated, %: C 76.29; H 7.36; Cl 11.26. *M* 314.85.

(2*S*,3*S*)-3-(4-Bromophenyl)-6-methyl-1-phenylhept-5-en-2-ol (11d). Yield 96%, light-yellow oil. IR spectrum, ν, cm^{-1}: 3458 (OH), 1605 (C=C). ^1H NMR spectrum, δ, ppm: 1.57 s (3H, CH_3C=C), 1.64 s (3H, CH_3C=C), 2.34–2.42 m (1H, CHC=C), 2.63 d (2H, CH_{2arom}, *J* 6.9 Hz), 2.75–2.83 m (1H, CHC=C), 2.90–2.98 m (1H, CH_{arom}), 4.02 q (1H, CHCO, *J* 5.2 Hz), 5.04 t (1H, CH=C, *J* 7.2 Hz), 7.15–7.23 m ($5H_{arom}$), 7.27 d ($2H_{arom}$, *J* 8.6 Hz), 7.42 d ($2H_{arom}$, *J* 8.6 Hz). Mass spectrum, *m/z* (I_{rel}, %): 360 (25) $[M + H]^+$, 342 (100) $[M - 18 + H]^+$. Found, %: C 66.71; H 6.54; Br 22.16. $C_{20}H_{23}BrO$. Calculated, %: C 66.86; H 6.45; Br 22.24. *M* 359.30.

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